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## Notes on *Potentilla* (Rosaceae) of Altai. 11. Eleven new national and regional findings

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**Summary.** Additions are provided on the distribution of rare species of *Potentilla* in the territory of the Altai Mountain Country (AMC). *Potentilla hubsugulica* is reported for the first time from the flora of Kazakhstan; *P. crantzii*, *P. penniphylla*, and *P. rigidula* are new records for China. New to Russia are *P. rhipidophylla* and *P. tyttantha*, and new to Western Siberia are *P. hubsugulica*, *P. × olchonensis* and *P. stepposa*. These five species, as well as *P. chalchorum* and *P. tuvunica*, complemented the flora of the Republic of Altai. Among the plants mentioned, *P. tyttantha* is endemic to the AMC. All studied collections are cited, with comments provided on the relationships, ranges, and primary morphological differences of the discussed taxa. For the AMC subendemic *P. rigidula*, we present a scanned herbarium specimen image and photos of wild plants from the new locality. In addition, its general distribution has been mapped based on all known, reliably identified collections and observations.

## Заметки о лапчатках (*Potentilla*, Rosaceae) Алтая. 11. Одиннадцать новых национальных и региональных находок

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**Ключевые слова:** Восточно-Казахстанская область, Западная Сибирь, Казахстан, Китай, Республика Алтай, Россия, Синьцзян, флористические находки, эндемики.

**Аннотация.** Приводятся дополнения о распространении редких видов *Potentilla* на территории Алтайской горной страны (АГС). Впервые для флоры Казахстана приводится *P. hubsugulica*; для Китая – *P. crantzii*, *P. penniphylla* и *P. rigidula*. Новыми для России являются *P. rhipidophylla* и *P. tyttantha*, для Западной Сибири – *P. hubsugulica*, *P. × olchonensis* и *P. stepposa*. Эти пять видов, а также *P. chalchorum* и *P. tuvunica* дополнили флору Республики Алтай. Среди указанных растений *P. tyttantha* относится к эндемикам АГС. Все изученные сборы процитированы, приведены комментарии о родстве, ареале и главных морфологических отличиях обсуждаемых таксонов. Для субэндемика АГС *P. rigidula* представлены изображение сканированного гербарного образца и фото в природе из нового местонахождения. Кроме этого, на основании всех известных достоверно определённых сборов и наблюдений показано его общее распространение.

## Introduction

A critical review of the subtribe *Potentillinae* J. Presl (Rosaceae) for the Altai Mountain Country (AMC) was published recently (Kechaykin, 2024). According to these data, the flora of the AMC includes 85 species of the genus *Potentilla* L. sensu stricto (cinquefoil). Among them, 14 taxa are endemic to the study area, 13 are subendemic, and 5 species are listed in regional Red Data Books. Active research of the AMC cinquefoils continues: a new species, *P. sanczirii* Gundegmaa, Onolr. et Urgamal, was described (Gundegmaa et al., 2025), and new findings were recorded (Kechaykin et al., 2025).

A revision of the collections from ALTB (Barnaul, Russia) and PE (Beijing, China), an analysis of literature data, and field studies have clarified the distribution of 10 species and revealed 11 new national and regional records, continuing the series of articles “Notes on *Potentilla* (Rosaceae) of Altai”. Thus, three species are new to the flora of China, two species are new to Russia, one is discovered for the first time in Kazakhstan, three are discovered in Western Siberia, and seven have not been recorded previously in the Altai Republic. The identification of *Potentilla* species was based on modern revisions of the flora of Central Asia, China, and Altai (Li et al., 2003; Soják, 2004, 2007, 2012a; Kechaykin,

2024). We also employed ArcGIS 10.6 to visualize the geographic distribution of *P. rigidula* Th. Wolf, a subendemic species of the AMC. The filtered occurrence data are provided in the Supplementary Materials available on the journal’s website. For each species, we provide citations of herbarium labels indicating the specimen’s storage location, along with comments on their relationships, geographical distribution, and morphological features. The data we provide significantly expand our understanding of the distribution range of these species not only within the AMC but also in Central Asia and Southern Siberia, and supplement existing knowledge regarding their morphology and differences. The research results are presented below.

