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DISTRIBUTION TRENDS OF *POTENTILLA* SECT. *AUREAE* (ROSACEAE) SPECIES IN LATVIA

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Abstract

The genus *Potentilla* sect. *Aureae* is represented in Latvia by four species: *Potentilla incana* P.Gaertn., B.Mey. & Scherb., *P. crantzii* (Crantz) Beck ex Fritsch, *P. verna* L. and *P. subarenaria* Borbás ex Zimmeter. There have been doubts about the occurrence of two species – *P. verna* and *P. subarenaria.* Research has shown that species are found in Latvia, but they are rare. *P. crantzii* has not been found in the last 20 years and is known only from herbarium records. The most common species of genus *Potentilla* sect. *Aureae* is *P. incana*. Our research shows that one of the most reliable and universally applicable characteristics is the type of leaf hairiness, as indicated in other studies. We primarily relied on submicroscopic characteristics, such as the type of leaf hairiness on both sides, as well as the hair types on the leaflets and on veins.

Keywords: species distribution, Latvia, flora, *Potentilla*.

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INTRODUCTION

Potentilla L. is a genus of *Rosaceae* family, represented in Latvia by 22 species with different floristic statuses (Leht 1997). The genus *Potentilla* sect. *Aureae* is represented in Latvia by four species: *P. incana* P.Gaertn., B.Mey. & Scherb., *P. crantzii* (Crantz) Beck ex Fritsch, *P. verna* L., *P. subarenaria* Zimmeter (Leht et al. 1996). *P. incana* is native to Europe, typically found in lowland and upland dry pastures, sandy areas, rocks, steppe slopes across all Carpathian territories (Bojnanský & Fargašová 2007) (Fig. 1). This species is rather rare in Latvia, mainly found in the coastal and central districts of the country. It reaches the northern border of its distribution area in Latvia (Leht 1997) and is common in the southern and eastern districts of Lithuania. According to the literature, it is absent in Estonia (Leht et al. 1996), although some individual herbarium specimens have been identified ar *P. incana* (TAM0030053 and TAA001364). *P. verna* is native to northern, western, and central Europe, extending into to the Baltic region, and is rare

in the Carpathians (Fig. 2). It grows in grassy areas, sunny hills, dry grasslands, and rocky places (Ball et al. 1968, Bojnanský & Fargašová 2007). According to the literature, it is only known from Estonia, where it is common in the western and northwestern parts (Kukk et al. 2020). *P. subarenaria* is a hybrid of *P. incana* and *P. verna* and is sparse in the western and northwestern parts of Estonia (Kukk et al. 2020). It is relatively frequent in western Estonia, but very rare in Latvia and absent in Lithuania (Leht et al. 1996). *P. crantzii* is native to northern Europe and the mountain regions of central and southern Europe (Fig. 3), where it grows on open, rocky, calcareous substrates (Ball et al. 1968). In Estonia it is found locally in coastal areas in the northern and western parts and is rare on mainland. Many of its historical habitats are now extinct (Kukk et al. 2020). In Latvia this species is considered very rare (Leht et al. 1996) and grows on the southern border of its distribution area (Leht 1997). It is not represented in Lithuania (Leht et al. 1996). There is no doubt about the occurrence and floristic status of *P. incana* as a native species in the Latvia. However, the floristic status, distribution dynamics and current size of micropopulations, as well as potential threats to the other three species, remain unknown or at least unclear. Despite detailed studies on the morphology of species in this section in the Baltic States (Leht & Paal 1998), the set of morphological characters most important for accurate species identification is still not entirely clear.

The aim of the study was to explore all available data on *Potentilla* sect. *Aureae* species in Latvia, investigate their distribution dynamics, compare the main morphological differences and assess population size and potential threats.

