



Taxonomic notes and distribution of *Gueldenstaedtia* (Chesneyinae, Fabaceae) in Mongolia

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ABSTRACT: The genus *Gueldenstaedtia* Fisch. is small genus of Fabaceae that includes four species worldwide. Among these, *G. monophylla* Fisch and *G. verna* (Georgi) Boriss. are currently recognized as occurring in Mongolia. Here, we present our findings on *G. verna* from our recent field surveys in eastern Mongolia in 2020. *Gueldenstaedtia monophylla* is mostly distributed in the western region, whereas *G. verna* occurs in eastern Mongolia. The regional conservation status of both species was assessed as near threatened based on criterion B in the country. We provided descriptions, grid distribution maps, taxonomic notes and photographic illustrations of the two species based on our newly collected samples.

Keywords: distribution maps, flora of Mongolia, *Gueldenstaedtia*, taxonomic notes

RECEIVED 13 February 2022; **REVISED** 7 March 2022; **ACCEPTED** 22 March 2022

INTRODUCTION

The genus *Gueldenstaedtia* Fisch., is small genus of Fabaceae including only four species worldwide (Zhu, 2004; Plants of the World Online, 2021). This genus ranges from the Sino-Himalayan region to Mongolia and Siberia (Lock and Schrire, 2005). *Gueldenstaedtia* formerly belonged to the Galegeae subtribe (Zhu, 2004), but more recently has been transferred to subtribe Chesneyinae based on extensive molecular studies (Duan et al., 2016). In the past, Zhu (2004) revised the genus, including the global distribution, illustration, taxonomic notes, and nomenclature. Furthermore, the pollen and seed morphology of this genus were characterized by Zhu (2005). In general, *Gueldenstaedtia* is characterized by perennial herbs, tick and woody roots, and flower purple, pink or yellow (Zhu, 2004). This genus is very similar to genus *Tibetia* (Ali) H. P. Tsui but several morphological characters differ from *Tibetia* by its two upper calyx free, and stipules free and adnate as well as pollen grains 3-colporate, psilate, and spheroidal (Zhu, 2004, 2005).

Two species of *Gueldenstaedtia* are currently distributed in

Mongolia: *G. monophylla* Fisch and *G. verna* (Georgi) Boriss. (Yakovlev, 1980, 2003; Grubov 1982; Baasanmunkh et al., 2022a). *G. monophylla* occurs in southern and western Mongolia (Oyuntsetseg et al., 2017), while *G. verna* is distributed in the eastern part of the country (Yakovlev, 1980, 2003; Grubov, 1982). Despite its presence, there are no detailed wild photographs or newly collected materials of *G. verna* in Mongolia. Only a small number of herbarium specimens of *G. verna* collected in Mongolia exist, stored at the Moscow Herbarium (MW) and gathered before 1990. In addition, this species was found in the Khuvsgul region (Doronkin et al., 2015). Moreover, several floristic studies from eastern Mongolia have been published in recent decades but *G. verna* has not been documented in these efforts (Neuffer et al., 2012; Shagdar and Yadamsuren 2017; Baasanmunkh et al., 2019). Here we present our findings of *G. verna* from our recent field surveys in eastern Mongolia in 2020.

MATERIALS AND METHODS

Since 2016, we have been actively conducting field surveys

in Mongolia to collect fresh vascular plants from the diverse vegetation types and document species occurrence data. During the field surveys, we found two species of *Gueldenstaedtia* from the western and eastern parts of the country. Detailed photographs of each species were taken during the field surveys by authors. In addition, we examined the herbarium specimens from several herbaria ALTB, MW, LE, NS, NSK, and UBU (Thiers, 2020) in order to make description and distribution map. Grid distribution maps of each species were produced in ArcGis, using the same approach as Baasanmunkh et al. (2021, 2022b).

The regional conservation assessments were based on IUCN (International Union for Conservation of Nature and Natural Resources) criterion B (including sub-criteria B1; the extent of occurrence, EOO, and B2; the area of occupancy, AOO) which uses geographic range size and evidence of declining or fragmented populations (International Union for Conservation of Nature and Natural Resources, 2019). The EOO and AOO were estimated using the ConR package (Dauby et al., 2017) in R 4.0.3. (R Core Team, 2016). The minimum AOO was calculated based on a user-defined grid

cell of 2 km², followed by the International Union for Conservation of Nature and Natural Resources (2019).

