

# A revision of the genus *Gueldenstaedtia* (Fabaceae)

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This paper provides a taxonomic revision of *Gueldenstaedtia* (Fabaceae). Four species and one form are recognized. The revision is based on herbarium material and includes pollen and seed morphological observations. I treat the genus as distinct from the closely related *Tibetia* based on pollen and seed morphology, other morphological characters and chromosome data. A number of names in *Gueldenstaedtia* are reduced to synonyms. A key to all species of the genus is provided. For each taxon, its description, ecology, phenology, notes and an illustration and distribution map are also provided.

Key words: Fabaceae, *Gueldenstaedtia*, taxonomy

## Introduction

*Gueldenstaedtia* (Fabaceae) is a papilionoid legume genus in the Astragalinae subtribe of the tribe Galegeae. Close relatives include *Astragalus*, *Oxytropis*, *Biserrula* and *Alhagi* (Polhill 1981). Polhill (1994) proposed a classification system of Fabaceae, in which *Halimodendron*, *Caragana*, *Calophaca*, *Spongiocarpella*, *Chesneya*, *Astragalus*, *Astracantha*, *Oxytropis*, *Neodielsia* and *Gueldenstaedtia* were included in the subtribe Astragalinae. The temperate Asian genus *Gueldenstaedtia* formerly comprised 12 species, including one subspecies and two forms (Wu 1991, Cui 1998). Mabblerley's (1997) circumscription of *Gueldenstaedtia* (including *Tibetia*) covered 14 species distributed from Sino-Himalaya to Siberia and confined to Asia, especially to China. The demarcation of *Gueldenstaedtia* and *Tibetia* is a point of dispute. They are treated either as two distinct genera (Tsui 1979, Cui 1998, Wu 1999) or a single genus (Yakovlev

1980, Li & Ni 1985, Grierson & Long 1987, Mabblerley 1997). In the course of a taxonomic revision of the genus *Gueldenstaedtia*, I studied herbarium specimens from the main distribution areas. My observations of morphological characters, pollen and seed morphology clarified the delimitation of *Gueldenstaedtia* and *Tibetia* as separate genera (Zhu & Wen 2004) — a conclusion supported by the chromosome data of Ni *et al.* (2002) and Yang (2002). In this revision, four species and one form are recognized in *Gueldenstaedtia*. For each taxon, its description, ecology, phenology and further notes are provided along with illustrations and distribution maps.

## Taxonomic history

*Gueldenstaedtia* was established in Fischer (1823) and named in honour of the Russian naturalist Anton Johann von Gueldenstaedt. *Gueldenstaedtia pauciflora* (Pall.) Fisch. was

chosen as the lectotype by Fischer, but is now a synonym of *G. verna* (Georgi) Boriss. In his original paper, only two species, *G. monophylla* Fisch. and *G. pauciflora* (Pall.) Fisch., were recognized. Kitagawa (1936) pointed out that *Gueldenstaedtia* Necker was a synonym of *Gueldenstaedtia* Fisch. and considered that it should be replaced by *Amblytropis* Kitagawa. Ali (1957) proposed conserving the generic name *Gueldenstaedtia* Fisch. In view of the uncertain nomenclatural status of the names in Necker's *Species Naturales*, the International Congress of Montreal made a decision against the acceptance of Necker's name (Rickett & Stafleu 1959) and maintained the name *Gueldenstaedtia* Fisch. for the genus. This is in accordance with ICBN (Greuter *et al.* 2000). Jacot (1927) adopted *Gueldenstaedtia* as one genus and did not propose a subdivision, but Ali (1962–1963) proposed two subgenera: subg. *Gueldenstaedtia* and subg. *Tibetia* Ali. Tsui (1979) separated *Tibetia* from *Gueldenstaedtia*, raised it to the generic level and amended the circumscription of *Gueldenstaedtia*. Therefore, the correct citation for this genus is *Gueldenstaedtia* Fisch. *emend.* Tsui. The separation of *Tibetia* from *Gueldenstaedtia* remains controversial (Grierson & Long 1987, Mabberley 1997, Cui 1998).

### Relationship between *Gueldenstaedtia* and *Tibetia*

The two genera belong to the subtribe Astragalinae of the tribe Galegeae (Fabaceae subfamily Papilionoideae). They are closely related to *Astragalus*, *Oxytropis*, *Biserrula* and *Alhagi* (Polhill 1981). While there is considerable variation in many pollen-morphological characters throughout Papilionoideae, their taxonomic value is also variable (Ferguson & Skvarla 1981). Zhu and Ohashi (2000) reported that the pollen morphology of *Astragalus* and *Oxytropis* is similar in shape, size and endoaperture characteristics. The pollen grains of *Alhagi* are 3-colporate, mostly spheroidal, with long colpi, without constriction and slightly protruding at the equator, as reported by Ohashi (1971) and Choi and Ohashi (1996). Differences in pollen grains between *Gueldenstaedtia* and *Tibetia* are discussed in Zhu and

Wen (2004) and can be summarized as follows. *Gueldenstaedtia*: pollen grains 3-colporate, psilate, and spheroidal, sometimes subprolate, prolate or oblong; *Tibetia*: pollen grains 3 and 4-colporate, perforate, spheroidal, sometimes subprolate or prolate. These data combined with the basic chromosome number  $x = 7$  for *Gueldenstaedtia* (Yang 2002) and  $x = 8$  for *Tibetia* (Ni *et al.* 2002) support the separation of these two genera. This is also consistent with some morphological differences; in *Gueldenstaedtia* the two upper calyx lobes are free, the stipules are free and adnate to petiole, and in *Tibetia* the two upper lobes of calyx are connate, and the stipules are connate and opposite to the leaves.