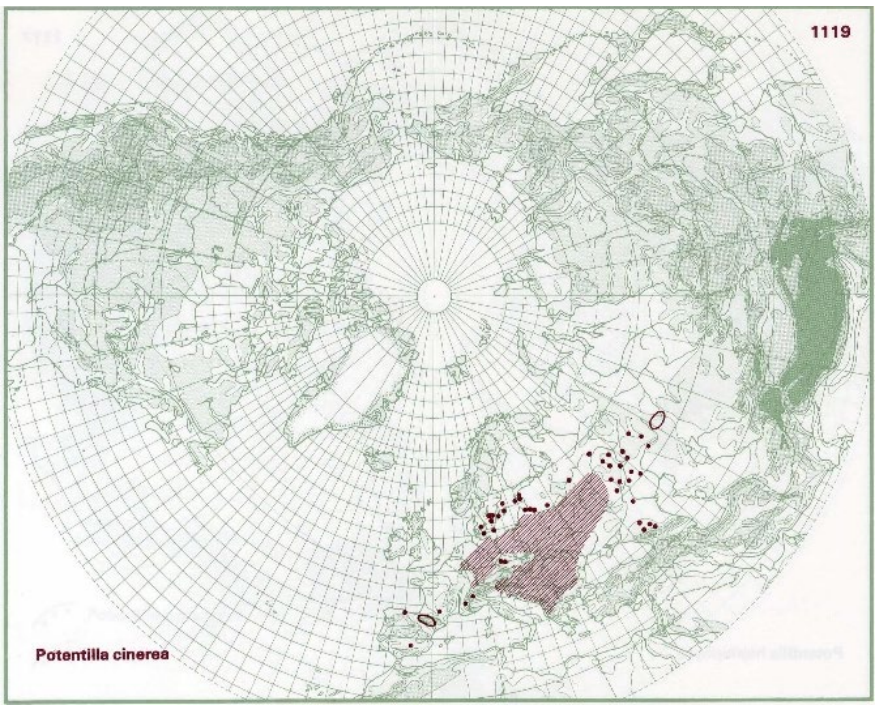

Figure 1. Global distribution of *Potentilla incana* P.Gaertn., B.Mey. & Scherb. (Hultén & Fries 1986).

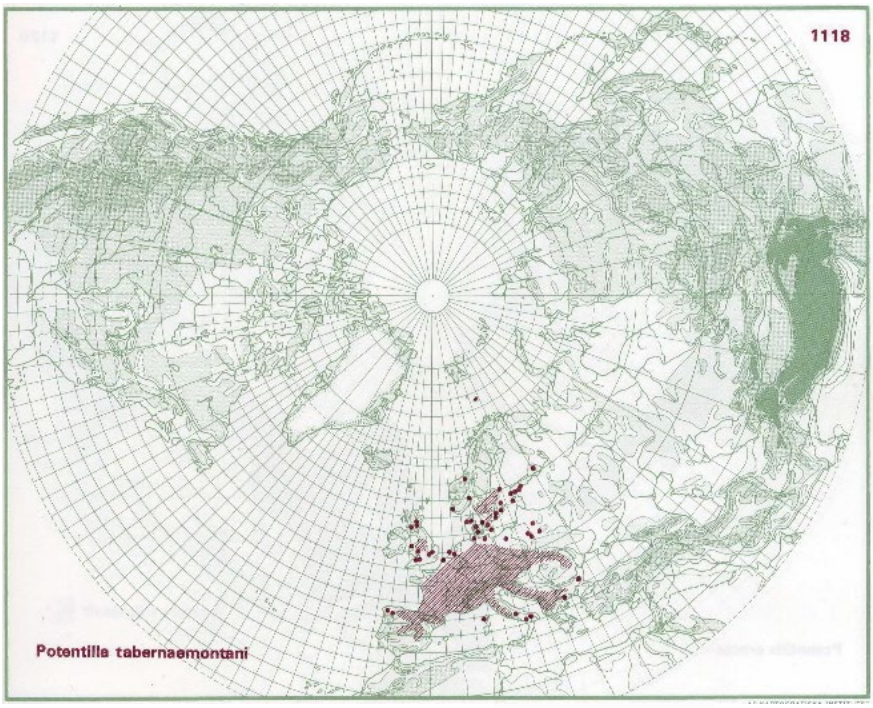

Figure 2. Global distribution of *Potentilla verna* L. (Hultén & Fries 1986).

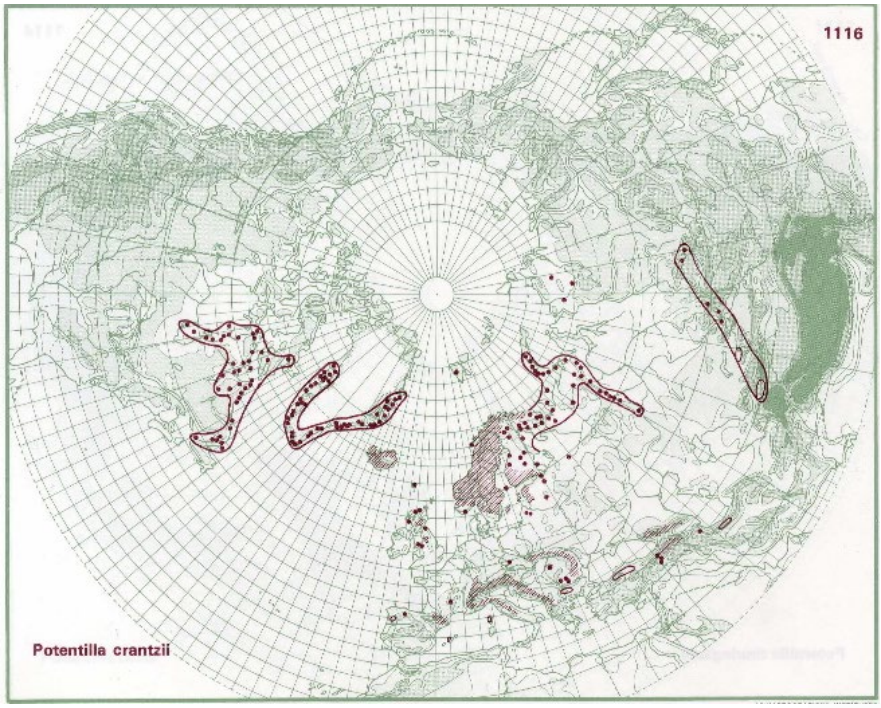

Figure 3. Global distribution map of *Potentilla crantzii* (Crantz) Beck ex Fritsch (Hultén & Fries 1986).