RESULTS AND DISCUSSION

Key to the species of *Gueldenstaedtia* in Mongolia

1. Flowers pink, leaves simple with orbicular or orbicular-reniform blade, root thin *G. monophylla*
1. Flowers pale pink, leaves imparipinnate, leaflets in 5–9 pairs, oblong or lanceolate, root thick, woody .. *G. verna*

TAXONOMIC TREATMENT

Gueldenstaedtia monophylla Fisch, Mém. Soc. Imp. Naturalistes Moscou 6: 171, 1823 (Figs. 1–3).—TYPE: RUSSIA. In Alp. Corgonensis ad Katunjam. Coll. Mordofkin, 1820. n. 57 (lectotype: designated by Yakovlev (1980), LE01057450, photo (Fig. 3)!; isolectotype LE01057452, photo!).

Perennial herb, 5–18 cm tall. Stem short. Leaf solitary, rarely 2- or 3-lobed; leaflets round, reniform, or orbicular, broad or

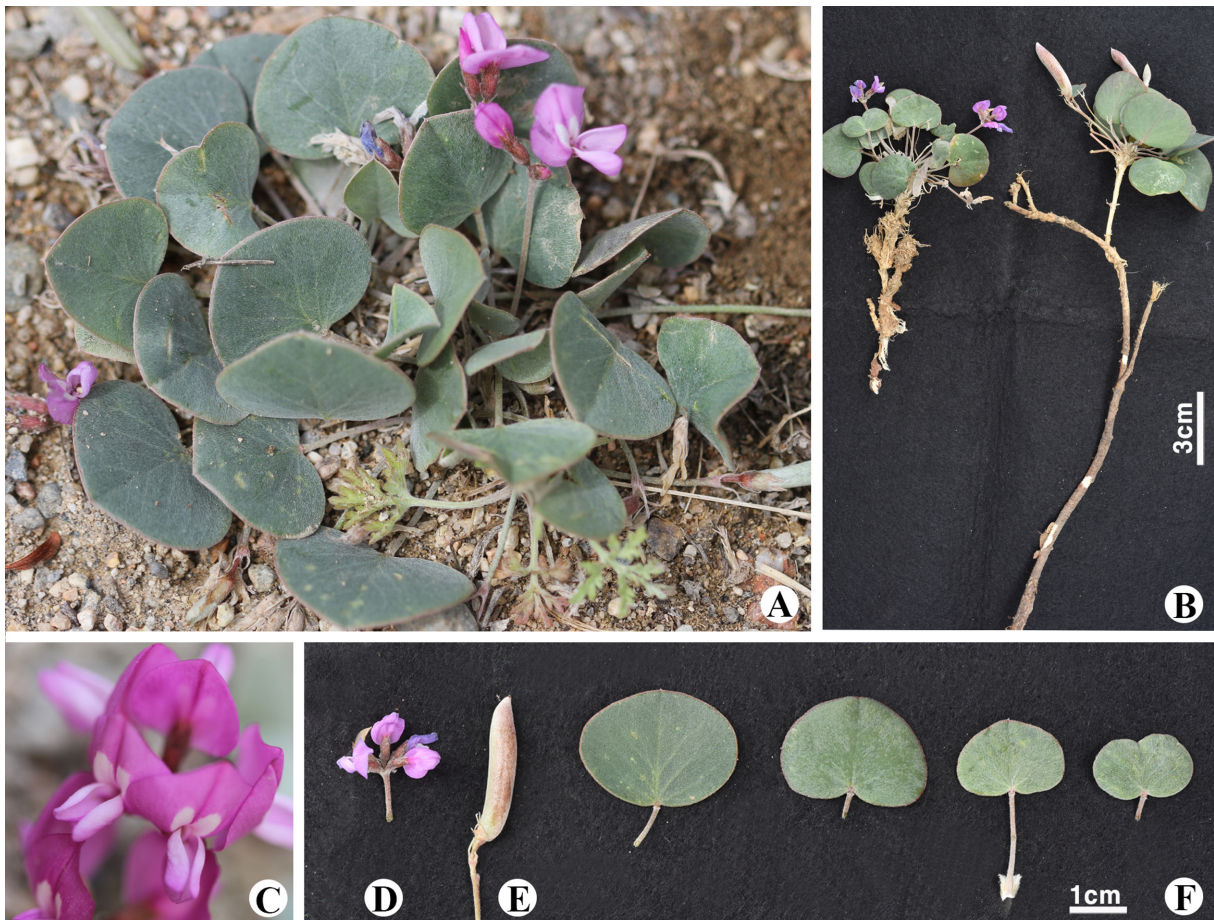


Fig. 1. Photos of *Gueldenstaedtia monophylla* in Mongolia. **A, B.** Habit. **C, D.** Flowers. **E.** Fruit. **F.** Leaves.

