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A novelty for the flora of China: Siberian "endemic" *Euphorbia karoi* (*Euphorbiaceae*) occurs in the south part of Inner Mongolia

Новинка для флоры Китая: сибирский «эндемик» *Euphorbia karoi* (*Euphorbiaceae*) встречается в южной части Внутренней Монголии

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Abstract. *Euphorbia karoi*, a species described from South Siberia (the vicinity of Nerchinsk) and known from only a few gatherings, is reported from China, the southern part of the Inner Mongolia Autonomous Region. This species was collected by the Russian expedition led by P. K. Kozlov (1908) in the Helan (Alashan) Mountains and also in the Jiufeng Mountains (according to the specimen image from PE Herbarium). *E. karoi* is accepted here in the strict sense; its taxonomic status and characters are discussed. The current disjunction in its distribution may be explained by the expansions of the steppe and desert flora into Siberia from Central Asia during the Cenozoic.

Keywords: *Euphorbia*, spurge, Siberia, Inner Mongolia, Helan Mountains.

Аннотация. *Euphorbia karoi* — вид, описанный из Южной Сибири и известный по немногим сборам, приводится для южной части автономного района Внутренняя Монголия (Китай). Этот вид был собран в горах Хэланьшань (Алашань) русской экспедицией под руководством П. К. Козлова (1908), а также отмечен в горах Юфенг. *E. karoi* принимается в узком смысле, обсуждается его статус и отличительные признаки. Современная дизъюнкция в его распространении объясняется неоднократными экспансиями степной и пустынной флоры в Сибирь из Центральной Азии на протяжении кайнозоя.

Ключевые слова: *Euphorbia*, молочай, Сибирь, Внутренняя Монголия, горы Хэланьшань.

During the preparation of *Euphorbia* L. treatment for the project "Plantae Asiae Centralis", I noted an unnamed specimen from the Helan (Alashan) Mountains (China, Inner Mongolia), which then was identified as *Euphorbia karoi* Freyn — a species described from South Siberia (Nerchinsk, Transbaikal Territory according to the modern administrative subdivisions of Russia). This paper aims to confirm the current taxonomic status of *E. karoi* and explore the possible origin of the significant disjunctions in its distribution area.

Taxonomic history of *Euphorbia karoi*

Euphorbia karoi Freyn (section *Esula* (Pers.) Dumort.) was described by Freyn (1896), who wrote a treatment of the Siberian collection of Ferdinand Karo — a pharmacist who worked in Irkutsk during 1887–1899. He gathered many specimens from the areas around Irkutsk, Nerchinsk and Blagoveshchensk; part of this collection after Freyn's treatment was sold (Borodin, 1908), so his specimens are currently housed in several herbaria of the world.

Originally *E. karoi* was known from the vicinity of Nerchinsk only. This fact was mentioned by Prokhanov (1949) in his *Euphorbia* treatment for the "Flora of the USSR". Later Popov (1959) recorded this species for some other localities in Transbaikalia and interpreted its characters (judging from the description and illustration) a little differently from the protologue. Grubov (1975) and Peschkova (1979) generally followed Popov's concept.

Basargin (1981) downgraded *E. karoi* to subspecies of *E. discolor* Ledeb.[1] and circumscribed it more broadly in terms of morphological characters and geographical distribution. According to Basargin (1981), *E. discolor* subsp. *karoi* (Freyn) Bassargin occurs in South-East

[1] Prokhanov (1949) gave the name *E. discolor* to the commonest and very variable species of *Euphorbia* sect. *Esula* occurring in Siberia, Russian Far East, Eastern Kazakhstan, Mongolia, part of China, Korean Peninsula, etc. However, this name is likely a later homonym. Baikov (2007) accepted several species in place of *E. discolor*, including *E. esula* L. and *E. borealis* Baikov. Authors of "Flora of China" (Ma, Gilbert, 2008) refer such plants to an extremely variable *E. esula*. A careful revision of this group is necessary.