MATERIAL AND METHODS

The results are based on the analysis of literature, a revision of historical herbarium material, and an inventory of previously known localities of *Potentilla* sect. *Aureae* species in various regions of Latvia during the 2019–2024 vegetation seasons. A comprehensive revision of major herbaria in Latvia was carried out. Data from the herbarium of the Laboratory of Botany, Institute of Life Sciences and Technology, Daugavpils University (DAU), the Institute of Biology, University of Latvia (LATV), the Museum of Botany, University of Latvia (RIG), the Herbarium of Slītere National Park (SVR), and private collections of botanist Alfrēds Rasiņš (RAS) were analyzed. The *Potentilla* sect. *Aureae* material consists of 83 specimens in DAU from 1946 to 2024, 109 specimens at LATV from 1926 to 2014, 103 specimens at RIG from 1824 to 1977. All 63 specimens collected during the research are deposited in the herbarium of the Institute of Life Sciences and Technology, Daugavpils University (DAU), and are registered in the PlutoF database (https://plutof.ut.ee/#/profile/groups/).

The distribution trends of these *Potentilla* species were surveyed in new, suitable habitats selectively, different grassland habitats, including protected European habitats 6120* *Xeric sand calcareous grasslands* and 6210 *Semi-natural dry grasslands on calcareous substrates*, and various anthropogenically impacted habitats such as xerophytic ruderal areas, forest edges, roadsides, and other suitable locations.

The diagnostic characters of *Potentilla* sect. *Aureae* were analyzed based on herbarium specimens collected in Latvia as well as on literature (Ball et al. 1968, Leht et al. 1996, Leht & Paal 1998, Bojnanský & Fargašová 2007, Sell & Murrell 2014). Due to the small and insufficient number of herbarium specimens for species such as *P. verna* and *P. crantzii* (with very few herbarium specimens from Latvia), analysis of most morphological characters using mathematical data processing was not fully possible. Instead, we relied mainly submicroscopic characteristics, such as the type of leaf hairiness on both sides, hair types on the leaflets and on veins, etc., where morphometry is not required.

The authors of the taxa are listed according to the *List of Authors of Plant Names* (Brummit & Powell 1992). The list of *Potentilla* species in the text was arranged in alphabetical order. The floristic status of each *Potentilla* species, indicating whether the taxon is native or alien to Latvia, was determined. The natural habitats of this group of plants are not species-specific; wild habitats are found in dry calcareous grasslands, riverbanks, and other areas, with differences arising mainly in the case of alien species found along railways, in disturbed grasslands.

Species distribution maps were prepared using the square method, based on standardized geobotanical grid cell map linked to geographical coordinates. One square or geobotanical grid cell corresponds approximately to 7.6 × 9.3 km, or 71 km^2, for Latvia (Tabaka et al. 1980). These maps were created to analyze the age of localities and the dynamics of species distribution across Latvia. As such, the species occurrence is shown in two stages:

1. **The period until 1990** (including all available old data up until World War II and the years of Soviet occupation, during which Latvia experienced significant changes in land use and transportation flow, particularly the influx of railway transport from the East).
2. **The period of second independence from 1991 to the present**, when land use methods and transportation flows changed significantly once again.

RESULTS

The genus *Potentilla* sect. *Aureae* is represented in Latvia by four species: *Potentilla incana* P.Gaertn., B.Mey. & Scherb., *P. crantzii* (Crantz) Beck ex Fritsch, *P. verna* L., and *P. subarenaria* Zimmeter.

Potentilla crantzii (Crantz) Beck ex Fritsch, Excursionsfl. Oesterreich 295 (1897).

Morphology: A perennial with a thick, branched stock and lateral flowering stems 10–25 cm long, slender, and ascending, never forming mats. Basal leaves are palmate with 5 leaflets. The leaflets are obovate or oblanceolate, 9–20 mm long, dentate, with 2–5 teeth on each side, and the terminal tooth is only slightly smaller than the adjacent lateral ones. The leaflets on both sides are nearly glabrous or sparsely hairy with simple, eglandular hairs, especially on the veins of lower surface. The stipules of the basal leaves are ovate-lanceolate, subacute, and sparsely hairy with simple hairs. The inflorescence is a lax cyme with few flowers; the pedicels are long, slender, and hairy. Flowers are 14–25 mm in diameter, yellow, often with an orange spot at the base.