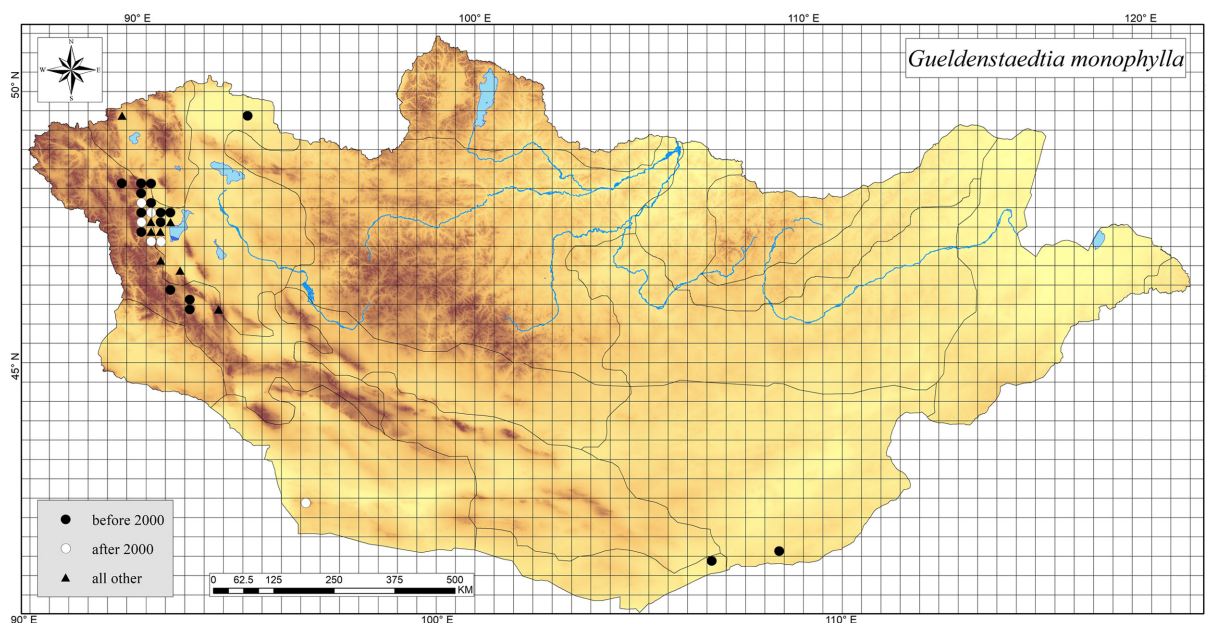


Fig. 2. Distribution map of *Gueldenstaedtia monophylla* in Mongolia.

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-mm long, 5-lobed, teeth lanceolate, 2/3 of tube; corolla violet; standard broadly obovate, entire or slightly emarginated 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, 3.5–5 mm wide, appressed-pubescent. Seeds reniform, irregularly circle reticulate.

Flowering and fruiting: May to August.

Distribution: Mongolia (Khovd, Mongolian Altai, Depression of Great Lakes, East Gobi, Trans-Altai Gobi, Alashan Gobi) and Russia (Altai, Tuva) (Yakovlev, 1980, 2003; Zhu, 2004; Plants of the World Online, 2022).

Note: In Mongolia, *G. monophylla* occurs in six phytogeographical regions (Selyutina 2021; Baasanmunkh et al., 2022a; Gundegmaa et al., 2022). Based on the grid map, we did not find any occurrences from the Gobi-Altai region (Fig. 2). *Gueldenstaedtia monophylla* grows on dry stony and debris slopes, rocks, and alkaline waterside pebbles (Grubov,