## Taxonomy

### *Gueldenstaedtia* Fisch. *emend.* Tsui

Mém. Soc. Nat. Moscon. 6: 170. 1823 & Bull. Bot. Lab. North.-East. Forest. Inst. 5: 36. 1979. — *Amblytropis* Kitagawa, Rep. First Sci. Exped. Manch. sect. IV 4: 26. 1936, *nom. superfl. rej.* — *Gueldenstaedtia* Fisch. subgen. *Gueldenstaedtia sensu* Ali, Candollea 18: 137. 1962.

TYPE: *Gueldenstaedtia verna* (Georgi) Boriss.

Perennial herbs. Roots thick and woody, cylindrical. Stem almost absent, or very short, with many branches. Leaves with many leaflets, rarely unifoliolate; stipules adnate to petioles, broadly to narrowly triangular, membranous, persistent, lateral, not leaf-opposed; petioles sessile, leaflets entire, ovate, lanceolate, elliptic, oblong, linear or sub-circular. Racemes with 3–8 flowers, flower pedicellate, bracteate, purple, pink or yellow; bracteoles 2; calyx campanulate, densely appressed with long white hairs, sometimes with black hairs, rarely glabrous, 5-lobed, upper 2 lobes longer and wider than lower 3 lobes; standard ovate or sub-round, tapering to claw at base, emarginate at apex; wings oblique obovate, slightly shorter than standard; keel-petals blunt at apex, ovate, very small, 1/2 as long as wing-petals. Stamens diadelphous (9 + 1); ovary tubular, sessile, pilose or glabrous, style incurved, stigma blunt, cylindrical. Pods cylindrical unilocular, dehiscent along both sutures, with many seeds; seeds reniform, sometimes with a depression. Flowering May to June, fruiting July to September.

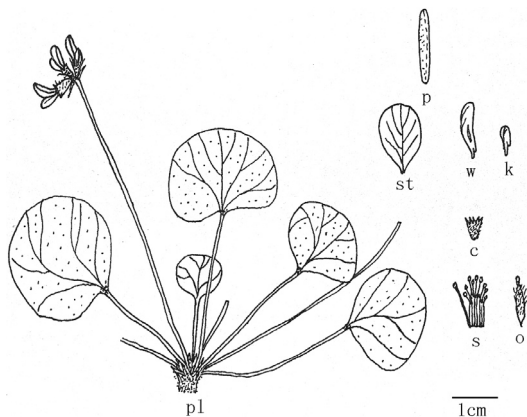


Fig. 1. *Gueldenstaedtia monophylla* (from isotype, PE). — pl: Plant. — c: Calyx. — st: Standard. — w: Wing petal. — k: Keel-petal. — o: Ovary. — s: Stamens. — p: Pod.

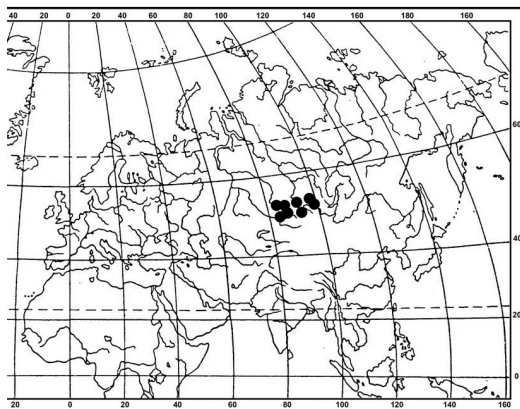


Fig. 2. Distribution of *Gueldenstaedtia monophylla*.

*Gueldenstaedtia* includes four species and one form mainly occurring in Asia.

### Key to the species of *Gueldenstaedtia*

1. Leaves simple or sometimes 2- or 3-lobed ..... *G. monophylla*
1. Leaves imparipinnate, leaflets rarely 3, 4 or 5 ..... 2
2. Leaflets widely elliptical to round ..... *G. taihangensis*
2. Leaflets elliptical to oblong-elliptical, ovate to lanceolate or linear ..... 3
3. Branches elongate, usually ca. 5.0 cm long, lignified; standard acute at apex; wings semilunate ..... *G. henryi*
3. Branches short, usually less than 5 cm long, non-lignified; standard round at apex; wings obovate ..... 4
4. Flowers purple, violet, or pink ..... *G. verna*
4. Flowers white ..... *G. verna f. alba*

### *Gueldenstaedtia monophylla* Fisch. (Fig. 1)

Mém. Soc. Nat. Moscon. 6: 171. 1823. — TYPE: Russia. Altai Mts., 1820 *Fischer 57* (holotype LE!, isotype PE!).

Perennial herb, 5–15 cm tall. Stem short. Leaf solitary, rarely 2- or 3-lobed; leaflets round, reniform, or orbicular, broad or sometimes slightly notched at base, obtuse to short-pointed at apex, sometimes 2- or 3-lobed, with appressed sericeous hairs, 1–3.5 cm long, 1.5–4.5 cm wide. Stipules lanceolate, 3–5 cm long, with appressed hairs, ciliate, connate at base; leaves with hairs, petiole 2–6 cm long; peduncles numerous, slender, sericeous, 3–13 cm long; racemes with 2–6

flowers, pedicels 1–2 mm long, or subsessile; bracts filiform, 2–5 mm long, bracteoles filiform, shorter than calyx tube; calyx broadly campanulate, sericeous, 5–6 mm long, 5-lobed, teeth lanceolate, 2/3 of tube; corolla violet; standard broadly obovate, entire or slightly emarginate at apex, 12–14 mm long, claw broad and short; wings 10–12 mm long, as long as standard, oblong, obtuse at apex, claw 1–1.5 mm long; keel-petals ca. 4 mm long, whitish, lamina incurved, as long as filiform claw; stamens diadelphous (9 + 1), shorter than keel-petals; ovary oblong, hairy; style curved, glabrous, ca. 1 mm long; stigma thick; pods linear-cylindric, ca. 2.5 cm long, 3.5–5 mm wide, appressed-pubescent. Seeds reniform, irregularly circle reticulate.