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Transbaikalia, North-East China, east and southeast parts of Mongolia; some "spots" are known in South Siberia, Yakutia, and the Russian Far East. Following this record, Gubanov (1996) included this subspecies in his vascular plant checklist of Outer Mongolia (Mongolian People's Republic). However, Baikov (1996, 2007) returned to a narrow circumscription of this taxon and treated it as a distinct species endemic to Siberia.

Recently, *E. karoi* became a subject of dedicated study of its ecological preferences and morphology. Some new localities have been discovered; the species was included in the "Red Data Book of the Transbaikal Territory" (Komissarova, 2010, 2017).

Material and methods

Collections of the Herbarium of the Komarov Botanical Institute (LE) and images of relevant specimens from other Herbaria (IRK, NS, P, TK, W, WU) were used for this work. I also used resources of Global Plants on JSTOR (2021), Virtual Herbaria JACQ (2021), Moscow Digital Herbarium (Seregin, 2021) and database of the Herbarium, Institute of Botany, Chinese Academy of Sciences (PE) (http://pe.ibcas.ac.cn/en/). Morphological terminology generally follows Riina et al. (2013). The morphological description is based on the available herbarium specimens, existing descriptions (Freyn, 1896; Prokhanov, 1949) and other sources (Baikov, 2007; Komissarova, 2010). The conservations status was assessed according IUCN (2012).

Results

In Siberia, *E. karoi* is known mainly in the Transbaikal Territory: *locus classicus* near Nerchinsk, two localities in the city limits of Chita and its close vicinity and one locality near the village of Bogomyagkovo in the Shilka District (Baikov, 2007; Komissarova, 2017).

Baikov (2007) also cited the herbarium specimen collected in the Kachug District of the Irkutsk Region, on the rocks of the Lena River near Chanchur village. Unfortunately, it was impossible to find this specimen in IRK where it should be kept.

The locality in China (Inner Mongolia) was discovered in the holdings of the LE Herbarium (East and Central Asia section). The specimen from the Helan (Alashan) Mountains in the Tszosto Gorge (full citation see below in "Taxonomic treatment") has been collected during the Imperial Russian Geographical Society expedition led by P. K. Kozlov (Fig. 1). During April — June 1908, the main body of the expedition team stayed in Dingyuanying oasis (now — Bayan Hot or Alashanchi — a center of Alashan aimag (prefecture)), but some members of the group made excursions to the Alashan Ridge (Kozlov, 1923).

The study of digital holdings of the PE Herbarium from Inner Mongolia showed that a specimen collected in the Jiufeng Mountain, Bautou District (PE 00928536) is very similar if not identical to *E. karoi*.

Thus, the distribution area of *E. karoi*, which was considered endemic to the southern part of East Siberia, was expanded to Inner Mongolia.

Taxonomic treatment

Euphorbia karoi Freyn, 1896, Oesterr. Bot. Z. 46: 58. ≡ *Tithymalus karoi* (Freyn) Prokh. 1949, Fl. URSS, 14: 424, nom. altern. ≡ *Euphorbia discolor* Ledeb. subsp. *karoi* (Freyn) Bassargin, 1981, Bot. Zhurn. 66, 3: 430, p. p., quoad typo. — Lectotype (Baikov, 1994: 125): Dahuria, Steingeroll am Nerczflus, w rossypach skał nad Nerczei, 1892[1], Karo, № 8 (LE: LE 01056950! (Fig. 2); isolectotypes: BM001050421 — image!, C10011239 — image!, DAO000424470 — image!, HBG-516224 — image!, G00441410!, GOET003721 — image!, JE00002883 — image!, LE 01056951–LE 01056953!, LD 1213456 — image!, LD 1213516 — image!, LD 1213576 — image!, MW0595596 — image!, P00606736!, P00606737!, P00606739!, W 1892-0003914!, WU 0044260!).