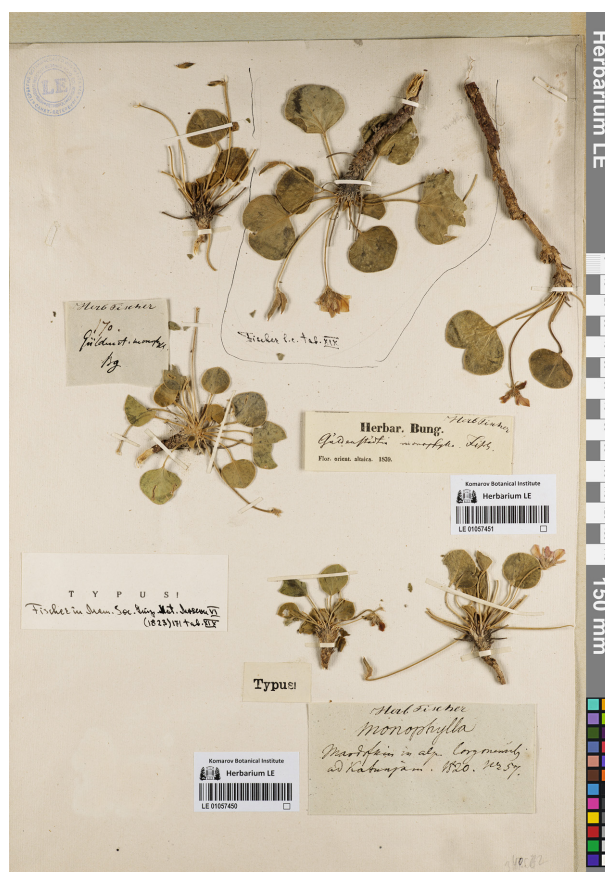


Fig. 3. The lectotype of *Gueldenstaedtia monophylla*.

1982; Oyuntsetseg et al., 2017). In general, *G. monophylla* is quite widely distributed in the western Mongolia, but several

isolated populations also occurs at low elevations in southern Gobi of the country (Fig. 2). This species is mostly grows on dry stone and debris slopes, rocks, and alkaline waterside pebbles at high (2,500 m) and low (780 m) altitude areas. According to Fig. 2, *G. monophylla* was recorded in low altitude area including three isolated populations in southern Gobi; however, this species is possible to be distributed across southern Gobi part due to limited field observations in Mongolia. According to ConR results, there were 17 unique occurrences in the country. The regional conservation status of *G. monophylla* was assessed as near threatened based on B criterion including EOO (107,721 km²) and AOO (12,800 km²) in Mongolia.

Specimens examined: MONGOLIA. Khovd region: Khovd province, Khovd sum, Ongontsnii Ulaan mountain, 48°16'55.2"N, 91°50'34.8"E, 1,500 m a.s.l., 7 Jun 1976, *W. Hilbig & Ts. Jamsran 43/74* (HAL46044); Khovd province, On the way to the Tavin Gasar from the Erdeneburen sum, 48°16'48"N, 91°33'10.8"E, 1,258 m a.s.l., 8 Jun 1976, *W. Hilbig & Ts. Jamsran 53/74* (HAL41426); Khovd province, Khovd sum, Khajuu khutul, 48°4'15.6"N, 91°36'25.2"E, 1,530 m a.s.l., 16 Aug 1976, *W. Hilbig & Ts. Jamsran* (HAL48720); Khovd province, Buyant Sum, 48°0'7.2"N, 91°38'31.2"E, 1,230 m a.s.l., 27 Jun 1982, *E. Jager* (HAL57860). Mongolian Altai region: Mountains near Shar-Nur lake, vicinity of Khovd town, 48°1'37.2"N, 91°21'32.4"E, 2,200 m a.s.l., 8 Aug 1898, *E. N. Klements* (LE); Steppe near Khovd town, 47°57'18"N, 91°24'7.2"E, 1,840 m a.s.l., 18 Jul 1906, *V. V. Sapozhnikov* (LE); Buyant river valley, 47°54'14.4"N, 91°17'13.2"E, 2,210 m a.s.l., 28 Aug 1930, *V. I. Baranov* (LE); 40 km north of Khovd town, along road to Tsagaan Nuur sum, 48°7'58.8"N, 91°24' 28.8"E, 1,900 m a.s.l., 7 Aug 1945, *A. A. Yunatov* (LE); Khovd town, gasoline station, 47°57'18"N, 91°29'27.6"E, 1,570 m a.s.l., 29 Jun 1971, *V. I. Grubov & N. Ulziikhutag et al.* (LE); 74 km north of Khovd town, socle plain, 48°36'50.4"N, 91°14'31.2"E; 1,400 m a.s.l., 4 Aug 1977, *Z. V. Karamysheva et al.* (LE); North bank of Bayan-Nur lake, 48°40'8.4"N, 90°34'22.8"E, 2,430 m a.s.l., 25 Jul; 60 km north west of Khovd town, Khagiin-Khush hill, 48°24'57.6"N, 91°9'18"E, 1,800 m a.s.l., 30 Jul 1979, *Z. V. Karamysheva et al.* (LE); Ulaan Ergiin gol valley, granite Muu Ulaan Tolgoi knoll, 46°45'43.2"N, 92°48'50.4"E, 2,100 m a.s.l., 12 Aug 1979, *V. I. Grubov, A. Muldashev, Sh. Dariimaa* (LE); Khovd province, Must sum, Ulaan Ereg river, 46°39'6.92"N, 92°49'23.3"E, 2,088 m a.s.l., 12 Aug 1979, *I. A. Grubov et al. 1278* (MW0182959); Khovd province, 11 km north from Khovd sum, valley of the Buyant river, 47°51'20"N, 91°5'30"E; 1,530 m a.s.l., 24 Jul 1984, *G. N. Ogureeva 271* (MW0182964); Khovd province, 1 km southwest from Khovd sum,