Distribution: In total, the species has been found in 4 geobotanical grid cells. It has not been observed in Latvia over the past 20 years and is known only from herbarium records: Talsu district, Vandzene parish, Upesgrīva, "Gatviņi" (I. Rēriha, SVR, Nr.7155, 02.07.2001); Talsu district, Kandava, left bank of the Abava River (J. Jukna, LATV, Nr.16318, 24.05.1973); Talsu district, left bank of the Abava River, Nature reserve "Čužu bog" (Z. Eglīte, LATV, Nr.17494; Nr.17497, 23.05.1974); Tukuma district, The Abava Valley, Nature reserve "Čužu bog" (G. Kļaviņa, LATV, Nr.56213, 30.05.1981), Tukuma district, Kandava, left bank of the Abava River (G. Kļaviņa, LATV, Nr.19439, 01.07.1974), Tukuma district, approximately 1 km SW Klapkalnciems (I. Kabucis, LATV, Nr.107469, 28.05.1993) (Fig. 4).

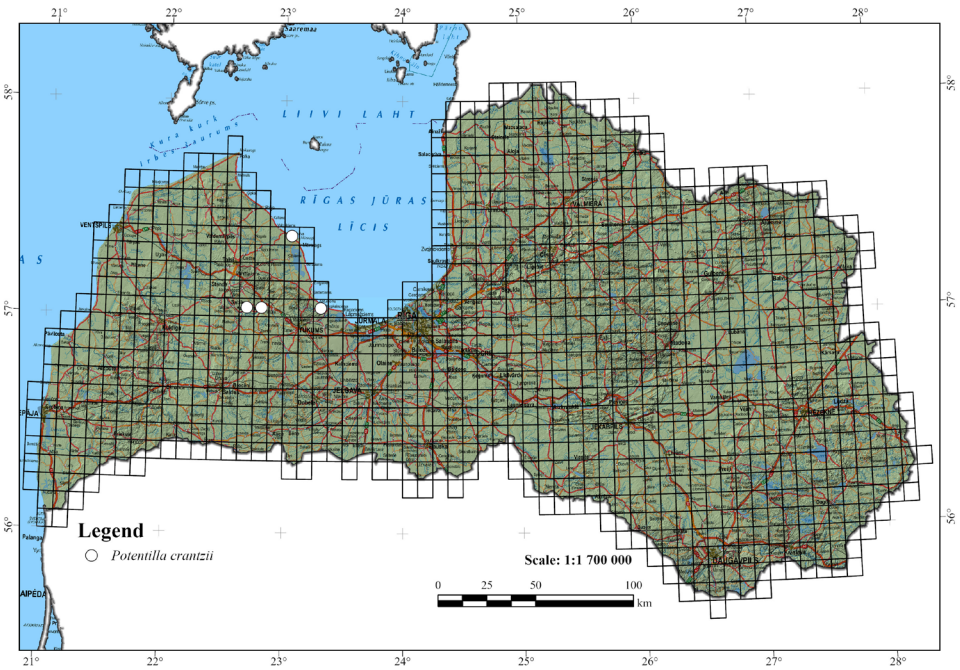

Figure 4. Distribution of *Potentilla crantzii* (Crantz) Beck ex Fritsch in Latvia according to all available herbaria collections. Map author: Māris Nitcis.