Glaucous perennial herb. Root thin, vertical, creeping. Stems erect, sometimes slightly curved, shortly pilose or glabrous, 6–12 cm high, 1–1.8 mm thin, usually with sterile axillary vegetative shoots, 1–9 cm long, sometimes exceeding the stem. Lower leaves scale-like, coriaceous. Stem leaves more or less scattered narrow-linear, linear-spathulate or linear-lanceolate, entire, base truncate, apex obtuse or slightly acutate, glabrose, 10–35 mm long and 1–2.2 mm wide, 7–15(30) times as long as wide, only midrib visible. Leaves of axillary vegetative shoots linear, base cuneate, apex shortly acute, glabrous, 15–60 mm long and 0.6–1.5 mm wide. Terminal rays of synflorescence (4)5, axillary rays 0–5, glabrous, 1–2 times dichotomous, 1.5–6 cm long. Ray leaves similar to upper stem leaves. Raylet leaves two, free, obtriangulate with cuneate flabellate base and triangulate or *widely truncate* apex (similar to *Ginkgo* leaf) or triangulate-reniform, 5–8 mm long and 10–12 mm wide. Cyathium ca. 1.5 × 2 mm, glands 4, purple, falcate or semilunate, converging, appendages very short or absent, styles ca. 1.5 mm long, coalesce about one-third of the length. Capsules subspherical, smooth, ca. 2.5 mm

[1] The collection date in the protologue is 24 V 1889. Borodin (1908) mentioned that Karo's collections made in 1889 were distributed in 1892. There are two kinds of labels on Karo's specimens from Nerchinsk: fully printed with the indication 1889 and handwritten with 1892 (year of distribution). Both bear the same number and are undoubtedly duplicates.