47°59'5.63"N, 91°38'49.6"E; 1,419 m a.s.l., 25 Aug 1985, *I. A. Grubov 2043* (MW0182963); Khovd province, Erdeneburen Sum, 48°15'N, 91°22'E, 2,500 m a.s.l., 20 Jul 2000, *B. Neuffer & H. Hurka 10246* (OSBU); Khovd province, Erdeneburen Sum, northern slope of Mant mountain, northern part of the Khong river, 48°23'23.86"N, 91°11'29.81"E, 1,549 m a.s.l., 22 Jun 2002, *A. Zemmrich* (GFW); Khovd province, Munkhkhairkhan sum, 29 May 2016, *B. Oyuntsetseg* (UBU). Depression of Great Lakes region: Uvs province, Tes sum, on the way to the Khar-Us lake from the Zuun lake, 50°18'32.22"N, 93°33'25.88"E, 779 m a.s.l., 23 Jul 1972, *T. P. Nadezhina 171* (MW0182960); Khovd province, south from Khovd river, Ulaan Uul mountain, 48°41'56.4"N, 91°21'7.2"E, 1,200 m a.s.l., 7 Jun 1974, *Ts. Jamsran & W. Hilbig* (UBU0009741); Khovd province, Khovd city, 48°1'12"N, 91°41'49.2"E, 2,025 m a.s.l., 3 Jul 1974, *Ts. Jamsran & W. Hilbig* (UBU0009742); Khovd province, Khajuu khutul, 48°9'18"N, 91°16'1.2"E, 2,000 m a.s.l., 16 Aug 1976, *Ts. Jamsran et al.* (UBU0009744); Khovd province, Must sum, Ulaan mountain, 46°52'37.2"N, 92°17'34.8"E, 3,300 m a.s.l., 12 Aug 1979, *N. Byambasuren* (UBU0009740); Khovd province, Khovd sum, Ongontsnii Ulaan mountain, 48°16'33.6"N, 91°46'30"E, 1,580 m a.s.l., 15 Jun 1985, *Sumya* (UBU0009739); Khovd province, Buyant sum, on the way from Khovd to Myangad sum, 48°11'10.01"N, 91°48'26.91"E, 1,232 m a.s.l., 13 Jun 2002, *A. Zemmrich AZ114* (GFW039244). East Gobi region: Ikh Shar Khid limestone massif, near Tenger Nuur lake, 100 km south west of Khatan-Bulag sum, 42°36'46.8"N, 108°28'44.4"E, 1,100 m a.s.l., 23 Jul 1974, *E. I. Rachkovskaya & E. A. Volkova* (LE). Transaltai Gobi region: Govi-Altai province, Tsogt sum, Arts Bogd mountain, 43°23'21"N, 96°24'41"E, 1,600 m a.s.l., 5 Jul 2005, *W. Hilbig* (HAL131081). Alashan Gobi region: Umnugovi province, Tarvagat sum, Aguit mountain, 42°36'25.2"N, 107°49'19.2"E, 1,250 m a.s.l., 23 Jun 1980, *I. A. Grubov 5615* (MW0182961).

Gueldenstaedtia verna (Georgi) Boriss. Spisok Rast. Gerb. Fl. S.S.S.R. 12: 122, 1953 (Figs. 4, 5); *Astragalus vernus* Georgi Bemerck. Reise Russ. Reich 1: 222, 1775.—TYPE: RUSSIA. Siberia, Georgi (lectotype: designed by Yakovlev (1980: 106), LE, Georgi's specimen has not been preserved in LE).

Geuldenstaedtia stenophylla Bunge, Mém. Sav. Etrang. Scad. Sci. St. Peterb. 2: 98, 1833.— TYPE: CHINA. Bor. Bunge s.n. (lectotype: LE, designated by Imkhanitskaya (2010: 194); syntypes: LE).

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



Fig. 4. Photos of *Gueldenstaedtia verna* in Mongolia. A, B. Habit. C. Leaf. D. Fruits.