## New records for the flora of China

***Potentilla crantzii*** (Crantz) Beck ex Fritsch: “Xinjiang, Mongolian Altai, Ulkun-Chingil valley, 30 km upstream from Qinhe (Chingil), larch forest and steppe slopes on the left bank, 1700 m. 46°56′N, 90°15′E. SRAE2004190. 29 V 2004. Sino-Russian Altai Expedition” (PE01766966). – A widespread Arctic-Alpine species found from Atlantic Europe to Southern Siberia and the Mongolian Altai, as well as in Greenland and the eastern regions of Canada (Bolbotov et al., 2024). Traditionally, *P. gelida* C. A. Mey.

and *P. boreoasiatica* (Jurtzev et Kamelin) Kechaykin, which have only ternate basal leaves, are considered the most closely related to *P. crantzii*. The latter species is dominated by palmate leaf blades.

***Potentilla penniphylla*** Soják: “Xinjiang, Altay Prefecture, Burqin County, Qibeiling, Altai foothills gully plain, 1250 m. [48°01′51″N, 87°22′28″E]. No. 6259. 15 VIII 1964. Gelin Zhu, Wenyong Xu, Yulan Liu” (PE00881661). – Distributed from Pamir-Alai to Altai (Kechaykin, 2016a; Kechaykin et al., 2020a). It is presumably a result of hybridization between *P. sericea* L. and *P. multifida* L. (or *P. ornithopoda* Tausch). *Potentilla penniphylla* differs from *P. multifida* by having leaf blades with 3–6 pairs of leaflets, longer hairs on the petioles, a lax inflorescence with relatively larger flowers and petals, and occasionally by the presence of small, solitary glands on the calyx. It differs from *P. sericea* by the appressed pubescence of the petioles and stems, leaflets that are almost always dissected nearly to the midrib into longer linear segments, and on average longer stems, which can reach up to 40 cm in height. In the AMC, *P. multifida* and *P. sericea* often occur sympatrically, particularly on gravelly riverbeds and stream banks in high-mountain areas, as well as near rocky outcrops.