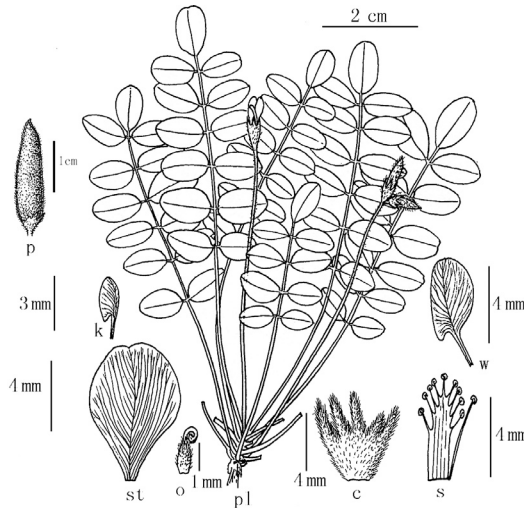
DISTRIBUTION: Russia, Mongolia (Fig. 2).

HABITAT ECOLOGY: Rocks, dry stony and gravelly slopes.

PHENOLOGY: Flowering from May to July, fruiting from June to August.

This species is readily distinguished from the congeners by its solitary leaf. *Gueldenstaedtia monophylla* has been recorded from the Altai mountain area of Xinjiang in China, but I have not seen collections from that area. The distribution map (Fig. 2) combines my observations with those of Yakovlev (1980) and Kurbatski (1994).

ADDITIONAL SPECIMENS EXAMINED. — **Mongolia.** Alashan Gobi, *s.coll.* (LE). **Russia.** Altai, *s.coll.* 575 (K); Altai, *Bunge s.n.* (K); Altai, *Prescott s.n.* (K); In supestribus apricis fl. Katanga, *Bunge s.n.* (K); Altai, 1835 *s.coll.* (K); Southern



**Fig. 3.** *Gueldenstaedtia taihangensis* (p from K. M. Liou 7786, PE; others from holotype). — pl: Plant. — c: Calyx. — st: Standard. — w: Wing petal. — k: Keel-petal. — o: Ovary. — s: Stamens. — p: Pod.

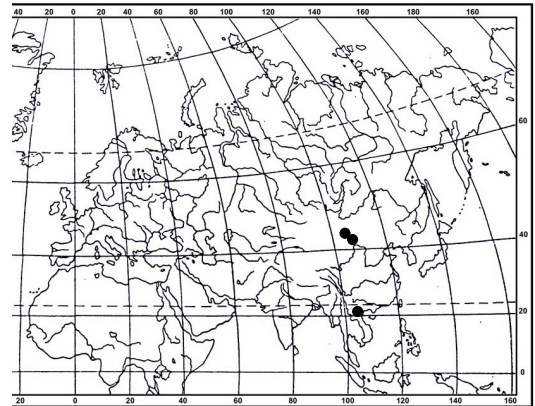
Siberia, Tuva Autonomous Republic, near village Teeli in Teli town suburbs, steppe with *Caragana*, rock debris, 1976 S. Timokhina & E. Kim N 478 (LE).

### *Gueldenstaedtia taihangensis* Tsui (Fig. 3)

Bull. Bot. Lab. North-East. Forest. Inst. 5: 40. 1979. — TYPE: China. On grassy slope hill, Nanjiaoshui, Neiqiu Xian, Hebei, alt. 1600 m, 22.VIII. 1950 Y. Liu 13470 (holotype PE).

*G. guangxiensis* W.L. Sha & X.X. Chen, Acta Bot. Yunnanica 3: 436–437. 1981. — TYPE: China. Duan Xian, 26.I.1973 Y. J. Luo 29544 (holotype GXMI!).

Perennial herb. Roots deep, thick at upper part. Stem with many branches. Leaves 3–13 cm long, imparipinnate, petiole thin, sulcate, with appressed hairs; leaflets 2–6 pairs, widely ovate to sub-circular, elliptic to ovate, 5–10 mm long, 3–8 mm wide, truncate, obtuse, mucronulate or lobed at apex, round at base, glabrous on upper side, sometimes pubescent on both sides, entire, petiole ca. 0.5 mm long. Stipules 2–5 mm long, adnate to petioles, lanceolate, with densely appressed hairs. Racemes with 1–6 flowers, pedicels thin, sulcate, bracts, bracteoles, peduncle, pedicel and calyx with appressed long hairs. Bracts linear or triangular, 4–5 mm long, bracteoles similar to bracts, narrowly triangular,



**Fig. 4.** Distribution of *Gueldenstaedtia taihangensis*.

ca. 3 mm, adnate to the base pedicel, pedicel ca. 1 mm long. Calyx campanulate, 5–7 mm long, 2.5–3 mm wide, appressed with hairs, 5-lobed, unequal, upper 2 lobes triangular, 3–3.5 mm long, 2.5–3 mm wide. Flowers violet, standard obovate or oblong, ca. 11 mm long, 6–7 mm wide, round or retuse at apex, tapering to base, wings obovate, 7–9 mm long, ca. 3 mm wide, claw ca. 1.5 mm long, keel-petals shorter than wings, 3–5 mm long, ca. 1.5 mm wide, lamina ovate, claw linear, ca. 1.5 mm long, ariculate, ovary cylindrical or oblong, pubescent, style short, incurved, glabrous. Pods cylindrical, pubescent, 10–17 mm long, 3–4 mm wide. Seeds reniform, with circular depression.