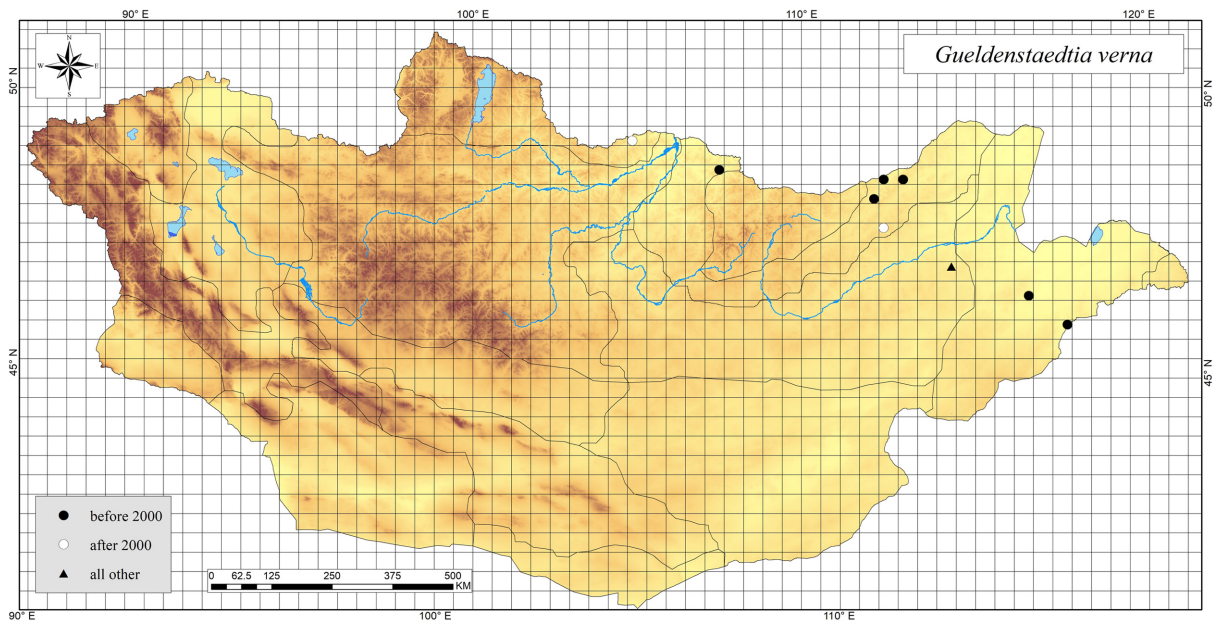


Fig. 5. Distribution map of *Gueldenstaedtia verna* in Mongolia.

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 cylindric-reniform or triangular-reniform, with mark.

Flowering and fruiting: May to September.

Distribution: China, Korea, Mongolia and Russia (Zhu, 2004).

Note: *Gueldenstaedtia verna* is distributed in China, Mongolia, Russia, and South Korea (Zhu 2004; Jang et al., 2020). South Korean populations of this species are known from Daegu and its adjacent regions, which flowering time is March to April (Lee and Kim 2017; Jang et al., 2020). In Mongolia, *G. verna* is recorded in the northern and eastern parts including the Khuvsgul, Khentii, Middle Khalkh, and East Mongolia regions (Fig. 4). *Gueldenstaedtia verna*, between 800–1200 m, grows on sandy, debris and stony steppe slopes, steppe abandoned fields, and sandy places in Mongolia (Grubov, 1982). During our field surveys, we found it from the typical steppe area with very few populations. Based on ConR results, there were nine unique occurrences in the country. The regional conservation status of *G. verna* was assessed as near threatened based on B criterion including EOO (66,446 km²) and AOO (12,800 km²) in Mongolia. In general, *G. verna* is very variable in morphology and has a wide north-south distribution (Zhu, 2005). However, several accepted species, slightly difference of leaf shape and flower size, have been treated into *G. verna* due to pollen morphology (Zhu, 2004).