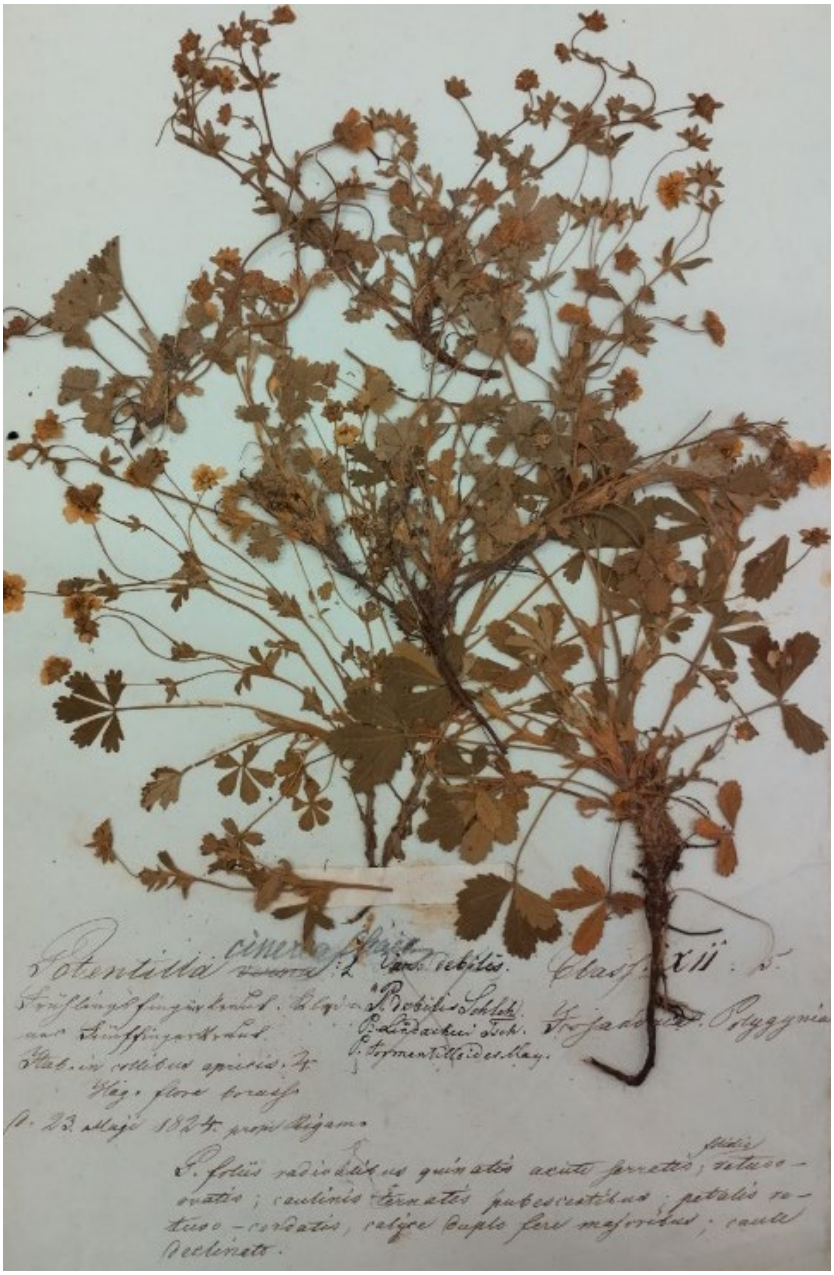

Figure 5. The oldest known herbarium specimen of *Potentilla incana* P.Gaertn., B.Mey. & Scherb. in Latvia, stored in the Museum of Botany, University of Latvia. The author remains unknown. The specimen was collected in 1824 in the Riga surrounding. Image courtesy: P. Evarts-Bunders.

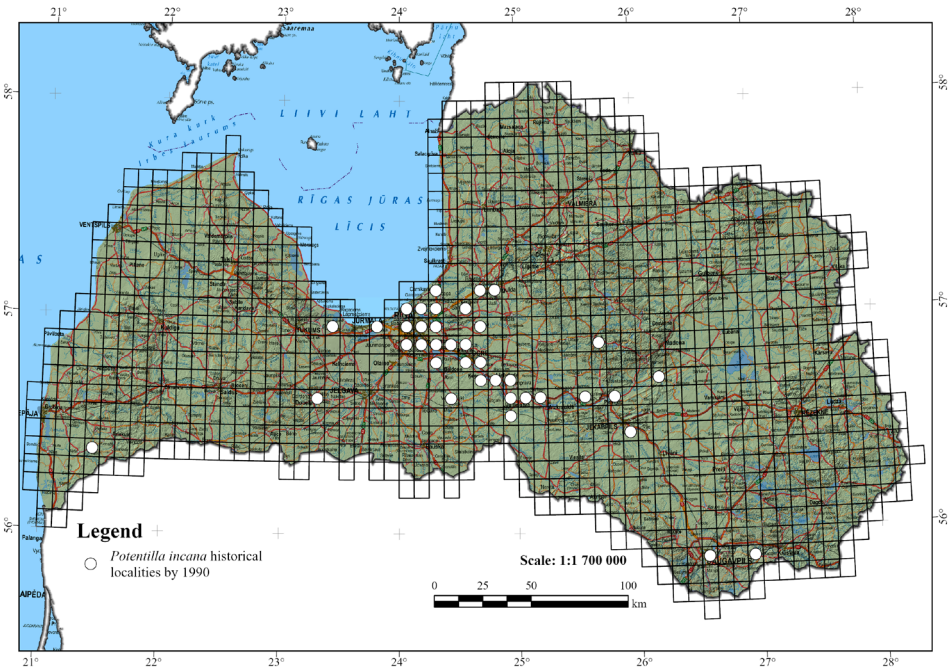

Figure 6. Distribution of *Potentilla incana* P.Gaertn., B.Mey. & Scherb.in Latvia based on all available herbaria collections. Localities known until 1990. Map author: Māris Nitcis.