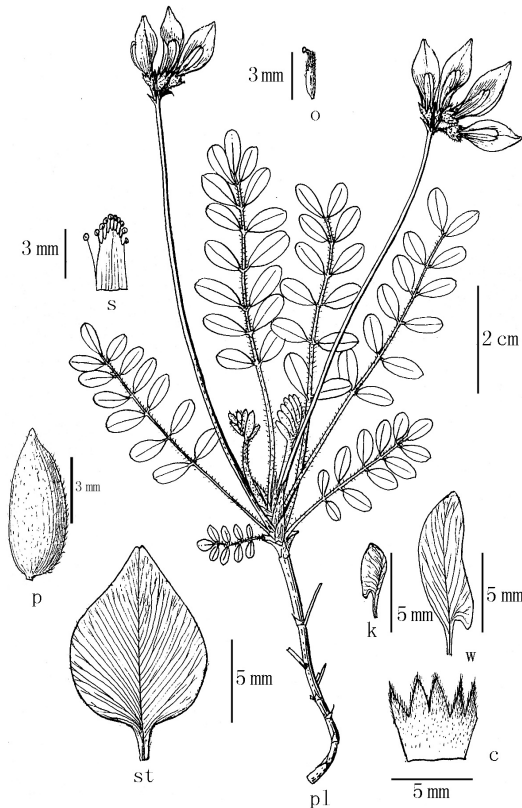
**DISTRIBUTION:** China (Hebei, Shanxi and Guangxi) (Fig. 4).

**ECOLOGY:** On roadside verges, hilly slopes or open, sandy areas, alt. 950 to 1150 m.

**PHENOLOGY:** Flowering from March to July, fruiting September.

The shape of leaflets in this species varies from elliptical to round, but they are distinctly different from the other species. Its distribution is disjunct, being known from Hebei, Shanxi and Guangxi.

**ADDITIONAL SPECIMENS EXAMINED:** — **China.** Hebei: on roadside of hill, Xiaolingdi, Neiqiu, alt. 950 m, 1985, s.coll. 22854 (BNU); on hilly slope, Xigou, Xiaodiling, 1952 Q. Y. Liu & F. Zhao 0026 (PE); Changgou, Neiqiu, 1936 Y. Liu 12282 (PE). Guangxi: on sand, Xiangyanggongshe, 1960 *Guizhou Team* 88 (PE). Shanxi: Huangmeitung, Taihangshan, Lingch'uan-hsien, alt. 1150 m, 1937 K. M. Liou 7786 (PE).



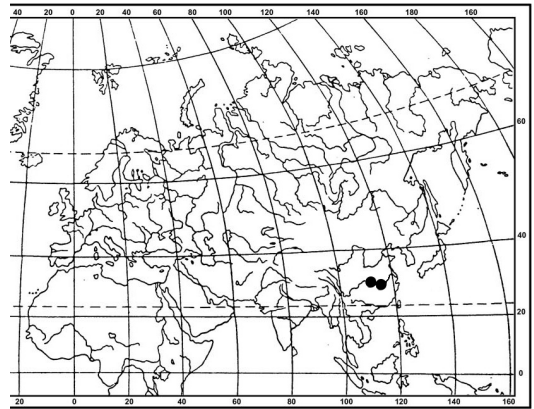
**Fig. 5.** *Gueldenstaedtia henryi* (from *T. P. Wang 10864*, PE). — **pl**: Plant. — **c**: Calyx. — **st**: Standard. — **w**: Wing petal. — **k**: Keel-petal. — **o**: Ovary. — **s**: Stamens. — **p**: Pod.

### *Gueldenstaedtia henryi* Ulbr. (Fig. 5)

Engl. Jahrb. 36. Biebl. 82: 59. 1905. — *Amblytropis henryi* (Ulbr.) C. Y. Wu ex Tsui, Fl. Illustr. Pl. Prim. Sin. (Leguminosae): 365. 1955. — TYPE: China. Sichuan, II. 1890 *Henry 8982* (holotype K!).

*Gueldenstaedtia multiflora* auct. non Bunge, J. Linn. Soc. Bot. 23: 164. 1887.

Perennial herb. Roots thick and woody, cylindrical, sometimes with adventitious root. Stem with branches, ca. 5 cm long, lignified. Leaves, 2–9 cm long, imparipinnate, pubescent or subglabrous; leaflets 5–7 pairs, oblong or obovate, 3–10 mm long, 2–5 mm wide, round or emarginate at apex, with clear apicule, glabrous on upper side, pubescent on lower side; stipules, 3–5 mm long, free from petioles at apex, broadly triangular, petioles short to sessile. Racemes with 4–5 flowers, peduncle longer than 10 cm long, pubes-



**Fig. 6.** Distribution of *Gueldenstaedtia henryi*.

cent or glabrous; bracts narrowly lanceolate, ca. 3.5 mm, pedicel ca. 3 mm long; bracteoles linear, ca. 2.5 mm long; calyx campanulate, ca. 6 mm long, with appressed hairs, upper 2 lobes longer and wider than the lower 3 lobes, narrowly triangular, ca. 4 mm long, ca. 1.5 mm wide, low 3 lobes lanceolate, ca. 2.5 mm long; standard widely obovate, ca. 14 mm long, ca. 8 mm wide, acute or retuse at apex, tapering to claw until the base; wings ellipsoid-semilunar, ca. 11.5 mm long, ca. 3.5 mm wide, claw very short; keel-petals ca. 5.5 mm long, ca. 2.5 mm wide, claw ca. 2 mm long; ovary oblong, pubescent; pods ca. 1.5 cm long, pubescent. Seeds reniform.