Specimens examined: MONGOLIA. Khuvsgul region: Selenge province, Tushig sum, 27 km west south from Tushig village, right bank of Zelter river, 50°13'1.2"N, 104°49'1.2"E, 807 m a.s.l., 23 Jun 2012, *V. I. Ivleva* (NSK). Mongolian Dauria region: Dornod province, 25 km north west from Bayan-Uul sum, south west macroslope Ereen davaa, Dalai amin river, 49°17'24"N, 112°28'26.4"E, 1,000 m a.s.l., 2 Aug 1990, *I. A. Gubanov et al. 514* (MW0182970); Khentii province, Dadal sum, 49°16'22.8"N, 112°6'43.2"E, 1,100 m a.s.l., 10 Aug 1990, *I. A. Gubanov & Sh. Dariimaa 718* (MW0182968); Khentii province, 17 km east from Dadal sum, Ereen davaa, Onon river, 49°5'9.6"N, 111°49'26.4"E, 900 m a.s.l., 12 Aug 1990, *R. V. Kamilen et al. 777* (MW0182969); Selenge province, Khuder sum, Khuder river valley 5 km

above Khuder village, 49°44'49.2"N, 107°26'24"E, 1,200 m a.s.l., 24 Aug 1990, *R. V. Kamilen et al. 982* (MW0182971); Khentii province, Norivlon sum, 48°30'32.4"N, 111°47'6"E, 1,100 m a.s.l., 3 Jun 2020, *Kh. Khaliunaa* (UBU). East Mongolia region: Dornod province, 25 km east from Matad sum, 46°49'58.8"N, 115°30'0"E, 800–850 m a.s.l., 22 Jun 1987, *R. V. Kamilen et al. 163* (MW0182967); Dornod province, 10 km south west from Baruun sul, Built mountain, 46°21'7.2"N, 116°33'7.2"E, 930 m a.s.l., 1 Aug 1991, *R. V. Kamilen et al. 858* (MW0182966).

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ACKNOWLEDGMENTS

This study was supported by a research project (A study on the distribution of vascular plants in Mongolia; Grant KNA1-2-38, 20-5) of the Korea National Arboretum, South Korea, and partially supported by the National University of Mongolia (Grant 2021-P4186). The study was carried out within the framework of the institutional research project “Vascular plants of Eurasia: systematics, flora, plant resources” (Grant: AAAA-A19-119031290052-1) at the Komarov Botanical Institute of the Russian Academy of Sciences. We thank Alex McAlvay (New York Botanical Garden, New York, USA) for critical English editing.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

LITERATURE CITED

- Baasanmunkh, S., S. Takashi, B. Oyuntsetseg, K. Wesche, C. M. Ritz, K. Khaliunaa, J. Y. Kim, H. J. Jo, N.-O. Batkhuu, G. Y. Chung and H. J. Choi. 2019. Contribution to the knowledge on the flora of Numrug Strictly Protected Area and some parts of East Mongolia. *Journal of Asia-Pacific Biodiversity* 12: 284–301.
- Baasanmunkh, S., B. Oyuntsetseg, P. Efimov, Z. Tsegmed, S. Vandandorj, K. Oyundelger, M. Urgamal, A. Undruul, K. Khaliunaa, T. Namuulin and H. J. Choi. 2021. Orchids of Mongolia: taxonomy, species richness, and conservation status. *Diversity* 13: 302.