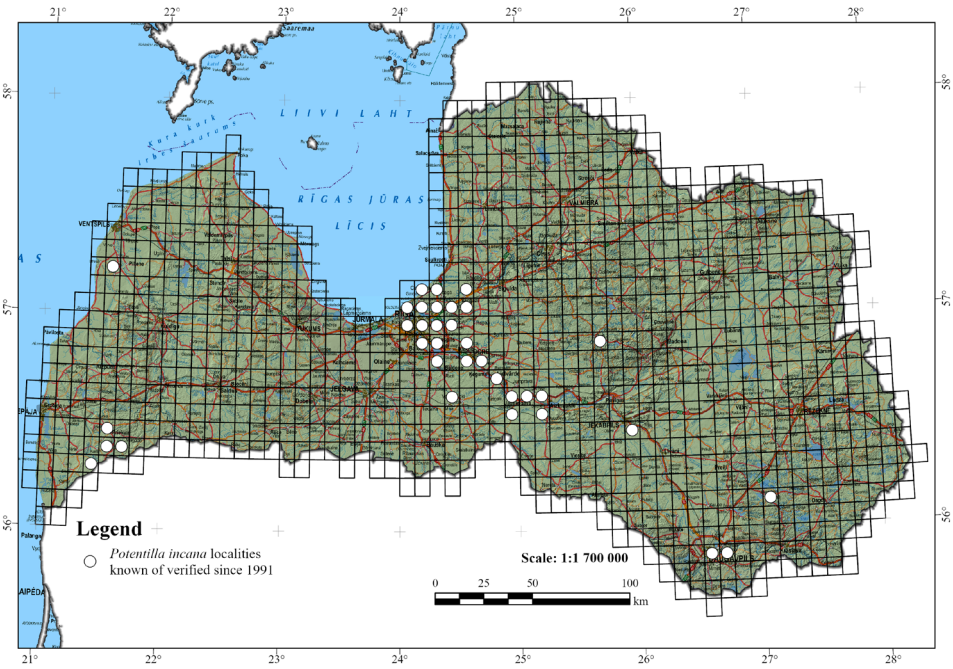

Figure 7. Distribution of *Potentilla incana* P.Gaertn., B.Mey. & Scherb. in Latvia based on all available herbaria collections or verified since 1991. Map author: Māris Nitcis.

***Potentilla incana* P.Gaertn., B.Mey. & Scherb.**, Oekon. Fl. Wetterau 2: 248 (1800).
Synonym: ***Potentilla arenaria* Borkh. ex G.Gaertn., B.Mey. & Scherb.**, Oekon. Fl. Wetterau 2: 248 (1800), nom. inval.

Morphology: A perennial herb with branched, freely rooting, procumbent, wooden stems. The lateral flowering stems are 5–10 (15) cm long, slender, and forming mats. Stems, leaves and other parts are covered with continuous tomentum of stellate hairs with 10–30 rays, mixed with long, simple hairs on the veins. Basal leaves are palmate with 3–5 leaflets. The leaflets are oblong-obovate, 15–25 mm long, dentate, with 3–5 teeth on each side, and the terminal tooth is equal in length to the adjacent lateral ones; in certain cases, it is slightly longer. The leaflets on both sides are grey-green and densely hairy, with stellate hairs, especially on the lower surface, and simple hairs only on the veins. The stipules of the basal leaves are linear and covered with stellate hairs. The inflorescence is a lax cyme with few flowers, and the pedicels are long, slender, and hairy. Flowers 12–20 mm in diameter and yellow. ***Potentilla verna* L.,** Sp. Pl.: 498 (1753) nom. cons.

Distribution: The majority of *Potentilla incana* localities are found in the valley of the Daugava River, in dry meadows, dry forest edges, roadsides, and railway embankments. The first collected herbarium material is stored in the Museum of Botany, University of Latvia; the author remains unknown, but the specimen was collected in 1824 in the surrounding of Riga (Fig. 5). The species has become less frequent in recent years, and since 1991, it has not been found in several localities in the surroundings of Riga, Sigulda, Dobele, Ķemeri, Ļaudona and Jēkabpils. At the same time new localities have been discovered around the Piltene, Gramzda and Aglona.
In total, until 1990, the species was found in 38 geobotanical grid cell (Fig. 6). After 1991, the species has been found in 35 grid cells (Fig. 7). In 12 grid cells, the species has been newly discovered, while in 15 grid cells, the species has not been found again or has not been surveyed.
Synonym: ***Potentilla tabernaemontani* Asch.**, Verh. Bot. Vereins Prov. Brandenburg 32: 156 (1891), ***Potentilla neumanniana* Rchb.** In: Fl. Germ. Excurs. 592. (1832).

Morphology: A perennial herb with a thick, branched stock, freely rooting at the nodes. The lateral flowering stems are 5–10 (15) cm long, prostrate (not ascending), form mats. Basal leaves are palmate with 5 (or 7) leaflets. The leaflets are obovate or oblanceolate, 8–20 mm long, dentate, with 2–3 teeth on each side, and the terminal tooth is markedly smaller as the adjacent lateral ones. The leaflets on the upper sides are nearly glabrous, while the lower surface is hairy with simple, eglandular hairs on the veins and leaf blade. The stipules of the basal leaves are narrowly lanceolate or linear, densely hairy with simple hairs. The inflorescence is a lax cyme with 1–4 flowers, and the pedicels are long, slender, and hairy. Flowers are 10–15 mm in diameter and yellow.