DISTRIBUTION: China (Hubei, Sichuan) (Fig. 6).

ECOLOGY: On grassland, alt. 120 m.

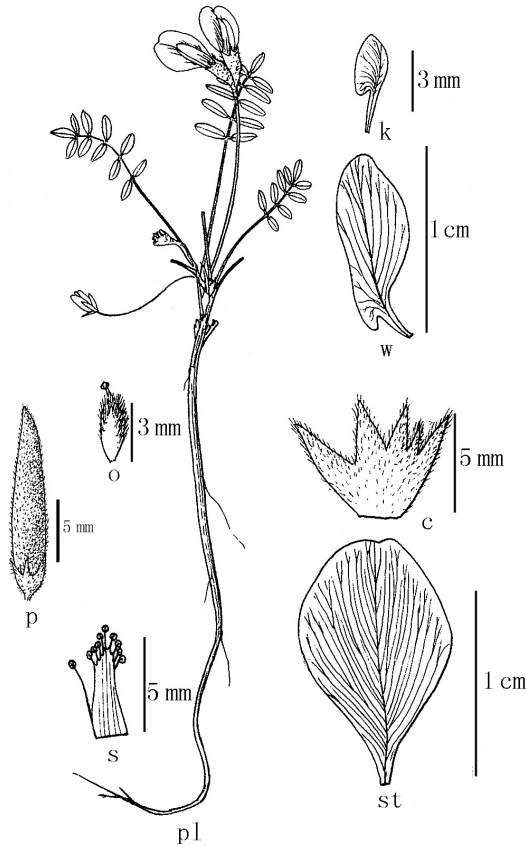
PHENOLOGY: Flowering May to July, fruiting June to August.

*Gueldenstaedtia henryi* is close to *G. verna*, but the main difference is that the former has a standard acute at apex and the latter, rounded. The pollen grains of *G. henryi* differ from those of the other species in having wide colpi. Thus I treat this as a distinct species.

ADDITIONAL SPECIMENS EXAMINED: — **China**. Hubei: Ba Dong, alt. 120 m, 1939 *T. P. Wang 10864* (PE); Ichang, *s.coll. 1308* (K).

### *Gueldenstaedtia verna* (Georgi) Boriss. (Fig. 7)

Spisok Rast. Gerb. Fl. SSSR 12: 122. 1953. — *Astragalus*



**Fig. 7.** *Gueldenstaedtia verna* (p from P. Y. Fu 614, others from G. Sato 312, both PE). — pl: Plant. — c: Calyx. — st: Standard. — w: Wing petal. — k: Keel-petal. — o: Ovary. — s: Stamens. — p: Pod.

*vernus* Georgi, Reise Russisch. Reich. 1: 226. 1775. — TYPE: Siberia, Georgi (LE!).

*Astragalus biflorus* Pall. auct. non L., Reise 3: 206. 1773.

*Astragalus pauciflorus* Pall., Astrag.: 81. 1800. — *Gueldenstaedtia pauciflora* (Pall.) Fisch., Mém. Soc. Nat. Moscou 6: 173. 1823. — *Amblytropis pauciflora* (Pall.) Kitagawa, Rep. First Sci. Exped. Manch. Sect. 4(4): 87. 1936. — TYPE: "In Dahuria" (G!).

*Gueldenstaedtia pauciflora* (Pall.) Fisch. var. *subglabrata* DC., Prodr. 2: 307. 1825. — TYPE: "In pratis udis circa Irkutiam" (LE!).

*Gueldenstaedtia stenophylla* Bunge, Mém. Sav. Etrang. Scad. Sci. St. Pétersb. 2: 98. 1833, *syn. nov.* — *Amblytropis stenophylla* (Bunge) Kitagawa, Rep. First Sci. Exped. Manch. sect. 4(4): 87. 1936. — TYPE: "China Bor.", *Fischer s.n.* (isotype PE!).

*Gueldenstaedtia mirpourensis* Benth. ex Baker, Fl. Brit. Ind. 2: 118. 1879. — TYPE: "Upper gangetic plain at Mirpour, Jacquemont, Hazara," *Dr. Stewart* (K!).

*Gueldenstaedtia maritima* Maxim., Bull. Soc. Nat. Moscon 54: 7. 1879, *syn. nov.* — *G. multiflora* Bunge var. *maritima* (Maxim.) Jacot, J. N. China Branch Roy. Asiat.

Soc. 58: 106. 1927. — *Amblytropis maritima* (Maxim.) Kitagawa, Rep. First Sc. Exped. Manch. Sect. 4, 4: 87. 1936. — TYPE: China. "In litore prope Chefoo", 12.IV.1875 *Hancock s.n.* (holotype LE!, isotype PE!).

*Gueldenstaedtia multiflora* Bunge, Mém Acad. St. Pétersb. Sav. Etrang. 2: 98. 1883. — *Amblytropis multiflora* (Bunge) Kitagawa, Rep. First Sc. Exped. Manch. Sect. 4, 4: 87. 1936. — *Gueldenstaedtia verna* (Georgi) Boriss subsp. *multiflora* (Bunge) Tsui, Fl. Reip. Pop. Sin. 42(2): 150. 1998. — TYPE: China. *s.coll. s.n.* (isotype PE!).

*Gueldenstaedtia guilloni* Franch., Mem. Soc. Sc. Nat. Cherb. 24: 210. 1884. — TYPE: China. "In litore prope Chefoo" (P!).