***Potentilla rigidula*** Th. Wolf: “Xinjiang, Sayur Mountain, Jeminay County, Altay Prefecture,

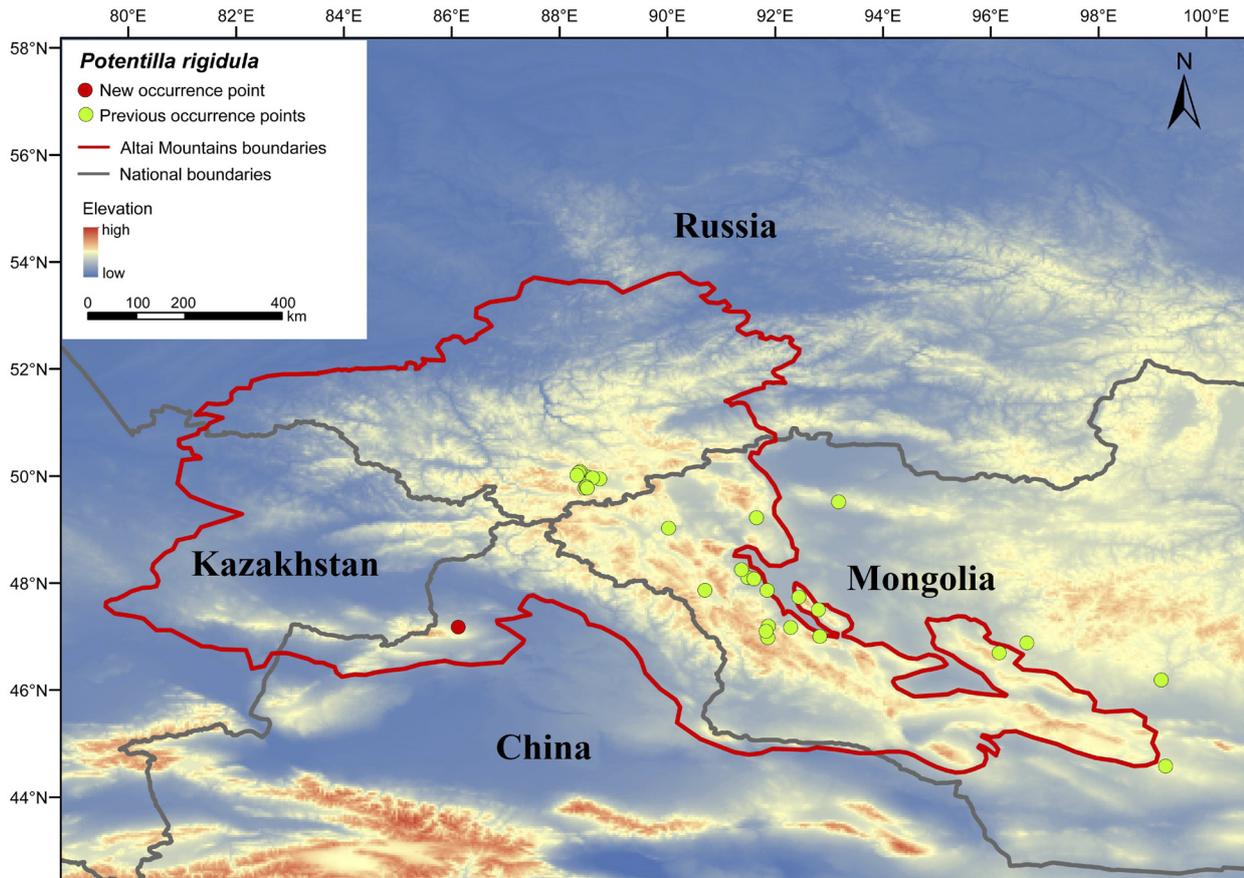
gravelly slope, 1852 m. 47.175143°N, 86.121048°E. ZTT0610. 10 VI 2025. Tingting Zheng” (PE) (Figs. 1, 2). – Described from a single specimen collected in Altai, it is a subendemic of the AMC. Outside the study area, several occurrences of *P. rigidula* have been recorded on the spurs of the Khangai Mountains and in the western part of the Gobi Altai (Fig. 3; see also the supplementary material in the appendix at the journal’s website). Numerous finds are concentrated in the Chuya steppe of the Republic of Altai and in northwestern Mongolia (Kechaykin, 2013; Kechaykin et al., 2022). It inhabits mainly intermontane basins on rocky steppes and semi-deserts, gravel beds. In Mongolia, it has been repeatedly found on alluvial fans. Apparently, *P. rigidula* replaces its close relative *P. soongorica* Bunge to the north and east of the Dzungarian Gobi, from which it differs in its pubescence, as well as leaf and stamen morphology. In the first species, the pubescence of petioles and leaves consists of long, thick, and stiff hairs, as well as numerous short bristly hairs; leaf blades are interruptedly pinnate, elliptic in outline, with the central pair of lateral leaflets being much larger than the others (Fig. 1B); leaflets are stiff and ribbed to the touch; anthers are ovate or rounded, 0.5 mm long, on short filaments. In the second species, the indumentum of petioles and leaves consists only of long, slender, and soft hairs, occasionally mixed with solitary short setose hairs; leaf blades are pinnate, narrowly ovate in



**Fig. 1.** *Potentilla rigidula* on the eastern spurs of the Saur Ridge: A – plant appearance (photo by Liguang Sun); B – separate leaf blade (photo by Tingting Zheng).



Fig. 2. Herbarium specimen of *Potentilla rigidula* (PE).



**Fig. 3.** Distribution map of *Potentilla rigidula*. The gray lines represent the national boundaries (GIS data from <https://diva-gis.org/data.html>), and red lines represent the boundaries of Altai Mountains (GIS data from <https://altaiflora.asu.ru/en/kapra-arc/>).

outline, with the uppermost pair of lateral leaflets much larger than the others; leaflets are soft and smooth to the touch; anthers are narrowly elliptic, 0.8–0.9 mm long, on longer filaments. *Potentilla astragalifolia* Bunge var. *latisecta* Th. Wolf can also be considered closely related to *P. rigidula*. This variety is distinguished by leaflets dissected into 2–3 lobes, representing a transitional form between *P. rigidula* and *P. astragalifolia*. It is likely that *P. rigidula* in the flora of China is the result of an introduction. However, this theory requires additional findings within the territory of Xinjiang.

#### New record for the flora of Kazakhstan

***Potentilla hubsugulica*** Soják: “East Kazakhstan Region, Katon-Karagay District, Tarbagatay Ridge, Burkhat Pass, 2164 m. 49°07′26.95″N, 86°01′22.15″E. 27 VI 2025. G. A. Bolbotov” (ALTB1100086700, ALTB1100082661); “East Kazakhstan Region, Katon-Karagay District, Ukok Plateau, lakes, 2404 m. 49°13′11.26″N, 87°15′40.53″E. 14 VII 2021.