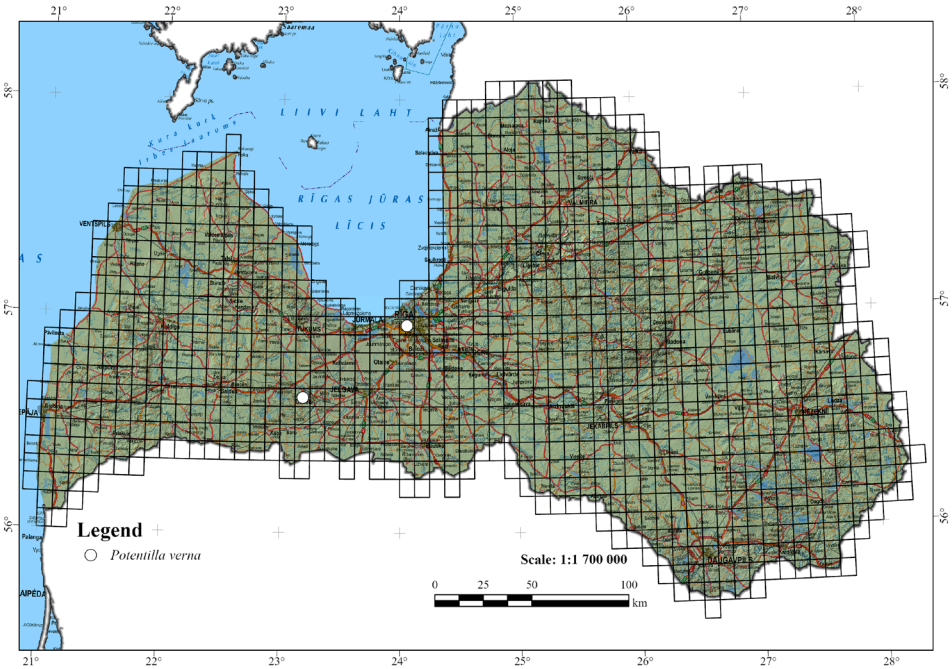

Figure 8. Distribution of *Potentilla verna* L.in Latvia based on all available herbaria collections or verified. Map author: Māris Nitcis.

Distribution: The species is known from only two historical localities: Riga, railway Lāčupe-Bolderāja, approximately 400 m from the Lāčupe railway station (Leg. I. Rūrāne, LATV, Nr.117145, 19.05.2012); Dobele, approximately 5 km SW, along the Dobele-Auce road (Leg. I. Jukna, LATV, Nr.15949, 07.06.1969).

***Potentilla subarenaria* Borbás ex Zimmeter**, Jahresber. K. K. Staats-Ober-Realschule Steyr 14: 21 (1884).

Morphology: A perennial herb with branched, freely rooting, procumbent wooden stems. The lateral flowering stems are 10–15 (20) cm long, slender, and form mats. Stems, leaves, and other parts are with a continuous tomentum of stellate hairs with 10–20 rays, mixed with long, simple hairs on the veins. Basal leaves are palmate with 3–5 leaflets. The leaflets are oblong-obovate, 10–20 mm long, dentate, with 2–5 teeth on each side, and terminal tooth is of equal length or slightly shorter than the adjacent lateral ones. The leaflets are grey-green and more or less densely covered with stellate hairs on the lower surface, and with only a few on upper surface. This species differs from the similar *P. incana* in having stellate hairs with fewer rays and an elongated central axis on the leaf blade, with simple hairs only on the veins. The stipules of the basal leaves are linear and covered with stellate hairs. The inflorescence is a lax cyme with few flowers, and pedicels are long, slender, and hairy. Flowers are 12–20 mm in diameter and yellow.

