Taxonomic revision of *Rubus* ser. *Sylvatici* in the Pannonian Basin and adjacent regions

Taxonomická revize ostružiníků *Rubus* ser. *Sylvatici* v Panonské nížině a přilehlých územích

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In this study we revised apomictic taxa of *Rubus* ser. *Sylvatici* occurring in the Pannonian Basin and adjacent regions (i.e. the northern Balkans, Carpathians, and eastern and southern edges of the Alps). The first modern taxonomic studies on this series in the area studied were carried out by W. Maurer (from the 1960s), who described three new species, *R. juennensis*, *R. salzmannii* and *R. venosus*, disentangled the position of *R. ferox* and presented the first reliable data on *R. macrophyllus*. A further species, *R. wimmerianus*, was recorded by various authors in the 1990s in the northern part of the area. Based on comprehensive herbarium revisions, incl. assessment of the original material for several names, and recent field studies, we confirmed that the species in ser. *Sylvatici* described by Maurer are well-defined and taxonomically well-positioned. In addition, we describe here a widely distributed new species, *R. maureri*, occurring from Italy to Hungary, that was earlier confused with *R. macrophyllus*. We present the full synonymy (incl. necessary typifications) and an updated distribution map for *R. ferox*, and broaden the knowledge on the taxonomic position, chorology and ecology of *R. juennensis*, *R. macrophyllus*, *R. salzmannii*, *R. venosus* and *R. wimmerianus*. An extended morphological characterization, iconography (pen-drawings, photographs of living plants and type specimens) for most of the species studied are provided. Finally, we discuss the taxonomic position of *R. angustipaniculatus* and *R. solvensis*, which were placed by some authors in the ser. *Sylvatici*, and support keeping the first species in ser. *Rhamnifolii* and the second in ser. *Vestiti*.

K e y w o r d s: apomixis, biogeography, distribution, herbarium revisions, nomenclature, taxonomy, typification

Introduction

The brambles (*Rubus* L. subgen. *Rubus*) constitute one of the taxonomically most complicated groups of vascular plants in Europe. Several novel investigations shed light on their evolutionary processes, the role of hybridization and polyploidization (e.g. Nybom 1996, Šarhanová et al. 2012, Krahulcová et al. 2013, Sochor et al. 2015), and there are many recent elaborations of their nomenclature (e.g. Weber 1985, Matzke-Hajek 2001, Beek et al. 2017), distribution (for a résumé see Kurtto et al. 2010) and traditional (morphology-based) monographs and checklists (e.g. Holub 1995, Weber 1995, Maurer & Drescher

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2000, Zieliński 2004). *Rubus* ser. *Sylvatici* (P. J. Müll.) Focke is accepted in the recent European standard monographs (e.g. Weber 1985, Holub 1995, Monasterio-Huelin 1999, Trávníček & Havlíček 2002, Kurtto et al. 2010, Stace 2010, Beek et al. 2014) as a well-defined group within the sect. *Rubus*. The representatives of the series are distinguished from the other groups of the sect. *Rubus* by the low- or high-arching, often hairy first-year stem without stalked glands (or if present, stalked glands are rare and inconspicuous), and by the lack of felted (tomentose) hairs on the underside of stem leaves (or they are restricted to younger leaves). All species in the ser. *Sylvatici* investigated for ploidy level proved to be tetraploid (Krahulcová et al. 2013) and this series probably includes only strict apomictic species (Weber 1995). In spite of the morphological homogeneity of this series, it is probably polyphyletic, based both on molecular investigations (Sochor et al. 2015) and comparative analysis of the leaf indumentum (Tomaszewski et al. 2013). Weber (1995) considers that a few species in ser. *Sylvatici* are morphologically intermediate; transitions are most often reported for the ser. *Micantes* Sudre. According to modern assessments, the number of European species in this series is approximately 80; the centre of their distribution is in north-western Europe with especially numerous species recorded in the Benelux States, north-western Germany and southern part of the British Isles (Edees & Newton 1988, Weber 1995, Kurtto et al. 2010). Only a few species in this series are recorded in the eastern part of Europe, however, two of them (*R. macrophyllus* Weihe et Nees and *R. wimmerianus* (Sprib. ex Sudre) Sprib.) are widely distributed there.

In Poland, Zieliński (2004) reports six species in this series, of which only *R. wimmerianus* and *R. angustipaniculatus* Holub occur in the Carpathians and four other species in western and/or central Poland. In the Czech Republic, there are four described representatives in this series (Holub 1992, 1995, Trávníček & Havlíček 2002), in addition to *R. angustipaniculatus*, *R. macrophyllus*, *R. wimmerianus* an adventive species, *R. silvaticus* Weihe et Nees, recorded at a single locality. In eastern Austria (and the neighboring part of Slovenia) there is a remarkable "hotspot" for the ser. *Sylvatici* (Weber & Maurer 1991, Maurer 1994, Maurer & Drescher 2000, Kurtto et al. 2010). Apart from the widespread *R. macrophyllus* and *R. wimmerianus*, four additional endemic species are found there: *R. ferox* Vest, *R. juennensis* Leute et W. Maurer, *R. salzmannii* W. Maurer and *R. venosus* W. Maurer (Maurer 1972, 1981, Leute & Maurer 1983). In Slovenia, Martinčič (2007) mentions six species of the ser. *Sylvatici*, including the four endemic species indicated previously and two other species (*R. constrictus* Lefèvre et P. J. Müll., *R. gracilis* J. Presl et C. Presl) that obviously (see Kurtto et al. 2010) do not belong to this series. Most of the Pannonian Basin and the Balkan Peninsula are unexplored from the point of view of modern batology (Király et al. 2013, 2014), and, although several species in the ser. *Sylvatici* were recorded in various countries (Hungary: Kiss 1966; Romania: Nyárády 1956, Slovakia: Marhold & Hindák 1998), these records are questioned or not accepted by Kurtto et al. (2010) because of the lack of supporting vouchers and the geographic distribution of certain species. This general approach of the leading Central European experts is well illustrated by the summarizing map for ser. *Sylvatici* (Kurtto et al. 2010, map "AFE 4087").

In this paper we present the first modern assessment of the ser. *Sylvatici* in the Pannonian Basin and adjacent regions (incl. northern Italy and the northern Balkans), which is based both on herbarium revisions and comprehensive field studies.

Material and methods

Field studies and distribution data

The field study was carried out between 2009 and 2018 at approximately 2000 localities where *Rubus* occurred. We systematically surveyed the Pannonian Basin, and its adjacent regions (the northern Balkans, Carpathians and south-eastern foreground of the Alps). For each locality, the geo-coordinates were determined using a Garmin GPSMAP64 handheld device in WGS84 projection. Nearby localities within 500 m were not considered unless they are situated in a different country or federal state. Terms used to describe range size are adopted from Weber in Kurtto et al. (2010). Distribution maps were compiled using ArcGIS software. As literature records generally proved to be unusable after herbarium revisions, in the absence of vouchers we only accepted the mapping data of W. Maurer for his species when delineating the ranges of the species studied.

Herbarium studies

The following herbaria (see acronyms according to Thiers 2018) were searched for possible previous records of *Rubus* ser. *Sylvatici* in the area studied: B, BEOU, BP, BPU, BR, BRA, BRNU, BUNS, CL, DE, GJO, GZU, IB, JPU, KL, LI, LJU, M, NI, OL, P, PECS, PR, PRA, SAMU, SAV, SLO, SZB, W, WU, ZA, ZAHO. Specimens of the ser. *Sylvatici* from the study area (cca. 800 specimens) are listed in Electronic Appendix 1. We paid particular attention to the reassessment of original material for each taxon. The voucher specimens collected during recent studies (incl. specimens used for morphological investigations) were generally deposited in BP and OL.

Morphological investigations

Morphological characterization of each taxa was based on the revision of at least 30 specimens in the herbaria listed above, some characters (e.g. features of flowers) were studied on plants growing in the field. First-year branches (primocanes) with well-developed leaves were typically examined together with intact inflorescences; abnormal and injured plants were not included in the assessments. Additional reference material for the comparative study of similar species was obtained from the herbaria listed above.