- Baasanmunkh, S., M. Urgamal, B. Oyuntsetseg, A. P. Sukhorukov, Z. Tsegmed, D. C. Son, A. Erst, K. Oyundelger, A. A. Kechaykin, J. Norris, P. Kosachev, J.-S. Ma, K. S. Chang and H. J. Choi. 2022a. Flora of Mongolia: annotated checklist of native vascular plants. *PhytoKeys* 192: 63–169.
- Baasanmunkh, S., B. Oyuntsetseg, Z. Tsegmed, K. Oyundelger, M. Urgamal, B. Gantuya, C. Javzandolgor, N. Nyambayar, P. Kosachev and H. J. Choi. 2022b. Distribution of vascular plants in Mongolia – I part. *Mongolian Journal of Biological Science* 20: 3–28.
- Dauby, G., T. Stévant, V. Droissart, A. Cosiaux, V. Deblauwe, M. Simo-Droissart, M. S. M. Sosef, P. P. Lowry, G. E. Schatz, R. E. Gereau and T. L. P. Couvreur. 2017. ConR: an R package to assist large-scale multispecies preliminary conservation assessments using distribution data. *Ecology and Evolution* 7: 11292–11303.
- Doronkin, V., S. Dmitry, I. Han, N. Vlasova, V. Ivleva, L. Enkh-tuya, T. Munkh-Erdene, N. Ochgerel and B. Munkhjargal. 2015. New records for the flora of Selenge province (Mongolia). *Skvortsovia* 2: 8–27.
- Duan, L., X. Yang, P. Liu, G. Johnson, J. Wen and Z. Chang. 2016. A molecular phylogeny of Caraganeae (Leguminosae, Papilionoideae) reveals insights into new generic and infrageneric delimitations. *PhytoKeys* 70: 111–137.
- Grubov, V. I. 1982. Key to the vascular plants of Mongolia. Nauka, Leningrad. 433 pp. (in Russian)
- Gundegmaa, V., T. Dashmaa, C. Bilegmandakh, Z. Tsegmed, J. Norris, B. Oyuntsetseg, A. S. Erst and S. Baasanmunkh. 2022. The vascular flora of the Sutai Khaikhan Mountain Nature Reserve, Mongolia. *Botanica Pacifica*. Advanced online publication. <https://doi.org/10.17581/bp.2022.11102>.
- Imkhanitskaya, N. N. 2010. *Gueldenstaedtia stenophylla* Bunge. In Catalogue of the Type Specimens of East-Asian Vascular Plants in the Herbarium of the Komarov Botanical Institute (LE). Pt. 2 (China). Grabovskaya-Borodina, A. E. (ed.), KMK Scientific Press, Moscow. 194 pp.
- International Union for Conservation of Nature and Natural Resources. 2019. Guidelines for Using the IUCN Red List Categories and Criteria, version 14. Retrieved Jan. 15, 2022, available from <https://www.iucnredlist.org/resources/redlist-guidelines>.
- Jang, J. G., S. T. Yoo, B. D. Kim, H. Y. Kim and M. H. Yi. 2020. The vascular plants of Apsan Park in Daegu, Korea. *Korean Journal of Plant Resources* 33: 365–397.
- Lee, J.-A. and J.-W. Kim. 2017. A new association of *Gueldenstaedtia-Zoysietum japonicae*: A syntaxonomical and syngéographical description of the southernmost population of *Gueldenstaedtia verna* in South Korea. *Weed and Turfgrass Science* 6: 40–54.
- Lock, J. M. and B. D. Schrire. 2005. Galegeae. In *Legumes of the World*. Lewis, G., B. Schrire, B. Mackinder and M. Lock (eds.), Royal Botanic Garden, Kew. Pp. 475–487.
- Neuffer, B., N. Friesen, B. Oyuntsetseg, T. Jamsran and H. Hurka. 2012. Osnabruck botanical expeditions to Mongolia. *Erforschung Biologischer Ressourcen der Mongolischen Volkrepublik Halle (Saale)* 12: 307–333.
- Oyuntsetseg, B., S. Baasanmunkh, K. Oyundelger, O. Munkhzul, J. Y. Kim, H. J. Cho, N.-O. Batkhuu, G. Y. Chung and H. J. Choi. 2017. Contribution to the knowledge on the flora of Munkhkhairkhan mountain area, Mongolia. *Journal of Asia-Pacific Biodiversity* 10: 573–582.
- Plants of the World Online. 2022. Facilitated by the Royal Botanic Gardens, Kew. Retrieved Dec. 10, 2022, available from <http://www.plantsoftheworldonline.org/>.
- R Core Team. 2016. R: A Language and Environment for Statistical Computing. Retrieved Jan. 24, 2022, available from <https://www.R-project.org/>.
- Selyutina, I., E. Konichenk, N. Igay and D. Darikhand. 2021. The specific features of the reproductive biology of the rare species *Gueldenstaedtia monophilla* Fisch. (Fabaceae). *Northern Asia Plant Diversity, Bio Web of Conference* 38: 00111.
- Shagdar, D. and O. Yadamsuren. 2017. Plant species composition and vegetation cover of Kherlen Toono Mountain, Mongolia. *Journal of Asia-Pacific Biodiversity* 10: 132–136.
- Thiers, B. 2020 [Continuously updated]. Index Herbariorum. A global directory of public herbaria and associated staff. Retrieved Jun. 1, 2021, available from <http://sweetgum.nybg.org/ih/>.
- Yakovlev G. P. 1980. On the genus *Gueldenstaedtia* Fisch. (Fabaceae). *Botanicheskii Zhurnal* 65: 104–108. (in Russian)
- Yakovlev G. P. 2003. *Plants of Central Asia: Plant Collection from China and Mongolia*, Vol. 8a. Leguminosae. Science Publishers, Inc., Enfield, NH, 170 pp.
- Zhu, X.-Y. 2004. A revision of the genus *Gueldenstaedtia* (Fabaceae). *Annales Botanici Fennici* 41: 283–291.
- Zhu, X.-Y. 2005. Pollen and seed morphology of *Gueldenstaedtia* and *Tibetia* (Leguminosae): with a special reference to their taxonomic significance. *Nordic Journal of Botany* 23: 373–384.