*Gueldenstaedtia multiflora* Bunge var. *longiscapa* Franch., Pl. David.: 92. 1884. — *G. longiscapa* (Franch.) Léveillé, Cat. Pl. Yunnan.: 155. 1917. — *G. giralddii* Harms var. *longiscapa* (Franch.) Jacot, J. N. China Br. Asiat. Soc. 58: 112, 1927. — TYPE: China. "Chensi meridional", III.1873 *s.coll.* (P!).

*Gueldenstaedtia delavayi* Franch., Bull. Soc. Bot. France 32: 5. 1885. — *Amblytropis delavayi* (Franch.) C.Y. Wu ex Tsui, Fl. Illustr. Pl. Prim. Sin. (Leguminosae): 371. 1955. — TYPE: China. "In pratis siccis ad Mo-so-yun, prope Lang-kong", 28.V.1884 n. 42 (P!).

*Gueldenstaedtia giralddii* Harms ex Diels., Bot. Jahrb. 29: 413. 1901. — TYPE: China. "Zwischen Fang yu und Gniuy" *Hügel G1 1602* (B?, not seen).

*Gueldenstaedtia harmsii* Ulbr., Bot. Jahrb. 36. Beibl. 82: 58. 1905. — TYPE: China. "Am Ufer des Flusses Kan y huo, Lao y shan, blüh, im April und Mai", *Gi 4079* (B?, not seen).

*Gueldenstaedtia giralddii* Harms ex Diels. f. *elongata* Pavolini, Nuov. Giorn. Bot. Ital. 15: 410. 1908. — *G. giralddii* var. *elongata* (Pavolini) Pampan, Nuov. Giorn. Bot. Ital. 17: 396. 1910. — TYPE: China. "Territorio di Ou-kia-ki, alt. 300 m" 1.-15.IV.1905, n. 1080 (FI!).

*Gueldenstaedtia brachyptera* Pampan, Nuovo Giorn. Bot. Ital. 17: 396. 1910. — TYPE: China. "Pa-tao-ho", alt. 1000 m, 15.-30.III.1906, n. 1077 (FI!).

*Gueldenstaedtia giralddii* Harms subsp. *glabra* Jacot, J. North China Br. Roy. As. Soc. 58: 113. 1927, *syn. nov.* — TYPE: "Tsina" (NY!).

*Gueldenstaedtia gansuensis* H.P. Tsui, Bull. Bot. Lab. North-East. Forest. Inst. 5: 44. 1979, *syn. nov.* — TYPE: China. "In waste land, on the valley of Xiaonan River, Gansu", alt. 1100 m, 15.IV.1954 Z. B. Wang 17429 (holotype PE!).

*Gueldenstaedtia gracilis* H.P. Tsui, Bull. Bot. Lab. North-East. Forest. Inst. 5: 44. 1979, *syn. nov.* — TYPE: China. "On gravel slope, Lancang River, Xishuangbanna, Chongjinghong, Yunnan", alt. 550 m, 20.IV.1957 X. T. Cai 80218 (holotype PE!).

*Amblytropis brachyptera* var. *elongata* Péi & Shieb, Key to Spermatophyta of S Jiangsu Province: 140. 1958, *nom. nud.*

Perennial herb. Roots thick and woody, cylindrical. Stem almost absent, with persistent stipules. Plants with appressed hairs or glabrous. Leaves imparipinnate, 2–23 cm long, young

leaves with long hairs, mature leaves with sparse appressed hairs or glabrous, petiole sulcate, slender, with white appressed hairs, leaflets 2–10 pairs, elliptical to lanceolate, ovate to widely ovate, apical leaflet sometimes obovate, ovate to elliptic, widely elliptic to widely obovate, blunt and apiculate at apex, sometimes young leaflets ovate and mature leaflets linear, 2–4.5 cm long, 1–10 mm wide, apiculate, acute, blunt, emarginated or retuse, pubescent or sometimes glabrous on both surfaces, rounded at base. Racemes with 2–8 flowers, peduncle sulcate, hairy, slightly longer than leaves before blooming, much longer than leaves after blooming. Pedicel slender, sulcate, 1–3 mm long, bracts triangular-linear, narrowly triangular, lanceolate, subulate, 2–4 mm long, bracteoles linear, 1/2 as long as calyx. Calyx campanulate, 5–8 mm long, with long appressed white hairs, 5-lobed, lanceolate, upper 2 lobes equal to calyx, low 3 lobes shorter than calyx. Corolla violet, purple, and pink, standard ovate or sub-round, ovate, widely ovate or obovate, 9–13.5 mm long, 4.5–8 mm wide, emarginated at apex, tapering to claw at base; wings oblique obovate, 6–11 mm long, 1.7–3.5 mm wide, claw linear, 1.8–2 mm long, auriculate; keel-petals 4.2–7 mm long, 1–2 mm wide, oblique obovate, ovate, obovate, acuminate at apex, claw linear, 1.8–2.5 mm long; ovary tubular, cylindrical, oblong, elliptic, with densely appressed hairs, style glabrous, incurved, stigma round. Pods cylindrical, narrowly ovate, tubular, unilocular, 1.2–2 cm long, diameter 3–4 mm, with long hairs, when mature dehiscent along both sutures, with many seeds; seeds reniform or cylindrical-reniform or triangular-reniform, with mark.

**DISTRIBUTION:** China (Beijing, Gansu, Hebei, Henan, Hubei, Jiangsu, Jiangxi, Jilin, Heilongjiang, Liaoning, Nei Menggu, Ningxia, Shaanxi, Shandong, Shanxi, Tianjin, Yunnan), Korea, Mongolia, Russia (Fig. 8).