Results and discussion

Although several taxa belonging to *Rubus* ser. *Sylvatici* have been reported from the Pannonian Basin and adjacent regions since the first half of the 19th century, they are almost unsuitable for use in recent assessments for various reasons. Older authors repeatedly used the taxonomic names incorrectly, i.e. not in accordance of their type (see below a list of misapplied names). In addition, most of the records in the archives are not properly documented, and the series is completely underrepresented in the herbaria of the study area: even widespread species in a country or region are nearly absent in the collections. Regional monographs on brambles (frequently presented as part of floras, e.g. Hayek 1908–1911, Gáyer 1924–1925, Nyárády 1956) have significant weaknesses and the assessment of the series in Flora Europaea (Heslop-Harrison 1968) is not up-to-date.

This situation has persisted for quite a long time in the area studied as modern batology (i.e. the taxonomy of brambles) is relatively recent. In this context the first steps were made in south-eastern Austria, thanks to the activity of Willibald Maurer. During decades of research he disentangled the position of *R. ferox* Vest (Maurer 1964), described three species new to science in ser. *Sylvatici* from Styria and Carinthia in Austria (Maurer 1972, 1981, Leute & Maurer 1983) and continually updated the distribution data for ser. *Sylvatici* in Austria and the former northern Yugoslavia (Maurer & Drescher 2000). His species were accepted, and their ranges defined by him were applied without modifications in Atlas Florae Europaeae (Kurtto et al. 2010). Another basis of the research on ser. *Sylvatici* in the study area is the activity of Czech batologists in Slovakia (among others with reports on the occurrence of *R. wimmerianus*, see Holub 1995) and northern Austria (with first records of *R. wimmerianus*, see Trávníček & Maurer 1998).

Based on the assessment of the original material for several names and additional herbarium and recent field studies, we confirmed that the species in ser. *Sylvatici* that were described or typified by Maurer are morphologically well-defined and taxonomically well-positioned, however, there were significant nomenclatural, taxonomic or chorological novelties concerning all these species.

The most important outcome of our research was the repeated observation of a bramble biotype (morphologically defined type) that belongs in ser. *Sylvatici*, that apparently can be treated as a distinct species. This taxon (named *R. maureri*) differs in several features from the already known species in the series, thus, we describe it below as a hitherto unexplored new species with a wide distribution. Although Maurer (1964) correctly defined the taxonomic position of *R. ferox*, he did not completely elaborate the complicated synonymy of this species. Here we present the full synonymy and necessary typifications, and an improved distribution map of *R. ferox*.

A further species from this region (*R. solvensis* W. Maurer) was placed by Kurtto et al. (2010) in the ser. *Sylvatici*, however, this viewpoint is not well-established. *Rubus solvensis* belongs in the ser. *Vestiti* (Focke) Focke based on both the original description (Maurer 1976) and several later sources (e.g. Weber & Maurer 1991, Weber 1995). We also support this position, which is strengthened by the underside of the leaves on first-year stems being grey to whitish and distinctly hairy to the touch. Consequently, we support keeping it in the ser. *Vestiti*.

Worthy of further assessment is the position of *R. angustipaniculatus,* which was described by Holub (1991) from Czechia and placed in the ser. *Rhamnifolii* (Bab.) Focke, however, with remarks indicating its intermediate position between this series and ser. *Sylvatici*. The same taxon was described and characterized by Zieliński (1991) from Poland under the invalid name "*R. pyramidaliformis* (Sudre) Ziel." as a ser. *Rhamnifolii*-species. Weber (1995) suggests that *R. angustipaniculatus* be classified as a member of ser. *Sylvatici*, but he does not discuss the detailed reasons for this. Even though this concept was adopted by Zieliński (2004) and Kurtto et al. (2010), we still believe that, due to its almost glabrous primocanes and rhombic leaflets of which typically have a dense stellate tomentum beneath, *R. angustipaniculatus* is better placed in the ser. *Rhamnifolii*, therefore we did not include it in the present study.

Finally, we significantly broadened the knowledge on the taxonomic position, chorology and ecology of *R. juennensis*, *R. macrophyllus*, *R. salzmannii* and *R. wimmerianus*. Except for *R. macrophyllus* and *R. wimmerianus* (both illustrated and clearly

circumscribed, e.g. in Holub 1995, Weber 1995, Zieliński 2004) we present here detailed morphological characterizations, pen-drawings and photographs of each of the species in the ser. *Sylvatici* that occur in the Pannonian Basin.

Synopsis of the species of *Rubus* ser. *Sylvatici* in the area studied

Rubus maureri Király, Trávn. et Žíla, **spec. nova**

Holotype: Hungary, Zala County, Surd, 1.8 km N of the village, forest fringes; 183 m a. s. l.; N46.348865°; E16.974632°; 9667.4; 15 VII 2015, fruiting, leg. G. Király, BP 00013209, BP 00013210 (parts of the same specimen! see Electronic Appendix 2). Isotypes: BP 00013211, BP 00013212, BP 00013213, BP 00013214, GJO 93569, GJO 93570, GZU 335715A, GZU 335715B, GZU 335715C, OL 37856.

Description (Fig. 1)

Large shrub, usually up to 200 (–250) cm tall. First-year stems high-arching or sometimes suberect, 5–10 (–15) mm in diameter, bluntly angled, sides flat, reddish tinted, violet-red or deep purple. Stem hairy with erect or patent, simple and/or tufted hairs 0.5 (–1.0) mm long, 20–40 per 1 cm length of stem side, and with scattered minute adpressed hairs and subsessile glands. Stalked glands and acicles lacking or up to 0.5 mm long, 1–3 per 1 cm length of stem side. Prickles ± uniform, hairy at the base, (3–) 5–10 (–12) per 5 cm of stem length, yellowish or purplish, usually on angles, straight or slightly curved, markedly declining, strong, compressed, gradually tapering, 5–10 mm long, at the base 4–6 mm broad.

Leaves on the first-year stem usually large, 5-foliolate, digitate (or rarely indistinctly pedate), dark (often bright) green and not hairy to the touch above with 0–20 adpressed, 0.1–0.4 mm long hairs per cm^2 and some sessile glands, and with a few adpressed, 0.1–0.3 mm long hairs on the leaf margin; light or whitish green and hairy to the touch beneath, with scattered 0.1–0.3 mm long hairs on veins and with numerous minute adpressed hairs not covering the entire surface. Venation strong, veins slightly depressed into the upper surface of the leaf. Terminal leaflet usually broadly obovate, obovate or elliptic, sometimes (on apical part of the stem) ovate to narrowly ovate, up to 150 mm long, rounded or very slightly cordate at the base, apex 15–30 mm long, conspicuously abruptly narrowed; petiolule of the terminal leaflet 40–60 mm long (35–45% as long as its lamina). Basal leaflets narrowly ovate to ovate or broadly lanceolate, 0.9–1.1× as long as the petiole; their petiolules (3–) 5–12 mm long. Indentation periodic or doubly serrate, with incisions (2–) 3–5 (–7) mm deep, teeth usually broader than long, with a thin narrow apex. Petioles sparsely hairy, with scattered subsessile and stalked glands, and with (7–) 9–15 (–18) strongly curved, stout prickles. Stipules filiform, with scattered hairs and stalked glands.

Inflorescence up to 30–40 cm long, relatively few-flowered, broadly paniculate, rounded near apex, with erecto-patent to almost erect lateral branches up to 15 cm long; distal 5–15 cm leafless, with upper (0–) 1 (–2) leaves simple, the ones below 3-foliolate, deeply (often doubly) serrate. Inflorescence axis densely hairy with many adpressed silky and scattered simple hairs; stalked glands 40–150 per 1 cm of the axis length, 0.2–0.5 mm long (usually shorter than the longest patent simple hairs). Prickles 4–12 per 5 cm of axis, strongly declining, slender, subulate, straight or slightly curved, 3–6 mm long.