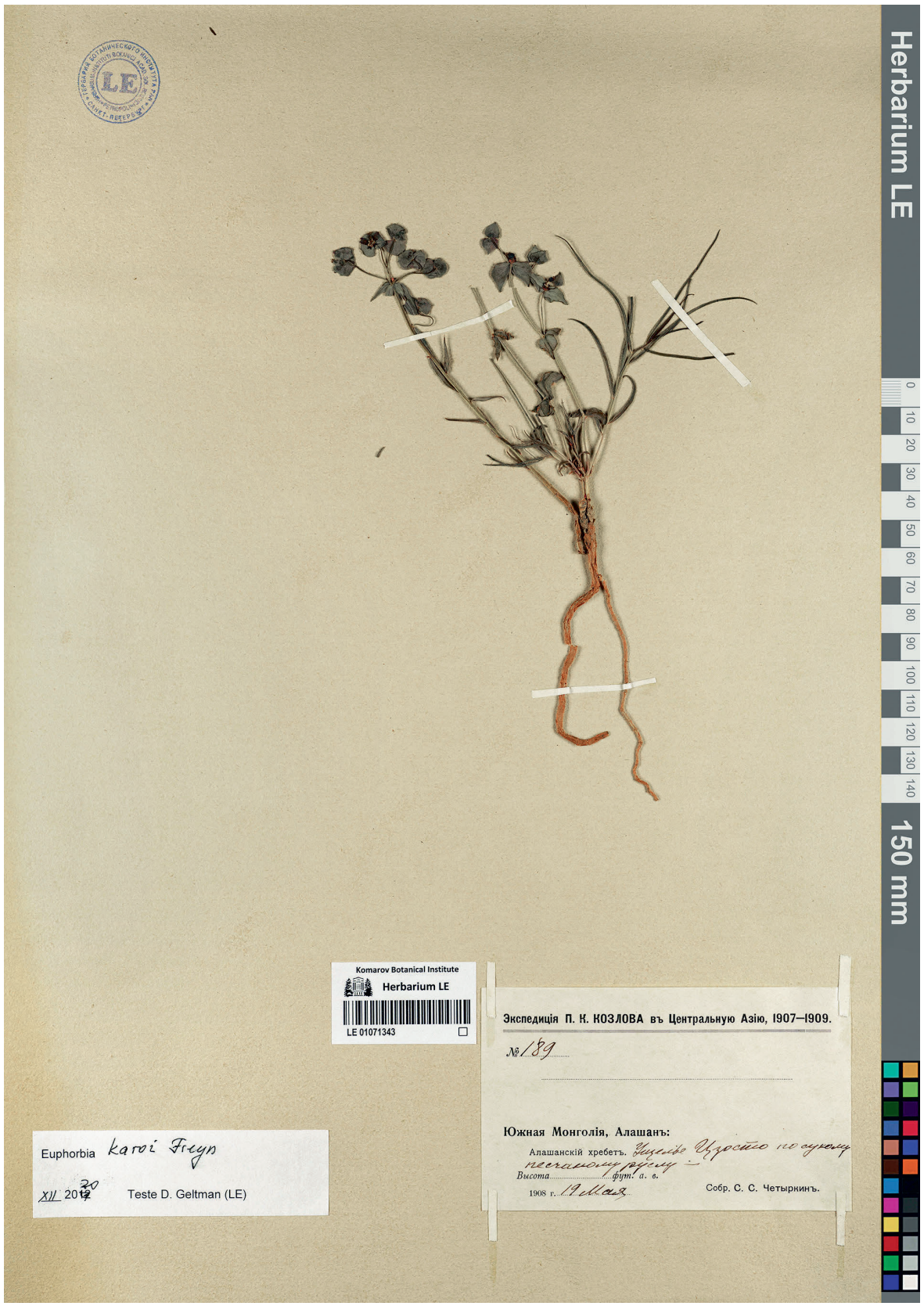


Fig. 1. *Euphorbia karoi* specimen from the Helan Mountains (LE 01071343).