**ECOLOGY:** Roadsides, grasslands and terraced fields, alt. from 80 to 2600 m.

**PHENOLOGY:** Flowering March to June, fruiting May to November.

*Gueldenstaedtia verna* is variable in morphology and has a wide north–south distribution. Cui (1998) considered it to be different from *G. gracilis* and *G. stenophylla* in the shape of the

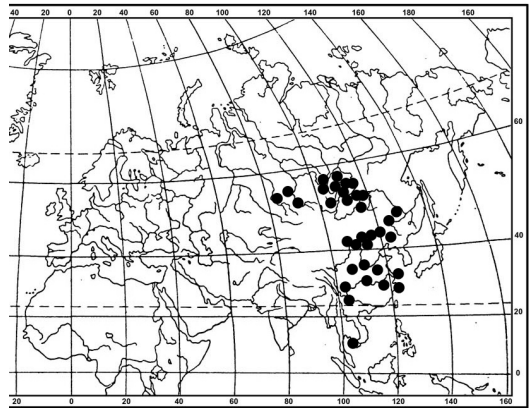


Fig. 8. Distribution of *Gueldenstaedtia verna*.

leaflets and standard-petal. However, our observations of wild populations revealed continuous variation in leaflet shape. Both these characters show variation within populations as well as in a single specimen (e.g. in specimens *s.coll.* 4116 and *Abbe E. Licent* 3675). Plant height was treated as the main character for distinguishing *G. verna* from *G. delevayi* and *G. gracilis* by Cui (1998). Based on the specimens examined, height varies considerably in different localities and is clearly an environmentally induced character. The name *G. delevayi* has been applied to small plants. *Gueldenstaedtia harmsii* is characterized by long peduncles and many flowers per raceme and can be considered to represent one extreme of the variation seen in *G. verna*. Two specimens (*Guan K. J.* and *Chen Y. L.* 64) from one locality were identified as *G. maritima* and *G. multiflora* by different scholars. Of them, *G. maritima* has glabrous morphological organs, an abnormal fascies in *G. verna*. This shows that glabrous and pubescent organs coexist in one population, and are thus unstable characters. I include *G. multiflora* in *G. verna* because the number of flowers per raceme is variable. The former species sometimes shows appressed, dense hairs and specimens with only one to two flowers. *Gueldenstaedtia verna* and *G. stenophylla* are identical except for some minor leaf shape differences, and *G. pauciflora* appears to be merely another variation of *G. verna*. Flower size among *G. verna*, *G. multiflora*, and *G. stenophylla* is identical. The pollen morphology supports that *G. gansuensis*, *G. gracilis*, *G. mul-*

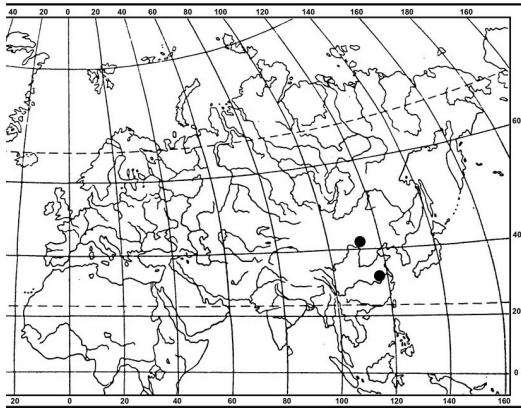


Fig. 9. Distribution of *Gueldenstaedtia verna* f. *alba*.

*tiflora*, *G. stenophylla*, and *G. verna* should be reduced to one species, consistent with macro-morphological characters such as leaf shape and plant height variation.

ADDITIONAL SELECTED SPECIMENS EXAMINED (total = 291): — **China**. Beijing: On roadside of grassland, within the Botanical Garden, 2002 X. Y. Zhu & Z. T. Wang 20020008 (PE); on roadside of hilly slope, Baiwang Shan, X. Y. Zhu 20020007 (PE); on stream side and meadow, Tsing-hwayuan, 1929 F. T. Wang 20024 (PE). Gansu: On damp place of grassland of valley, Xiahe Xian, alt. 1150 m, 1962 T. W. Liu 0732 (PE); on roadside of plain place, Jilacun, 10 km away from Min Xian, alt. 2400 m, 1957 Taohe Team 3090 (PE); on maize field, Xiaojingou, Lanzhou, 1956 Huanghe Team 10275 (PE). Hebei: Peitaiho, 1919 N. H. Cowdry s.n. (K); Hsiao-wutai Shan, 1934 s.coll., 61228 (PE); on side of field, Qinglong Xian, alt. 130 m, 1971 Chengde 511 (PE). Henan: On sunny place of valley, Dazhangzuoyuxiping, Song Xian, alt. 770 m, 1959 s.coll. 35298 (PE); in wasted place, Chengchow, alt. 140 m, 1936 T. P. Wang 3998 (PE). Heilongjiang: Huangshanzuizi, Harbin, 1953 Dongbei Team 394 (PE); on dry field of roadside, Majiagou, Harbin, 1951 G. Z. Wang et al. 600 (PE). Hubei: In valley, Shenlongjia, alt. 470 m, 1982 G. F. Tao & Z. D. Jiang 278 (TI); W. Hupeh, E. H. Wilson 1755 (K); S. W. Bushell s.n. (K). Jiangsu: Nanking, Kiangsu, 1929 W. P. Fang 63 (K); on airport of Huaiyin, 1951 Staff of the Work Station 2282 (PE); Nanjing, 1957 S. Y. He 570622 (BUN). Jiangxi: Hukou, 1910 K. K. Tsoong 180 (PE). Jilin: Sanjiazi, Tongyu Xian, 1960 J. X. Ye 51 (PE); Sanjiazi, Tongyu Xian, 1960 J. X. Ye 6 (PE); Guandongzhou, Lushun, G. Sato 10253 (PE). Liaoning: On dry slope of hill, Dahushan, Heishan Xian, 1953 S. E. Liu 5566 (PE); on dry grassland of hilly slope, Chezhandong, Shihe, Yudaqu, Jin Xian, 1960 Y. C. Deng & M. Q. Nan 1 (PE); on sunny slope of hill, Shidongou, Dahebei Gongshe, Lingyuan Xian, 1965 S. C. Cui & W. H. Ju 624 (PE). Nei Menggu: Manshuria Chinensis, Prov. Kirinensis, 1896 V. Komarov 945 (K); on sandland of plain, Hohhot City, 1965 P. C. Wang 11 (PE); on the way from Momiao to Huangheba, Urad Qianqi, 1956 X.