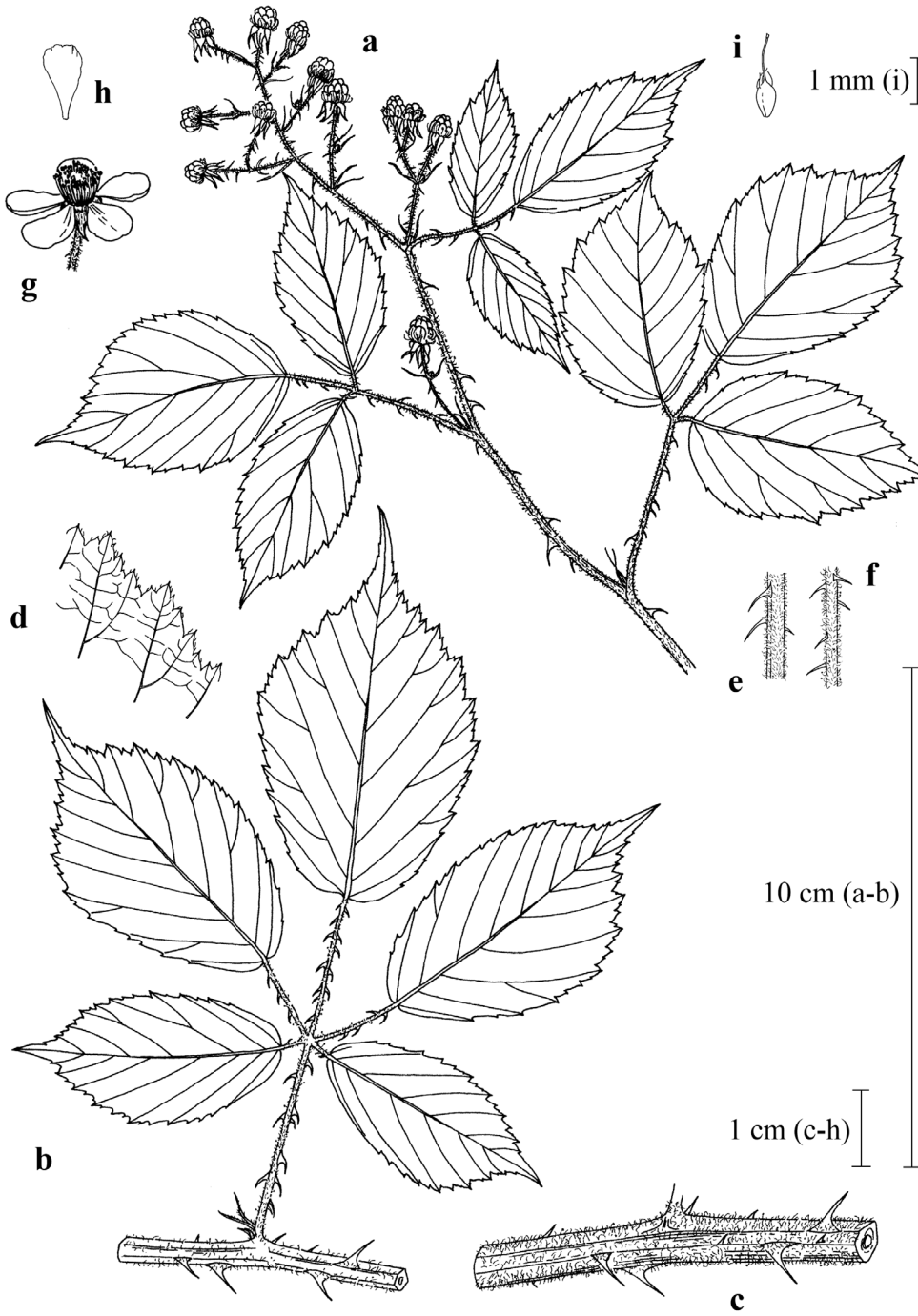

Fig. 1. – *Rubus maureri*: a – infructescence, b – first-year stem with a leaf, c – part of the first-year stem, d – margin of the terminal leaflet, e – inflorescence axis, f – peduncle, g – flower, h – petal, i – carpel. Drawn by J. Táborská.

Pedicels (5–) 15–20 (–30) mm long, densely hairy and with 30–100 stalked glands; prickles 4–8 (–12), slender, patent to slightly declining, 1.5–3 (–4) mm long. Sepals reflexed after anthesis, 6–9 mm long, whitish-felted with scattered stalked glands on the outer surface; pricklets absent. Petals not touching each other, pink, ± spathulate, 6–8 mm broad and 8–12 mm long, rounded (or rarely slightly emarginate) at the apex. Stamens longer than the yellowish-green styles; anthers glabrous, yellowish-green; filaments yellow. Carpels usually with few longer hairs, rarely ± glabrous, receptacle hairy. Flowering (V–)VI–VII.

Etymology

The epithet "*maureri*" refers to Willibald Maurer (1926–2016), an outstanding batologist from Styria (Austria) and pioneer of modern studies on brambles in east-central Europe.

Taxonomic remarks

The overall impression is that *R. maureri* is an imposing plant with large leaves that resembles *R. macrophyllus* (and is probably closely related to this species), but they differ in several characters (for distinguishing features see Table 1). Some former collections of *R. maureri* (from northern Italy) were originally identified as *R. macrophyllus* or *Rubus* ser. *Discolores* (P. J. Müll.) Focke (see Electronic Appendix 1).

Table 1. – Main distinctive features of *Rubus maureri* and *Rubus macrophyllus*.

Characters	*R. macrophyllus*	*R. maureri*
Length of the prickles on first-year stem (mm)	4–7	5–10
No. of stalked glands on first-year stem per 1 cm of stem side	0	0 (–3)
Leaf blade of living plants	often conspicuously convex	usually flat
Length of the apex of the terminal leaflet of first-year stem (mm)	15–20	15–30
Length of teeth of the leaves on first-year stem (mm)	1–2 (–3)	(2–) 3–5 (–7)
Shape of the inflorescence	paniculate, rather compact	broadly paniculate, loose
Number of prickles per 5 cm length of inflorescence axis	2–6	4–12
Number of stalked glands on the pedicel	0–5 (–20)	(5–) 30–100
Colour of the petals	white or light pink	pink
Hairiness of carpels	usually glabrous	usually with few long hairs

Distribution

Rubus maureri is a widely distributed bramble species with a characteristic area consisting of two distant major parts; the longest diameter of the area is more than 500 km (Fig. 2). The larger part of its range is situated on both sides of the Drava river in south-western Hungary (southern part of Somogy and Zala Counties, with the northernmost point of the area in Kemeneshát Hills north of Zalaegerszeg), and in northern Croatia (especially in Međimurje region and Bilogora Hills, to Moslavačka gora Hills to the south). In these regions it is a frequent and dominant species of the shrub layer of bramble-rich habitat

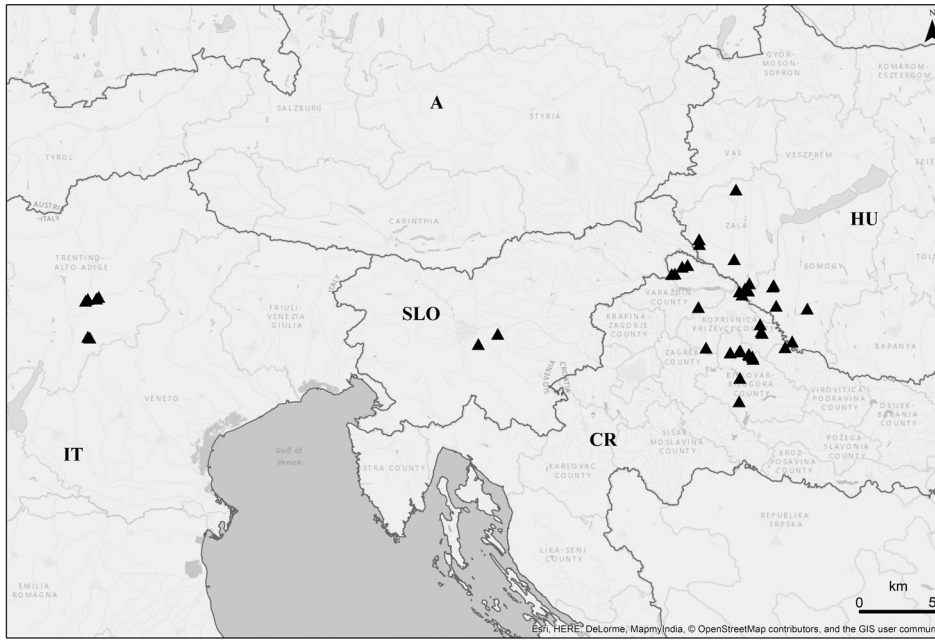

Fig. 2. – Distribution of *Rubus maureri* based on localities supported by herbarium vouchers.

types. Its occurrence is expected (but not yet proven) also in eastern Slovenia (Slovenske gorice and Prekmurje); in central Slovenia it occurs at isolated localities SE of Ljubljana. The smaller and quite distant part of the range is in northern Italy, Trentino-Alto Adige region (slopes of the Adige, Cembra and Sugana Valleys); *R. maureri* is here rather rare and occurs in small numbers.