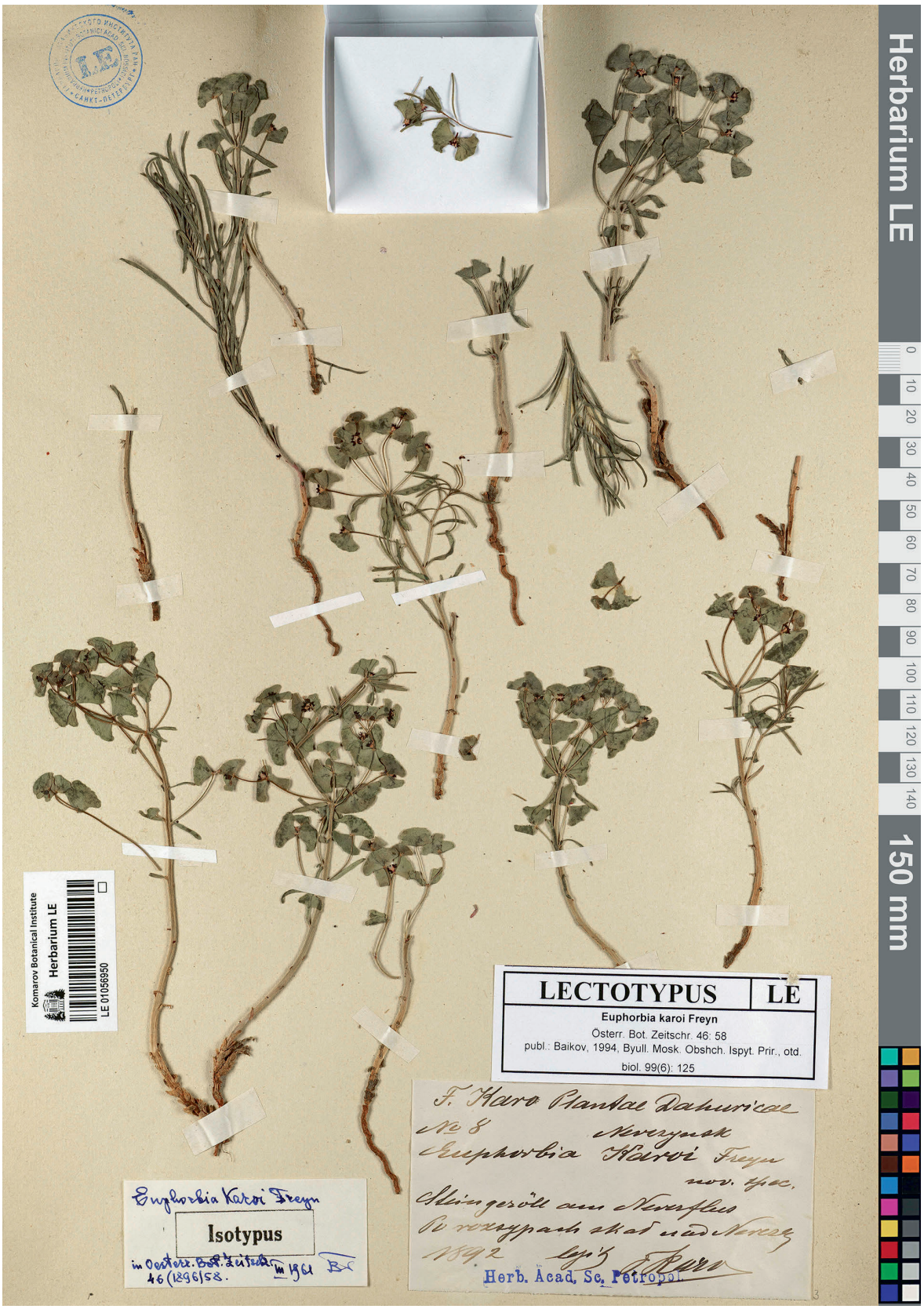


Fig. 2. Lectotype of *Euphorbia karoi* (LE 01056950).

diam., seeds more or less ovoid, ca. 2 mm long and 1.5 mm wide, carunculate.

Specimens studied (except type material): **Russia, Transbaikal Territory:** Нерчинск, по каменистому обрыву горы Муромихи на р. Нерчи, VI 1891, Стуков, № 270 [Nerchinsk, of stony cliff of the Muromikha hill on the river Nercha, VI 1891, Stukov, № 270[1]] (LE 01071341!, LE 01071342!); *Окр. г. Чита, Титовская сопка, степной склон,* VIII 1966, [Б. И.] Дулепова [*Vicinity of Chita, Titovskaya hill, steppe slope,* VIII 1960, *B. I. Dulepova*] (TK-004253 — image!); *там же,* 15 V 1970, *она же* [*ibidem,* 15 V 1970, *eadem*] (NSK0084779 — image!, NSK0084780 — image!); **China, Inner Mongolia:** Алашанский хребет, ущелье Цзосто, по сухому песчаному руслу, 19 V 1908, С. С. Четыркин, № 189 [Alashan Range, Tszosto Gorge, on dry sand riverbed, 19 V 1908, S. S. Chetyrkin, № 189] (LE 01071343!); 九峰山, 刘东来 73 [Jiufeng Mountain, s. d.[2], Liu Donglai, № 73] (PE 00928536 — image!).

Habitats: steppes on well-warmed rubble-stony south-facing slopes (Komissarova, 2010, 2017), dry riverbeds.

Flowering time: mid-April — May (Komissarova, 2010, 2017).

Distribution: Russia: Irkutsk Region (?), Transbaikal Territory (4 known localities); China: Inner Mongolia Autonomous Region (2 localities). — Fig. 3.

Conservation status: VU B2a,b(i,iii).