Z. Lang 318 (PE). Ningxia: Suyukou, Helanshan, Yinchuan, alt. 1700 m, 1959 Y. Q. He 7204 (PE); Nuanquan, Helanshan, 1973 Ningxia Institute of Drug Control 217 (PE); on roadside, Tongxin Xian, alt. 1400 m, 1959 Y. Q. He 6550 (PE). Shaanxi: Middle School of Mizhi, Mizhi Xian, alt. 1200 m, 2002 X. Y. Zhu 20020006 (PE); on road side, near Maanshan, Mei Xian, 1939 K. T. Fu 2900 (PE); on grassland of hilly slope, Manchuan Gongshe, Shanyang Xian, alt. 400 m, 1964 J. X. Yang 2447 (PE). Shandong: Weihai, 1973 X. F. Jiang s.n. (BNU); on roadside, Shanlu, Jiulongchi, Kunyushan, 1959 T. Y. Zhou et al. 760 (PE); on roadside, The First Tomb, Qingdao, 1964 H. B. Cui 227 (PE). Shanxi: On hilly slope, plain land, 5 km away from Sanjiaozhen, Lin Xian, alt. 1000 m, 1955 Huanghe Investigation Team 1399 (PE); on side of field, Doucun Gongshe, Wutai, K. J. Guan & Y. L. Chen 1819 (PE); Fenshui, 1942 T. Kanasiro 5085 (PE). Tianjin: Nanjiao, 1913 s.coll. & s.n. (PE); Xijiao, 1875 s.coll. & s.n. (PE); Yunnan: On wasteland, Dengchuan, July, 1962 W. C. Wang 604a (PE); on the way to Laschi-ba, Likiang, 1939 Feng K. M. 386 (PE); in slope of grassplace, Ku-cho-r, Y. Yun-ning, alt. 2600 m, 1937 T. T. Yü 5246 (PE). **Korea**. Xianzhongnandao, 1937 Shunsan, Tsutani s.n. (TI). **Mongolia**. Mongol-Dauria, s.coll. (LE). **Russia**. Irkutsk, distr. Balagansk, prope pag. Bazheevskoe, in clivis stepposis, 1906 N. Maltzev s.n. (PE); Prov. Primorje, distr. Nadeshdinsk, prope pag. Terechovka, in arenis ad ripam dextr. fl. Rasdolnaja, 1981 K. Ulanova & D. Bassargin s.n. (PE); Prov. Irkutsk, distr. Balagansk, prope pag. Bazheevskoe, in clivis stepposis, 1906 N. Maltzev s.n. (K).

#### f. *alba* (H.P. Tsui) P.C. Li

Vasc. Pl. Hengduan Mount. 1: 940, 1993. — *Gueldenstaedtia delavayi* f. *alba* H.P. Tsui, Bull. Bot. Lab. North-East. Forest. Inst. 5: 43. 1979. — TYPE: China. On hilly slope of very dry and grassy place, Y. Yun-ning, ku-cho-r, Yunnan, alt. 2600 m, 2.V.1937 T. T. Yü 5247 (holotype & isotypes PE!).

*Gueldenstaedtia multiflora* Bunge f. *alba* F.Z. Li, Acta Phytotax. Sin. 22 (2): 152. 1984. — TYPE: China. Tai Shan, Shandong, 5.V.1980 F. Z. Li 0512 (holotype SDFS!).

*Gueldenstaedtia verna* (Georgi) Boriss ssp. *multiflora* f. *alba* (F.Z. Li) H.P. Tsui, Fl. Reip. Pop. Sin. 42(2): 152. 1998.

*Gueldenstaedtia giraldii* Harms var. *alba* Jacot, J. North China Br. Roy. As. Soc. 58: 113. 1927. — TYPE: China. Tsina or Tsingtao, s.coll. & s.n. (NY).

DISTRIBUTION: China (Beijing, Shandong) (Fig. 9).

ECOLOGY. On sunny and dry slopes, alt. from 150 m to 2600 m.

PHENOLOGY. Flowering May.

The form has been placed in various species. It is easily distinguished by the white flowers.

ADDITIONAL SPECIMENS EXAMINED: — **China**. Beijing, on



sunny slope, Shisanling, alt. 150 m, Beijing Normal University 00239 (BNU); on grassland of Sanzhan, 1957 s.coll., 051 (PE).

## Excluded taxa and names

*Gueldenstaedtia latifolia* (Lam.) Fisch. ex D. Don., Gen. Sys. 2: 273. 1832. = *Astragalus latifolius* Lam.

*Gueldenstaedtia cuneata* Benth. in Royle, Illustr. Bot. Himal.: 200. 1835. = *Chesneya cuneata* (Benth.) Ali.

*Gueldenstaedtia oliveriana* Fisch. ex Jaub. & Spach. Illustr. Pl. Or.: 94. 1842, nom. nud.

*Gueldenstaedtia australis* Leveille, Cat. Pl. Yunnan.: 155. 1916, nom. nud.

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