This species grows in Hungary and Croatia in the lowlands or lower hills; the localities there range from 100 to 350 m a.s.l., whereas the localities in the (sub-)montane regions in central Slovenia and northern Italy range from 280 to 900 m a.s.l. In terms of the grid system of AFE (Atlas Florae Europaeae), it is present in the following units: 32TPR3, 32TPS4, 33TVL3, 33TXL1, 33TXL3, 33TXM1, 33TXM2, 33TXN4.

Ecology and biogeography

Rubus maureri is moderately thermophilous, and often suffers from heat stress and is adversely affected by low relative air humidity in summer. Its range overlaps with the precipitation-rich Illyrian beech and oak-hornbeam forest belt southeast of the Alps. This species is most abundant in the eastern part of its range (Hungary and Croatia) in areas covered by alluvial or tertiary sandy or loamy sediments, where it prefers the nutrient-rich, weakly acidic, mesic to water-logged alluvial and brown forest soils. In the western part of its range (Slovenia and Italy), it grows in montane areas both on acidic (porphyrites) and carbonate-rich (dolomite) bedrocks, always at mesic sites.

In terms of vegetation, *R. maureri* occurs in several communities of the Illyrian *Aremonio-Fagion* Borhidi alliance; growing most often in clearings, fringes and semi-

shaded parts of forests. This species is connected with natural forest communities, and practically unknown from non-native woods (e.g. black locust or coniferous stands that are often planted throughout its range). In the eastern part of its distribution, on both sides of Drava river it occurs in oak-hornbeam forests, and alluvial forests of hardwood trees and black alder; occurrences in beech forests are quite rare here. In the western part of its range it occurs (at high altitudes) in various Illyrian beech forests and their derivatives. At localities where *R. maureri* occurs, typical companion species belong to *Rubus* ser. *Discolores* (P. J. Müll.) Focke and ser. *Micantes* and in the eastern part of its range also to ser. *Sylvatici* (e.g. *R. juennensis*, *R. macrophyllus*, *R. salzmannii*) and ser. *Vestiti*.

Rubus ferox Vest, Steiermark. Z. 1: 162, 1821.

Loc. typ. cit.: "häufig um Grätz, Geydorf, Leonharderwald, Ulrichsbrunn, u. s. w.". Type (designated by Maurer 1964: 2): "Steyrmark" (Ch. Vest, s. d., GJO 91345!, lectotype, see Electronic Appendix 2; Ch. Vest, s. l., s. d., WU! paralectotype)

= *R. macrophyllus* var. *acanthosepalus* Borbás et Waisb., Oesterr. Bot. Z. 43: 319, 1893. Loc. typ. cit.: [Eisenburger Comitat]. **Lectotype (designated here)**: "Waldrand in Czák, West Ungarn" (A. Waisbecker, 10 VII 1890, BP 83486!, see Electronic Appendix 2, isolectotype in SAMU!).

= *R. lasiaxon* Borbás & Waisb., Oesterr. Bot. Z. 43: 361, 1895. Loc. typ. cit.: "Kőszeg". **Lectotype (designated here)**: "Waldschläge in Czák bei Güns" (A. Waisbecker, 8 VII 1892, WU 0103773! see Electronic Appendix 2).

≡ *R. macrophyllus* [unranked] *lasiaxon* (Borbás et Waisb.) Sabr., Verh. K.K. Zool.-Bot. Ges. Wien 58: 77, 1908.

≡ *R. gremlii* microgen. *lasiaxon* (Borbás et Waisb.) Sudre, Rubi Eur. 117, 1910.

≡ *R. macrophyllus* subsp. *lasiaxon* (Borbás et Waisb.) Sabr., Verh. K.K. Zool.-Bot. Ges. Wien 63: 278, 1913.

= *R. apum* Fritsch, Oesterr. Bot. Z. 55: 85, 1905. Loc. typ. cit.: "Steiermark. Auf der Platte bei Graz auf tertiärem Schotterboden, gegen 600 m". **Neotype (designated here)**: "In fruticetis in colle Platte proper urbem Graz, … locus classicus" (K. Fritsch, Flora Stiriaca Exsiccata 753, Lief. 16, VII 1908, GJO 93571!, see Electronic Appendix 2, isoneotypes in WU!, LJU 22586!)

≡ *R. macrophyllus* var. *apum* (Fritsch) Hayek, Fl. Steierm. 761, 1909.

Illustrations: Maurer 1964 (on unnumbered pages), Mauer 1981: 94, Leute & Maurer 1977: 290, 292, Maurer & Drescher 2000: 166.
Distribution maps: Maurer 1964 (unnumbered), 1979: 147, 1996: 157, Leute & Maurer 1977: 291, Hartl et al. 1992: 303, Maurer & Drescher 2000: 156, Kurtto et al. 2010: 121.

Morphology (Fig. 3, Electronic Appendices 3, 4)

Shrub, usually up to 150 cm tall. First-year stems low-arching or procumbent, angled, 4–7 (–10) mm in diameter. Sides flat or slightly furrowed, greenish or reddish when exposed to the sun, with 0.3–1.0 mm long, erect to patent, simple or tufted hairs (10–30 per 1 cm length of stem side), and with several adpressed minute stellate hairs and subsessile glands. Stalked glands up to 0.3 mm long, (0–) 1–3 (–5) per 1 cm length of stem side. Prickles often in clusters, somewhat unequal, yellowish or red, (5–) 10–25 per 5 cm length of stem, hairy at the base, usually on angles, slightly declining or rarely patent, straight or somewhat curved, conspicuously slender, at the base compressed, 3–4(–5) mm broad, abruptly tapering, 5–8(–10) mm long (often longer than the cross-section of the stem).

Leaves on the first-year stem usually 5-foliolate, digitate (or rarely indistinctly pedate), their lamina thin and dull, often slightly flaccid, light green, not hairy to the touch above (with 0–10 adpressed, 0.1–0.2 mm long hairs and few sessile glands per cm^2),