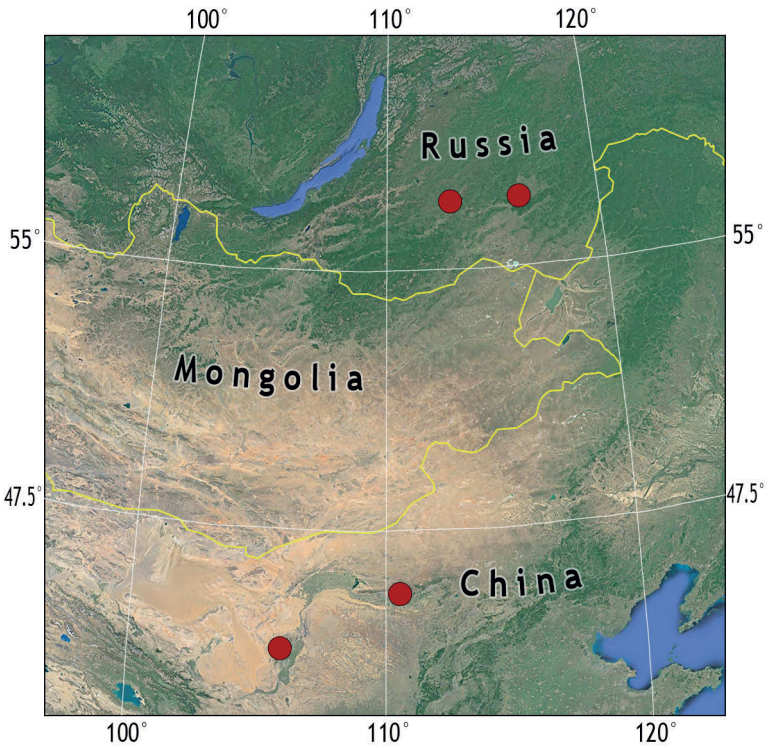


Fig. 3. Distribution of *Euphorbia karoi*.

Discussion

So far, most of herbarium specimens of *E. karoi* were known from the *locus classicus*, and the discovery of new localities could revise our understanding of its habit. Currently, *E. karoi* could be recognized from the commonest species (or group of species, see footnote jn p. 131) of the section *Esula* (*E. borealis* Baikov, *E. esula* L. in the sense of the authors of "Flora of China", etc.) by its dark glaucous colour, short stem, very narrow stem leaves, usual presence of more or less long sterile axillary shoots with more narrow leaves than stem ones. Specimens from *locus classicus* have pilose stems and rays, but the specimen from the Helan Mountains is glabrous, similarly to the one from the Irkutsk Region (Baikov, 2007). It also evidently differs by its earlier flowering time.

By morphological characters, *E. karoi* is similar to small glaucous ephemeroid, more or less narrow-leaved perennials, such as *E. leptocaula* Boiss., *E. subtilis* (Prokh.) Prokh., *E. astrachanica* C. A. Mey. ex Trautv., and especially to the latter. All these species occur in steppes and steppe-like plant communities and sometimes occupy rocky localities by river valleys.

The discovery of this "Siberian endemic" in the mountains of Inner Mongolia is exciting and interesting, but not very unexpected. A strikingly similar case is represented by *Borodinia tilingii* (Regel) Berkut. (*Brassicaceae*), initially described as *B. baicalensis* N. Busch from the Lake Baikal area. Later, this species was found in several localities in Transbaikalia and the Russian Far East. However, it was later discovered that this species also occurs in Inner Mongolia (in the Helan Mountains!) and for a long time was known as *Arabis alaschanica* Maxim., so the combination *A. tilingii* (Regel) Berkut. has been made (Berkutenko, 2003). Then it was renamed as *A. macrophylla* (Turcz.) Berkut. (Berkutenko, 2005); recently molecular data shown the close relationship of *Borodinia* N. Busch with *Boechera* Á. Löve et D. Löve, at least one of its clades (Kiefer et al., 2009; Alexander et al., 2013). A second prominent

[1] Two specimens share the same number, but the first is dated as VI 1889–91, the second — June 1891.

[2] The specimen was collected before 27 VII 1953, because bears a determination slip with this date.

example of a similar distribution pattern is *Mannagettaea hummelii* H. Smith (*Orobanchaceae*), described from the Gansu Province and occurring in the East Sayan Mountains and known as *M. ircutensis* Popov (Krasnoborov, 1975).

During the Cenozoic era and even earlier, there were several waves of expansion of steppe and even desert plants in Siberia (Malyshev, Peschkova, 1984). The current distribution pattern of *E. karoi*, and other species mentioned above, is clear evidence of this phenomenon. New localities of *E. karoi* will likely be discovered during field observations and excursions during the springtime (April — May).

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