G. A. Bolbotov. Uk-605” (ALTB1100083623). – *Potentilla hubsugulica* was described from collections in the area of Lake Khubsugul (Soják, 2003). Recent discoveries (Kechaykin et al., 2022, 2024b) have significantly expanded its range, and now this species is distributed from Altai to Eastern Sayan. According to Soják (2003), *P. hubsugulica* originated from hybridization between *P. crebridens* Juz. and *P. gelida*, but morphologically it is most similar to *P. evestita* Th. Wolf, from which it differs in eglandulose petioles, leaflets, and sepals, as well as styles not thickened at the base. Indeed, in all known locations, *P. hubsugulica* grows near the populations of putative parent species, which supports its hybridogenic nature. In *P. hubsugulica*, the underside leaflets are greyish and pubescent with numerous curly and curved hairs; often young leaflets are greyish-whitish below due to dense tomentum. This character clearly distinguishes this taxon from *P. gelida* (and *P. boreoasiatica*), in which the leaflets are glabrous or pubescent only with a small number of straight hairs. *Potentilla hubsugulica*

is also very similar in habitus to *P. khanminczunii* Keczaykin et Shmakov described from Altai but differs from it in a number of characters. Terminal leaflets of basal leaves in the former species with 5–8 teeth, in the latter with 3–5. The leaf arrangement of *P. hubsugulica* is two-rowed, while that of *P. khanminczunii* is multi-rowed. It is possible that the latter species could result from hybridization between *P. turczaninowiana* Stschegl. and *P. nivea* L. *Potentilla hubsugulica* lives in forb meadows and stony places in the alpine and subalpine zones.

#### New records for the flora of Russia

*Potentilla* × *rhipidophylla* Soják: “Russia, Republic of Altai, Kosh-Agach District, Ukok Plateau, Kalguty River valley above the Argamdzhi River mouth, steppified meadow, 2244 m. 49°16′50″N, 87°48′16″E. 17 VII 2014. A. I. Shmakov, A. A. Kechaykin, M. S. Ivanova, I. Yu. Evdokimov, I. K. Mazko, P. Tyutyunik, T. Larionova, V. Aripov, M. Chernyshov, I. Mamontov. ASHK 194” (ALTB1100082367, ALTB1100081682); “Russia, Republic of Altai, Kosh-Agach District, Ukok Plateau, vicin. of Lake Kara-Chad, 2400 m. 49°16′N, 87°43′E. 24 VII 2000. R. V. Kamelin, A. I. Shmakov, V. I. Dorofeyev, S. V. Smirnov, I. N. Chybarov, E. V. Antonyuk, P. A. Kosachev, O. V. Uvarova, S. A. Kostjukov, S. A. Djachenko. ADSH 2805” (ALTB1100081699). – A hybridogenous species originating from a cross between *P. crebridens* and *P. multifida* has been described from Mongolia based on several collections from the Khangai Mountains (Soják, 1986). In addition to Khangai Mountains, *P.* × *rhipidophylla* has also been recorded on the Ukok Plateau in Kazakhstan (Kechaykin et al., 2020b) and in the Khubsugul Region (Kechaykin et al., 2024a). Specimens collected in the Altai were found growing nearby populations of the putative parental species and match the description provided by J. Soják. A key for distinguishing *P.* × *rhipidophylla* from closely related species is provided in the work of V. Gundegmaa and A. A. Kechaykin (2018).

*Potentilla tytthantha* (Soják) Kechaykin: “Russia, Republic of Altai, Kosh-Agach District, Elangash valley at the mouth of the Turoi River, gravel and mixed grass lawn, 2457 m. 49°50′08″N, 88°03′10″E. 3 VIII 2015. A. I. Shmakov, A. A. Kechaykin, M. S. Ivanova, T. A. Sinitsyna, A. P. Shalimov, I. Yu. Evdokimov. KAN 213” (ALTB1100087004). – An endemic species of the AMC, distributed in highlands from the Mongolian Altai in China

(Kechaykin et al., 2014) to the Kharkhira-Ula Ridge in northwestern Mongolia (Kechaykin et al., 2022). Based on a number of morphological characters (the presence of small sessile glands on the calyx, larger petals (8–9 mm long) with a distinct notch, and more deeply dissected leaflets with acute teeth), *P. tytthantha* was elevated to a species rank from a variety of *P. chamaeleo* Soják (Kechaykin et al., 2019).