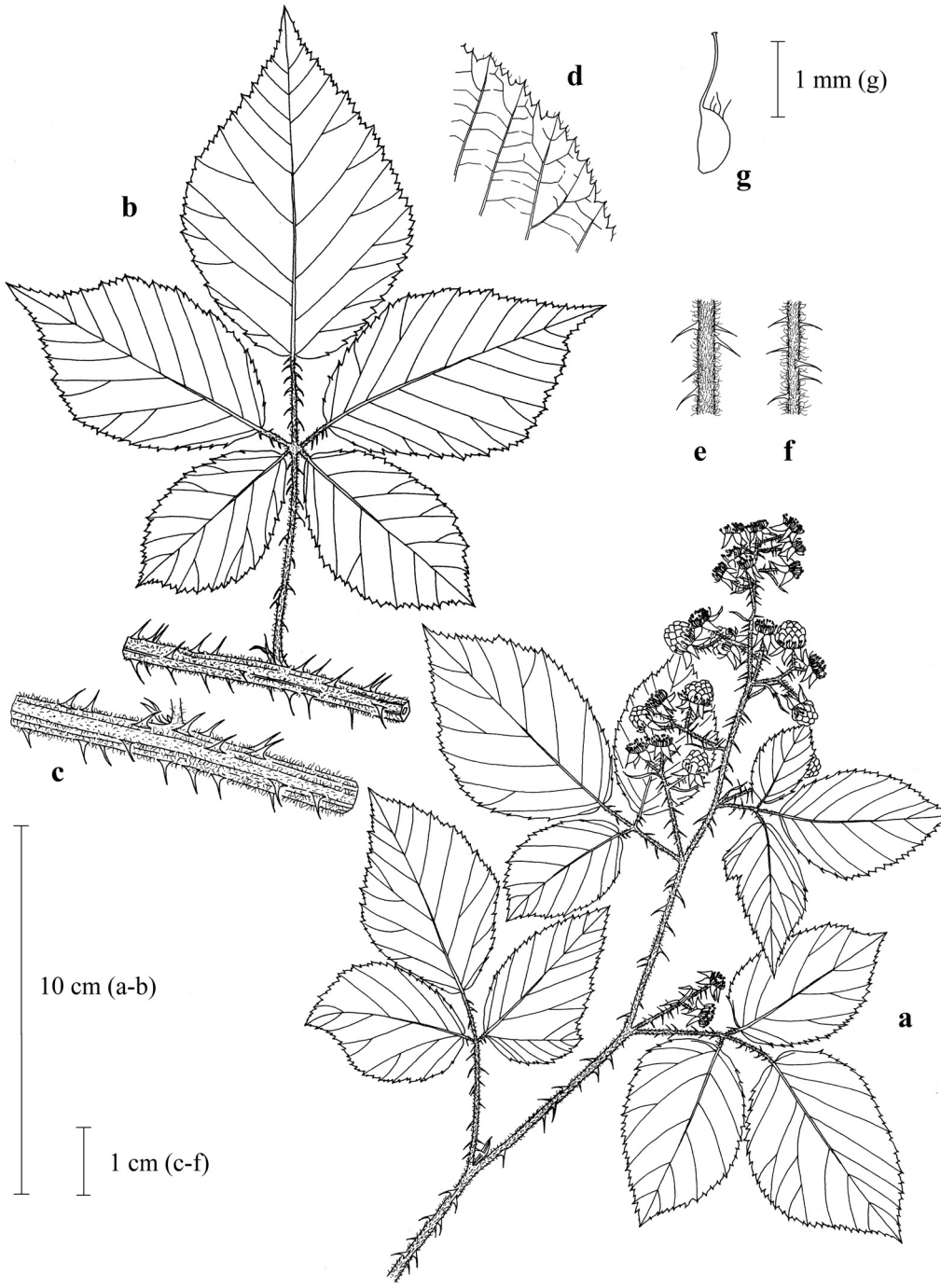

Fig. 3. – *Rubus ferox*: a – infructescence, b – first-year stem with a leaf, c – part of the first-year stem, d – margin of the terminal leaflet, e – inflorescence axis, f – peduncle, g – carpel. Drawn by J. Táborská.

with scattered 0.1–0.2 mm long hairs on the leaf margin; underside of leaves light green and hairy to the touch, with scattered 0.2–0.5 mm long hairs on veins and with numerous shorter adpressed silky or felted hairs not covering the entire surface. Venation weak, veins on the upper surface of leaves not depressed into the surface.

Terminal leaflet usually obovate to narrowly obovate, rarely narrowly ovate, up to 130 mm long, rounded or slightly cordate at the base, apex conspicuous, 15–25 mm long, gradually narrowed; its petiolule 25–40 mm long (25–35% as long as the lamina). Basal leaflets narrowly ovate or obovate, or broadly lanceolate, 1.0–1.1 (–1.2)× as long as the petiole; their petiolule 2–4(–6) mm long. Indentation evenly serrate, with incisions 1–1.5 (–2.5) mm deep, lower (triangle-shaped) part of the teeth significantly broader than long, with a conspicuous narrow apex. Petioles densely hairy, with many subsessile and few stalked glands, and with (10–) 14–18 (–22) strongly curved, slender prickles. Stipules filiform or narrowly lanceolate, with scattered hairs and few stalked glands.

Inflorescence up to 20 cm long, dense, compact, narrowly paniculate, gradually narrowing at the apex, with erect or patent lateral branches up to 4 cm long; distal 5–10 (–15) cm leafless, in the lower part with 3-foliolate leaves having similar or slightly coarser serration than the leaves on the primocane. Inflorescence axis densely hairy with many adpressed silky and simple hairs up to 1 mm long, and with scattered sessile glands; longer stalked glands normally lacking. Prickles yellow or purplish, 15–25 per 5 cm length of axis, slightly declining, rather slender, subulate, straight or slightly curved, 2–7 mm long. Inflorescence branches mostly 1–2 flowered, only the lower ones 3 or more flowered. Pedicels 5–10 (–15) mm long, densely hairy and with scattered sessile glands; stipules with regular shorter stalked glands at the margin among the longer hairs. Prickles of the pedicels 6–12 (–18), yellowish, slender, erect, 0.5–2 (–3) mm long. Sepals usually reflexed after anthesis, 5–8 mm long, whitish-felted with longer hairs and sparse yellow pricklets on the outer surface.

Petals (almost) touching each other, white, broadly elliptical, rounded or slightly emarginate at the apex. Stamens longer than the green styles; anthers glabrous, yellowish-green; filaments yellow. Carpels usually with scattered hairs, rarely nearly glabrous, receptacle hairy. Flowering VI–VII.

Taxonomic remarks

This taxon was recognized a long time ago by botanists working in Styria (Austria), however, it was described under various names. The correct assessment was presented by Maurer (1964), who typified the name *Rubus ferox*, and showed that it takes precedence over other names (*R. apum*, *R. lasiaxon* and *R. macrophyllus* var. *acanthosepalus*), and identified it a typical representative of the ser. *Sylvatici*. This classification was followed by nearly all subsequent authors (e.g. Weber 1995, Maurer & Drescher 2000, Kurtto et al. 2010), only Danner & Fischer (2008) placed it in ser. *Vestiti*. However, the latter viewpoint is unreliable as it is supported neither by the type of hairiness of the leaves, or by features of the inflorescence, so it is not accepted here.

Although *R. ferox* fits well the general morphological features of the ser. *Sylvatici*, it is not similar to any other species in this series in this region, due to having low-arching or procumbent first-year stem and the form of the leaf blade, which it shares with some members of the ser. *Micantes* (e.g. *R. balatonicus* Borbás and *R. clusii* Borbás; for comparison of the species see Király et al. 2013).

Notes on distribution and ecology

Rubus ferox has long been treated as a regional species with a range of approximately 120 km diameter in south-eastern Styria (on tertiary hill ranges along the Rába and Mura rivers), and with a single occurrence near Kőszeg in western Hungary (Gáyer 1921, Maurer 1964, Kiss 1966). The species was subsequently recorded in isolated stands in western Carinthia (Leute & Maurer 1977, Hartl et al. 1992) and in the Inn valley in Tyrol (Pagitz 2013). Finally, we recently found a surprising outpost north of the Alps along the Inn in Upper Austria. Kurtto et al. (2010) mentions it with a question mark also from two AFE grid units in central Hungary, however, we could not find any reliable source for this reference, therefore, they seem to be erroneous. The "new sites" from Tyrol and Upper Austria make *R. ferox* a regional species with a tendency of wider distribution (400 km in diameter in an east-west direction, see Electronic Appendix 5) according to the 'Weberian' approach (Weber 1996). *Rubus ferox* grows chiefly in hilly regions; most of the localities range from 350 to 600 m a.s.l., but in some East-Alpine valleys nearly up to 1000 m a.s.l. This species is reported by Kurtto et al. (2010) in 10 grids of the AFE system, however, their record for 33TXN1 (because it refers to data from 33TXN2) is clearly misplaced. After Pagitz (2013), and based on recent field studies, we can add the following grid units: 32TPT4 and 33UUP2.

Rubus ferox is a sub-Atlantic species, its distribution includes areas with high relative air humidity in the valleys and higher foothills in the Eastern Alps. It requires tertiary clayey and gravelly sediments, prefers nutrient-poor, acidic, mesic to semi-wet brown forest soils. This species usually grows in semi-shaded forest stands and gaps, especially in submontane and montane beech forest associations; it typically does not prefer secondary (e.g. spruce-dominated) stands. It occurs mainly scattered in the scrub layer in forests and never forms large homogenous stands. *Rubus ferox* grows in species-rich bramble scrubs of the Eastern Alps, which typically includes several species of the ser. *Discolores* and ser. *Micantes* (often with more than 15 species of bramble co-occurring at the same place).

Rubus juennensis Leute et W. Maurer, Carinthia II 173/93: 237, 1983.

Loc. typ. cit. and type designation: "SE-Kärnten. Jauntal: an der Straße zwischen Rückersdorf und Proboj, Waldschlag am Rande eines Rotföhrenbestandes, 540 m" (Leute, Maurer & Müller, 16 VII 1980, KL 48821!, holotype; GZU 000240300!, 000240672!, WU 068027!, WU 068028!, isotypes, see Electronic Appendix 2)
Illustrations: Leute & Maurer 1977: 298, Leute & Maurer 1983: 239–242, Maurer & Drescher 2000: 167.
Distribution maps: Leute & Maurer 1977: 299, Leute & Maurer 1983: 243, Hartl et al. 1992: 304, Maurer & Drescher 2000: 157, Kurtto et al. 2010: 122.