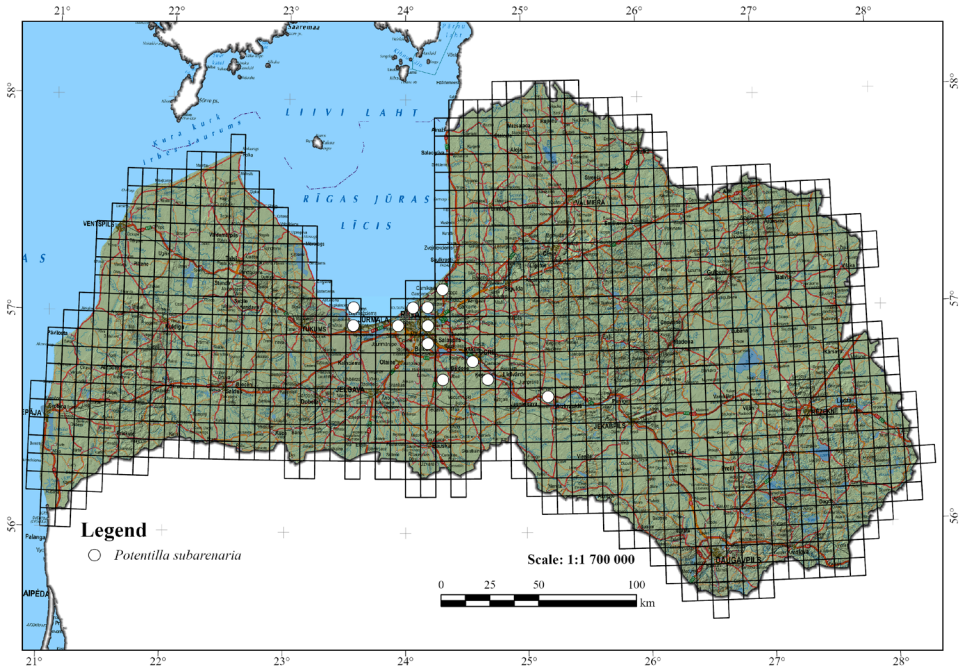

Figure 9. Distribution of *Potentilla subarenaria* Borbás ex Zimmeter in Latvia based on all available herbaria collections or verified. Map author: Māris Nitcis.

Distribution: The species has become more frequent, with 18 herbarium specimens collected in recent years from 12 grid cells. The first herbarium specimen collected in 1983 in the Riga district, Doles Island, NW (Leg. H. Zariņa, LATV, Nr. 70446, 26.04.1983), and all other specimens have been collected during the last 30 years. The majority of localities are concentrated near the railway, with fewer occurrences in other disturbed areas.

DISCUSSION

The analysis of the collected material, as well as the revision of the known localities, shows that all four species are easily distinguishable by morphological characteristics.

Previous morphological analyses of *Potentilla* sect *Aureae* species in the Baltic region have shown that the most useful distinguishing traits are the lengths of the sepals and stipules, and the number of teeth on the central leaflet (Leht & Paal 1998). However, species identification based on the characteristics is often hindered by the fact that herbarium material is typically collected, and field surveys often take place outside the anthesis period, making generative characteristics less useful. On the other hand, herbarium specimens are often collected in early spring when the first flowers appear, without fully developed leaves or other vegetative features. Our research shows that one of the most reliable and universally applicable characteristics is the type of leaf hairiness, as indicated in other studies on the genus *Potentilla* (Ball et al. 1968, Leht et al. 1996, Sell & Murrell 2014). The most common species *P. incana* is easily distinguishable by the type of hairiness on the leaves – densely hairy with stellate hairs, especially on the lower surface, and simple hairs only on the veins. The characteristic can be used throughout the growing season; however, it is possible to make a mistake during the early stages of leaf development in spring when the

vein hairs are already visible, but the leaf blade has not yet fully developed.

P. crantzii and *P. verna* are morphologically well-separated from the other species of this group by their hairiness type – only simple, eglandular hairs, especially on the veins of the lower leaf surface. Both species are extremely rare in Latvia and are known only from a few localities. *P. verna* has been collected only twice from anthropogenic, disturbed habitats – railways and roadsides. Despite surveying historical localities, we have not been able to reconfirm its presence. This species is clearly distinguishable by the type of leaf hairiness – simple, eglandular hairs on the veins and leaf blade on the lower surface. As this species is found only in anthropogenic habitats in Latvia, there is no reason to consider it part of the wild flora. *P. crantzii* is very rare in Latvia. In the last 30 years, the species has been recorded only twice, near Klapkalnciems and Upesgrīva, and has not been found in later surveys. This undoubtedly autochtonous species is associated with calcareous grasslands and is most likely extinct in most of its earlier known localities from the first half of the 20th century – such as the Abava River Walley, Biksti, Jaunpils and Dundaga – where it had previously been reported (Eglīte 2003, Tabaka & Kļaviņa 1981). The main threat to this species is the abandonment of land management or changes in management type in semi-natural calcareous grasslands.

The most complicate is determining the most important morphological features essential in identification in case of *P. subarenaria* – an apomictic species of recent hybrid origin from the parent species *P. incana* and *P. verna* (Ball et al. 1968, Leht & Paal 1998). While most of its morphological features overlap with those of the parent species, it can be clearly separated by its characteristic leaf hairiness. The leaves are grey-green on and densely hairy with stellate hairs only on the lower surface. However, it differs from *P. incana* in having stellate hairs with an elongated central axis on the leaf blade and simple hairs only on the veins. Although the species was not rediscovered at its historical locations, suitable species-specific habitats still exist in these areas, suggesting that its presence may yet confirmed in the future. This species is also associated with disturbed, anthropogenic habitats – mainly railways, roadsides, quarries and we assume, that this species most likely is not native in Latvia.

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