#### New records for the flora of Western Siberia

*Potentilla hubsugulica* Soják: “Russia, Republic of Altai, Kosh-Agach District, North-Chuysky Ridge, Aktru River valley in the upper reaches, 1900–2150 m. 50°05′47″N, 87°47′38″E. 23 VII 2018. A. I. Shmakov, A. A. Kechaykin, A. A. Batkin, V. A. Tolmachev, R. O. Shishov. SHKB 193” (ALTB1100083965); “Russia, Republic of Altai, Ulagansky District, Kuraysky Ridge, upper reaches of the Yarly-Amry River, 2600–2800 m. 50°20′08″N, 87°44′27″E. 30 VII 2015. A. I. Shmakov, A. A. Kechaykin, T. A. Sinitsyna, A. P. Shalimov, M. S. Ivanova, I. Yu. Evdokimov. KAN 28” (ALTB1100083631, ALTB1100082815); *ibid.*, “slope above the mine, 2400–2800 m. 50°19′42″N, 87°44′06″E. 22 VII 2018. A. I. Shmakov, A. A. Kechaykin, A. A. Batkin, V. A. Tolmachev, R. O. Shishov. SHKB 123” (ALTB1100086675, ALTB1100086716); “Russia, Republic of Altai, Kosh-Agach District, Ukok Plateau, left bank of the Kalguty River in the upper reaches, near peak 3020.7, 2724 m. 49°21′48″N, 88°04′28″E. 17 VII 2014. A. I. Shmakov, A. A. Kechaykin, M. S. Ivanova, I. Yu. Evdokimov, I. K. Mazko, P. Tyutyunik, T. Larionova, V. Aripov, M. Chernyshov, I. Mamontov. ASHK 191” (ALTB1100082323, ALTB1100083639). – See comments above for new record for the flora of Kazakhstan.

*Potentilla* × *olchonensis* Peschkova: “Russia, Republic of Altai, Kosh-Agach District, Dzhumala River valley below Lake Krasnoye, slopes and floodplain, 2270–2300 m. 49°31′08″N, 88°01′17″E. 27 VII 2013. S. V. Smirnov, A. A. Kechaykin. MKD 789” (ALTB1100087042, ALTB1100082991); “Russia, Republic of Altai, Kosh-Agach District, Ukok Plateau, right bank of the Kalguty River, pass south of the Karsulu Pass, 2303 m. 49°22′34″N, 87°45′49″E. 20 VII 2014. A. I. Shmakov, A. A. Kechaykin, M. S. Ivanova, I. Yu. Evdokimov, I. K. Mazko, P. Tyutyunik, T. Larionova, V. Aripov, M. Chernyshov, I. Mamontov. ASHK 316” (ALTB1100086708). – A hybridogenous species found in Altai, Southern Siberia and Northern

Mongolia (Gundegmaa, Urgamal, 2016; Kechaykin et al., 2024a; *Potentilla* × *olchonensis*, 2026). *Potentilla* × *olchonensis* was described as a hybrid between *P. arenosa* (Turcz.) Juz. and *P. sericea*, which has been confirmed by further studies (Soják, 1986). It is distinguished by basal leaves with 2–3 pairs of lateral leaflets (sometimes mixed with palmate ones) and styles thickened at the base with well-defined papillae. *Potentilla* × *olchonensis* was previously reported for Western Siberia but without specifying exact locations (Kechaykin, 2016b).

***Potentilla stepposa*** Soják: “Russia, Republic of Altai, Ulagansky District, left bank of the Chulyshman River, 1 km downstream from the mouth of the Kendyr River, steppe slope with rock outcrops, 580 m. 51°00′59.41″N, 88°00′58.12″E. 15 VIII 2021. A. I. Shmakov, S. Yu. Pankratov, I. A. Shestakov. KVK 1870” (ALTB1100086676, ALTB1100083647); *ibid.*, “valley of Chuya, vicin. of Chibit, mixed forest, bank gravel. 50°20′N, 87°28′E. 17 VI 2000. V. I. Dorofeyev, S. A. Dyachenko, D. A. German, E. V. Antonyuk” (ALTB1100081545). – *Potentilla stepposa* was described based on collections from Mongolia and Southern Siberia as a hybridogenous species occupying an intermediate position between *P. conferta* Bunge and *P. sericea* (Soják, 1992). It is distributed from Eastern Kazakhstan to Eastern Mongolia (Kechaykin, 2016a; Kechaykin et al., 2024a) and has also been reported from China but without specifying exact localities (Soják, 2012a). *Potentilla stepposa* differs from *P. conferta* by its non-glandular achenes, small sporadic glands on the sepals, and a laxer inflorescence during flowering. It differs from *P. sericea* by the less dense tomentum on the underside of the leaflets, the presence of glandular pubescence, and shorter petals. *Potentilla stepposa* also has a higher chromosome number than *P. conferta* ( $2n = 56$ ) and *P. sericea* ( $2n = 28, 34, 35, 42$ ) and is an aneuploid ( $2n = 62$ ) (Měsíček, Soják, 1992).