Morphology (Fig. 4, Electronic Appendices 3, 4)

Shrub, usually up to 150 cm tall. First-year stems low-arching or procumbent, angled, 5–10 (–12) mm in diameter. Sides slightly purplish to intensely purple, ± dull, with simple and bifid hairs (0.3–1.0 mm long, 5–40 per 1 cm length of stem side), and numerous sessile glands. Prickles usually purplish, ± equal, 5–10 (–12) per 5 cm length of stem, straight (rarely weakly curved), strongly compressed and gradually tapering, usually declining, 4–7 mm broad at base and 5–9 (–11) mm long.

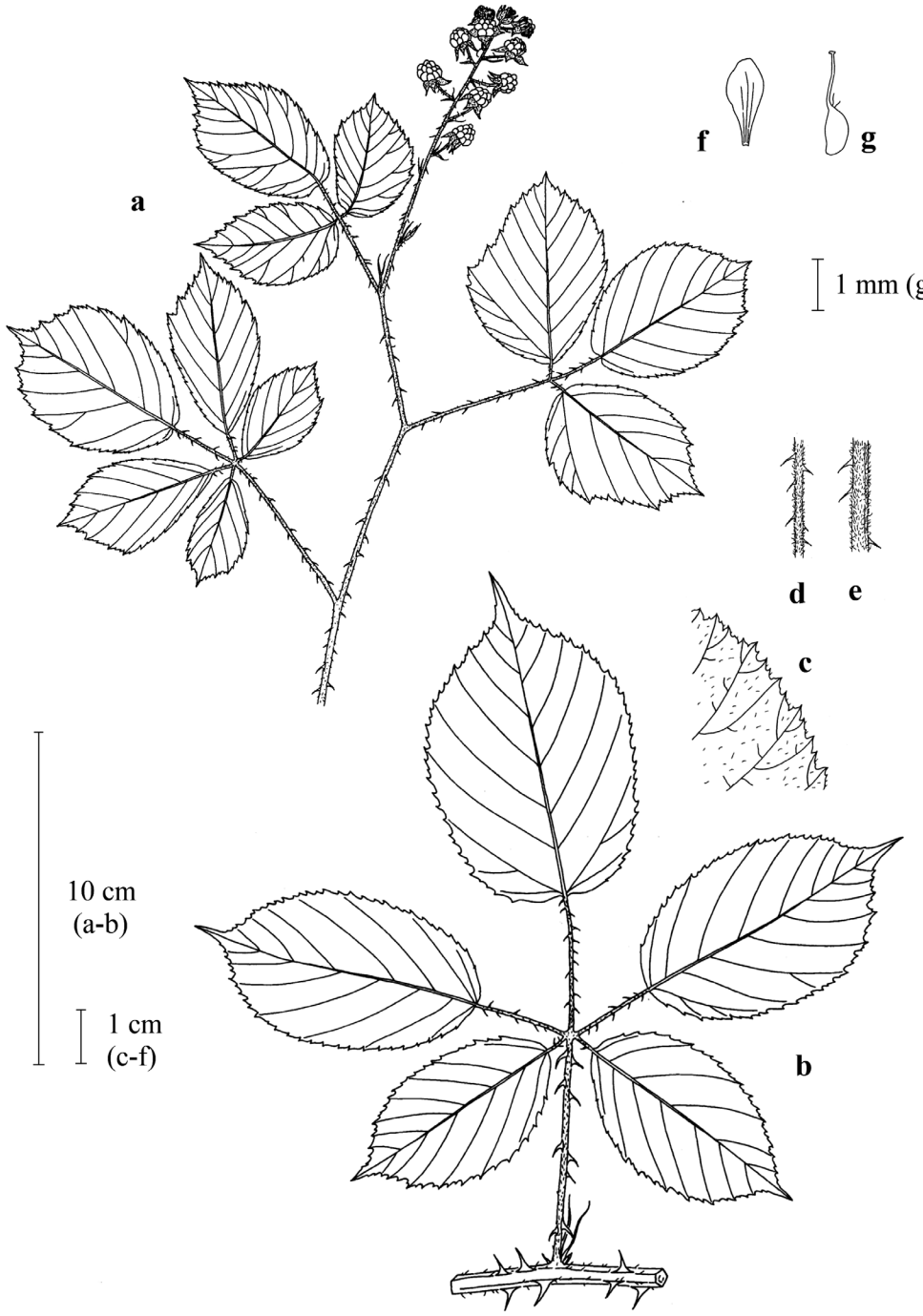

Fig. 4. – *Rubus juennensis*: a – infructescence, b – first-year stem with a leaf, c – margin of the terminal leaflet, d – peduncle, e – inflorescence axis, f – petal, g – carpel. Drawn by J. Táborská.

Leaves on the first-year stem 5-foliolate, digitate or indistinctly pedate, their lamina leathery and dull, dark green (often with irregular yellowish spots), ± hairy to the touch above with 10–40 adpressed ca. 0.5 mm long hairs per cm^2, glabrous or with few minute hairs on the leaf margin; definitely hairy to the touch beneath, greenish to greyish-greenish tomentose over the entire surface, without long simple hairs on veins. Venation rather strong, reticular, veins depressed into the upper surface of the leaf.

Terminal leaflet broadly oblong, obovate or elliptic, rounded, truncate or slightly cordate at the base, apex conspicuous, 10–18 (–25) mm long, abruptly narrowed; its petiolule 28–45 mm long (35–52% as long as the lamina). Basal leaflets obovate, 0.7–0.9 (–1.1)× as long as the petiole; their petiolule 2–6 mm long. Indentation evenly serrate, with incisions 1–2 (–2.5) mm deep, teeth longer than broad with a very short apex. Petioles sparsely hairy, with few subsessile glands up to 0.2 mm long, and with (8–) 10–18 (–20) strongly curved, broad-based prickles. Stipules filiform, with scattered hairs and few stalked glands.

Inflorescence narrowly paniculate or (on weak specimens) racemose, rounded at the apex, with erecto-patent or patent lateral branches; distal 6–12 cm leafless. The uppermost leaf on the inflorescence axis 3-lobed (or rarely unlobed), the lower ones 3- or 5-foliolate with similar serration to that on the leaves on the primocane. Inflorescence axis densely pubescent with several patent simple hairs up to 1 mm long, and with many sessile glands (but hidden among hairs); stalked glands longer than 0.2 mm lacking. Prickles yellow or purplish, 4–12 per 5 cm length of axis, rather slender, compressed, straight or slightly curved, ± declining, 2–6 (–8) mm long. Inflorescence branches mostly 1–2 flowered, lower ones 3-flowered. Pedicels (5–) 10–20 (–30) mm long, pubescent and with scattered sessile glands; stipules with sparsely subsessile glands. Prickles of the pedicels 2–5 (–15), yellowish, slender, straight, 0.5–2 (–3) mm long. Sepals usually reflexed after anthesis, 5–8 mm long, greyish-felted, without or with few pricklets and subsessile glands.

Petals not touching each other, bright pink, 10–18 mm long. Stamens conspicuously longer than the pink styles; anthers glabrous, pink or purple. Carpels sparsely hairy, receptacle hairy. Flowering VI–VII(–VIII).

Taxonomic remarks

Rubus juennensis has an intermediate position between ser. *Discolores* and ser. *Sylvatici*, this is supported by several features: strong and dense prickles on the primocane and felted hairs on the leaves beneath. Based on its bright pink petals this species supposedly originated via hybridization between *R. ulmifolius* Schott and ancestral members of ser. *Sylvatici*. We collected its putative primary hybrids with *R. ulmifolius* in Slovenia and other putative hybrids with several other species of bramble from various series have also been recognized. There is no similar species among the species in ser. *Sylvatici* in this area, however, even the above-mentioned local hybrids can complicate the identification.

Notes on distribution and ecology

Rubus juennensis supposedly evolved in the valleys of the south-eastern Alps. It was first described as a local biotype in a small area in eastern Carinthia (Leute & Maurer 1983). A second centre of distribution is reported in southern Styria and northern Slovenia

(Weber & Maurer 1991). Subsequently, this species was found also along a broad north-south strip from the region of Ljubljana to Istria and north of the Danube in Lower Austria (Maurer & Drescher 2000, Starmühler 2003); in both areas it established probably as a result of secondary spread by ornithochory. Recently, we found rich occurrences of this species in Hungary in the Belső-Somogy region and an isolated stand near Sárvár, furthermore, it is also recorded near Břeclav (South Moravia, Czechia), most probably with a connection with the Lower Austrian stands (see Electronic Appendix 5). Kurtto et al. (2010) reports its occurrence in 10 grid cells of AFE and we added the following: 33TWN4, 33TXM1, 33TXM3, 33TXM4, 33TXN4, 33UXP1.

Rubus juennensis is considered as the most xerophilous member of the ser. *Sylvatici* in the area studied, it occurs both in climatically dry regions (e.g. in Turkey and sessile oak forests in Hungary and Austria), and edaphically dry sites (e.g. in forests on sand in south-western Hungary, or in rocky Illyrian beech forests in Istria and central Slovenia). It is recorded occurring from the lowlands to the lower submontane zones (i.e. between 150–800 m a.s.l.). The species tolerates sunny sites, e.g. fully open forest fringes and scrubs on southern or western slopes. It grows both at calcareous sites (on limestone or dolomite) and on siliceous bedrocks.

Rubus macrophyllus Weihe et Nees, Rubi Germ. 35, t. 12A, 1824.

Loc. typ. cit.: "in Principatu Mindensi, circa Mennighüffen". Type (designated by Beek 1974: 82): s. loc. (Weihe, s. d., lectotype, MSTR).
Synonymy: see Weber 1985, Matzke-Hajek 1993, Kurtto et al. 2010.
Illustrations: Weihe & Nees 1822–1827 (tab. 12A), Sudre 1908–1913 (tab. LII), Weber 1972: 157, 149, 1985: 133, 1995: 419, 448, Holub 1995: 131, Zieliński 2004: 112–113, Henker & Kiesewetter 2009: 97.
Distribution maps: Beek 1974 (map 23), Weber 1972: 381, 1985: 132, Martensen et al. 1983: 65, Matzke-Hajek 1993: 55, Maurer & Drescher 2000: 158, Zieliński 2004: 114, Henker & Kiesewetter 2009: 96, Kurtto et al. 2010: 119.

Distribution and biogeography in the region

Rubus macrophyllus is a widespread west and west-central European plant with numerous questionable records in the south-eastern part of the continent. In the region studied, we largely support the concept of Kurtto et al. (2010) that omits earlier data on this species from most of the Balkans and the Carpathians because of a total lack of supporting herbarium material. We also affirmed that the south-eastern part of its range is separated by a large gap (covering most of the Eastern Alps including the northern foreland and Northern Carpathians, as shown on map 4123 of Kurtto et al. 2010) from the main north-western part of its range. However, we found old vouchers from a few isolated stands at the foot of the North-Eastern Carpathians in Ukraine. The south-easternmost occurrences of this species are recorded south of Bjelovar in Croatia, nevertheless, we could not corroborate its presence (as reported by Starmühler 2003) in Istria (see Electronic Appendix 5).

Localities of *R. macrophyllus* in the Pannonian Basin are in the sub-Atlantic – sub-Mediterranean edge of the area and mainly located in low submontane regions up to 600 m above sea level (e.g. central Slovenia, Styria, the Bilogora Hills in Croatia, Bakony Mts in Hungary). There are also a few records from lowlands (e.g. Drava valley in northern Croatia). This species occurs widely in forest communities of the area, from gallery forests to beech-dominated stands.

Kurtto et al. (2010) reports this species in 16 grid cells of AFE in the study area and presented several further dubious records from Hungary and the Balkans. We consider its occurrence in the grids in Austria, north-eastern Italy and Slovenia to be correct, records for 33TXN1, 34TCT1 are probably erroneous. Based on the results of the recent study, we can add the following units: 33TXL1, 33TXL3, 33TXM2, 33TXM3, 33TXN4, 34UFU1.

Rubus salzmannii W. Maurer, Österr. Bot. Z. 120: 279, 1972.

Loc. typ. cit. and type designation: "Feuchter Mischwald bei Kirchbach in Steiermark, an der Straße nach Glatzau, 340 m" (W. Maurer & A. Neumann, 24 VI 1967, GZU 000280897!, holotype, see Electronic Appendix 2; GZU 000280898!, isotype)
Illustration: Maurer 1972: 280, 282, 1996: 286.
Distribution maps: Maurer 1972: 285, 1981: 85, 1996: 157, Maurer & Drescher 2000: 162, Kurtto et al. 2010: 122.

Morphology (Fig. 5, Electronic Appendices 3, 4)

Shrub, usually up to 200 cm tall, often with several long vegetative stems. First-year stems low-arching or procumbent, angled (young stems often bluntly angled or rounded), 5–10(–12) mm in diameter. Sides greenish or purplish suffused when exposed to the sun, dull, with several adpressed or reflexed tufted and fewer simple hairs (0.1–0.8 mm long, 20–200 per 1 cm length of stem side), and with scattered (sub)sessile glands up to 0.1 mm long. Prickles yellowish, ± unequal, 4–8(–11) per 5 cm length of stem (often crowded), hairy at the base, declining, straight or somewhat curved, at the base conspicuously strong (4–7 mm broad), gradually tapering, (4–)5–8(–10) mm long.

Leaves on first-year stem large (often as broad as 30 cm), 5-foliolate, digitate, glossy, light green, not hairy to the touch above (0–20 adpressed hairs per cm^2, mainly on veins), with 0.2–0.5 mm long hairs on the leaf margin, light or whitish green and softly hairy to the touch beneath, with many 0.3–0.8 mm long adpressed or reflexed hairs on veins and scattered shorter adpressed hairs not covering the entire surface between them.

Terminal leaflet usually broadly obovate or elliptical, slightly cordate at the base, apex conspicuous, (20–) 25–35 (–40) mm long, abruptly narrowed; its petiolule 30–50 mm long (27–39% as long as the lamina). Basal leaflets obovate, (1.0–) 1.1–1.6× as long as the petiole; their petiolules 3–7 mm long. Leaf margin slightly crispate, indentation roughly doubly serrate with incisions 2–5 mm deep, teeth as long as broad with a short narrow apex. Petioles hairy, with few subsessile glands, and with 10–19 strongly curved, broad-based prickles. Stipules filiform, loosely hairy and with sessile and short-stalked glands on the margins.

Inflorescence broadly paniculate, loose, few-flowered, truncate at the apex, distal 3–8 cm leafless, lateral branches patent or erecto-patent, up to 8 cm long; the uppermost 1 (–2) leaves simple, the lower ones 3-foliolate; serration of leaves in the inflorescence quite rough and deep. Inflorescence axis densely hairy with many tufted and simple hairs up to 1 mm long, and with a few (sub)sessile glands not longer than 0.1 mm. Prickles yellow or purplish, 4–10 per 5 cm length of axis, declining, straight or slightly curved, (1–) 2–4 (–5) mm long. Pedicels (10–) 20–30 mm long, densely hairy, with few sessile glands, and with 5–15 slender, straight pricklets 1–2(–3) mm long. Sepals usually reflexed after anthesis, 5–10 mm long, greyish-felted, without pricklets, with several sessile and subsessile glands hidden among hairs.