#### New records for the Republic of Altai

***Potentilla chalchorum*** Soják: “Russia, Republic of Altai, Ulagansky District, left bank of the Chuya River opposite the mouth of the Belgibash River, floodplain, steppe meadow, and glades in the spruce forest, 1108 m. 50°20′13″N, 87°26′18″E. 18 VII 2020. A. I. Shmakov, A. A. Kechaykin, A. A. Batkin, S. Yu. Pankratov. ABP 206” (ALTB1100086437). – *Potentilla chalchorum* is found from the Tien Shan to eastern China and the Amur River basin (Soják,

2007; Kechaykin et al., 2021). Recently, the first confirmed location of this taxon in the AMC was discovered in the territory of the Republic of Tuva (Kechaykin et al., 2025). In some studies, J. Soják suggested that *P. chalchorum* is a hybrid resulting from crosses between *P. longifolia* D. F. K. Schltld. and *P. tergemina* Soják. To confirm this hypothesis, the author attempted to experimentally prove the hybrid nature of this species. He artificially crossed the putative parental species and hybridized *P. longifolia* and *P. tergemina* to obtain the species similar to the natural species *P. chalchorum* (Soják, 2012b). The hybrids obtained by J. Soják were found to be identical to the species *P. chalchorum* from natural populations collected by him in southern Siberia and Mongolia. *Potentilla chalchorum* exhibits the traits of both parents but is closer in appearance to *P. conferta*. These species differ in the following morphological characters: leaf petioles of *P. chalchorum* are covered with 0.8–2 mm hairs, petals are distinctly longer than the calyx, achenes smooth, and several small glands can be found in sepal pubescence. Leaf petioles of *P. conferta* are covered with 2–3.5 mm hairs, petals do not exceed the calyx, achenes are glandular, numerous large glands, typically yellowish, can be found on the entire plant. It should be noted that the length of the *P. chalchorum* stems varies depending on environmental conditions (similar to many other *Potentilla* species), but the morphology of its leaf blades and the pubescence of the entire plant are constant characteristics. The species grows in different places from wet valley meadows to steppes and woodlands (typically larch and pine), sometimes forming numerous populations. *Potentilla chalchorum* can also be found around tourist sites, near settlements, and it often occupies disturbed habitats.

***Potentilla tuvunica*** Artemov: “Russia, Republic of Altai, Kosh-Agach District, Dzhumala River valley below Lake Krasnoye, slopes and floodplain, 2270–2300 m. 49°31′08″N, 88°01′17″E. 27 VII 2013. S. V. Smirnov, A. A. Kechaykin. MKD 780” (ALTB1100086684); “Russia, Republic of Altai, Kosh-Agach District, Ukok Plateau, southern macroslope of Mount Krasnaya near Lake Krasnoye, 2270–2550 m. 49°31′16″N, 88°01′30″E. 16 VII 2014. A. I. Shmakov, A. A. Kechaykin, M. S. Ivanova, I. Yu. Evdokimov, I. K. Mazko, P. Tyutyunik, T. Larionova, V. Aripov, M. Chernyshov, I. Mamontov. ASHK 124” (ALTB1100086692, ALTB1100085904). – The species was described based on collections from Western Tuva as a hybridogenous taxon resulting from a

cross between *P. evestita* Th. Wolf and *P. multifida* (Artemov, 2005), which is morphologically confirmed. Furthermore, in all known localities, specimens of *P. tuvinnica* grew among populations of the putative parental species. This species is found from Tien Shan to Altai (Kechaykin et al., 2020c). Other close relationships and morphological

features of *P. tuvinnica* are analyzed in the work of V. Gundegmaa and A. A. Kechaykin (2018).

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