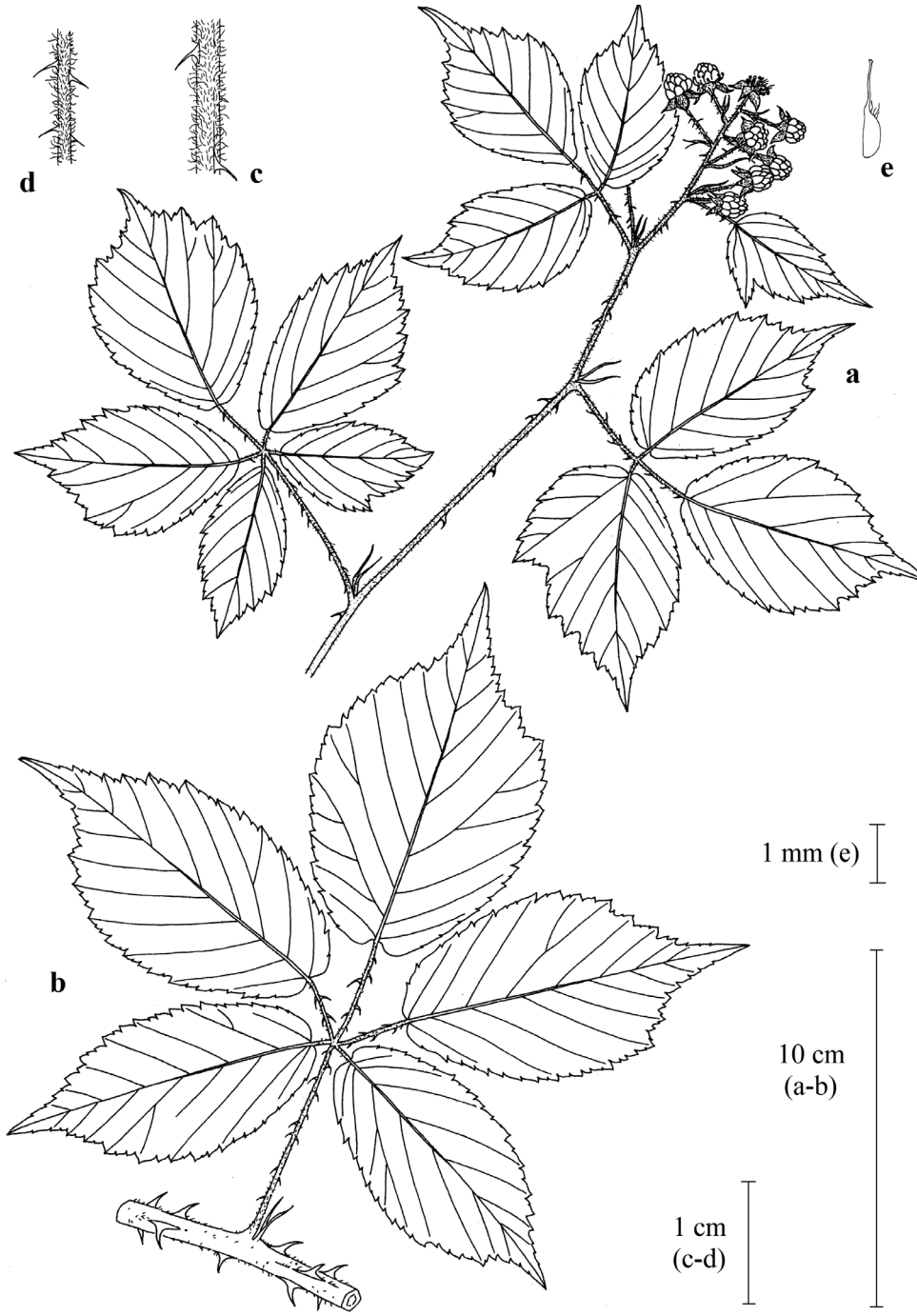

Fig. 5. – *Rubus salzmannii*: a – infructescence, b – first-year stem with a leaf, c – inflorescence axis, d – peduncle, e – carpel. Drawn by J. Táborská.

Petals not touching each other, elliptical (often spathulate), slightly hairy, light pink, 8–12 mm long. Stamens longer than the green styles; anthers glabrous, light pink or whitish. Carpels glabrous or with some hairs, receptacle hairy. Flowering VI–VII.

Taxonomic remarks

Rubus salzmannii is a typical species of the ser. *Sylvatici* and differs significantly from all the other species in the series. Young leaves of first-year stems has a glaze of silky hairs that slightly resembles that in some species in the ser. *Discolores*, but *R. salzmannii* never has a dense tomentum on the leaves. It resembles *R. venosus*, however, the number and size of the prickles and shape of the leaves and inflorescence are different. Vegetative stems are distinguishable from those of some members of the ser. *Micantes* by the lack of stalked glands.

Notes on distribution and ecology

Rubus salzmannii was described as a regional species occurring on both sides of the Mura river south of Graz in Austria and with a single locality in Slovenia (Maurer 1972), which is complemented by few later records of Maurer & Drescher (2000). We significantly widened the known range by finding it at several localities in south-western Hungary and northern Croatia; now it can be classified as a regional species: the longest diameter of the range (along a SE-NW axis from Pitomača in Croatia to Lannach in Styria) is about 200 km (see Electronic Appendix 5).

The localities of *R. salzmannii* in south-eastern Styria are between 250-500 m a.s.l.; whereas in Croatia and Hungary it is a lowland species (with occurrences from 100 to 230 m a.s.l.). The species is reported by Kurtto et al. (2010) as only occurring in 2 grid cells of the AFE system. A specimen collected by Maurer near Lichtenwiesen (but omitted by Kurtto et al. 2010) is from cell 33TWN2. Based on recent field studies we can also add the following units: 33TWM4, 33TXL1, 33TXL3, 33TXM2, 33TXM3, 33TXM4.

Despite its planar-colline character, *R. salzmannii* occurs in an area with relatively high air humidity. Stands of this species occur on loose tertiary sediments and it prefers nutrient-poor, slightly acidic, mesic to semi-wet brown forest or alluvial soils. It grows in semi-shaded forest fringes in oak-hornbeam and black alder forest associations; derivatives (i.e. black locust or conifer-dominated stands) are usually not colonized by this species. Although it can form large clones, it is only exceptionally (e.g. even at the 'locus classicus') a dominant species. *Rubus salzmannii* occurs in species-rich bramble scrubs along with several species of the ser. *Discolores*, ser. *Micantes* and ser. *Vestiti*.

Rubus venosus W. Maurer, Pflanzenw. Steiermark 90, 1981.

Loc. typ. cit. and type designation: "Weststeiermark, auf einem Holzschlag an der Straße zwischen Muttendorf und Purgstall, Gemeinde Tobisegg, 350 m" (W. Maurer, 16 VIII 1974, GZU 000280781, 000280782, 000280783, 000280784, parts of the same specimen!, holotype, see Electronic Appendix 2)
Illustration: Maurer 1981 (unnumbered photograph after page 94).
Distribution maps: Maurer 1981: 92, Maurer & Drescher 2000: 164, Jogan 2001: 326, Kurtto et al. 2010: 122.

Morphology (Fig. 6, Electronic Appendices 3, 4)

Shrub, usually up to 150 cm tall, with a tendency to develop a mass of vegetative stems. First-year stems low-arching or procumbent, bluntly angled, 4–6 (–8) mm in diameter. Sides greenish (or slightly purplish when exposed to the sun), dull, with simple hairs (0.3–0.8 mm long, 5–20 per 1 cm length of stem side), and with few (sub)sessile glands. Prickles yellowish, somewhat unequal, 5–10 (–12) per 5 cm length of stem, hairy at the base, relatively strong, declining, somewhat curved, at the base 3–5 mm broad, gradually tapering, (2–) 3–6 (–7) mm long.

Leaves on the first-year stem 5-foliolate, digitate or indistinctly pedate, their lamina leathery and dull, light green, not hairy to the touch above (0–20 adpressed minute hairs per cm^2), with scattered 0.1–0.2 mm long hairs on the leaf margin; light green and hairy to the touch beneath, with scattered 0.1–0.5 mm long hairs on veins and shorter adpressed silky or felted hairs not covering the entire surface among them. Venation rather strong, veins depressed into the upper surface of the leaf.

Terminal leaflet usually broadly obovate, rarely elliptic, rounded or slightly cordate at the base, its petiolule 28–40 mm long (28–40% as long as the lamina), apex 20–25 mm long, abruptly narrowed. Basal leaflets obovate, 0.9–1.1× as long as the petiole; their petiolules 2–5 mm long. Indentation unevenly (rarely doubly) serrate, with incisions 1.5–3 (–4) mm deep, teeth as long as broad with a short narrow apex. Petioles loosely hairy, with many subsessile and few stalked glands up to 0.3 mm long, and with 11–16 strongly curved, slender prickles. Stipules filiform, with scattered hairs, sessile glands and a few stalked glands.

Inflorescence up to 15 (–20) cm long, dense, compact, narrowly paniculate (lowermost branch is somewhat longer and distinct), rounded at the apex, with erect or erecto-patent lateral branches up to 5 cm long; mainly leafy at the apex, or only the distal 2–5 cm leafless. The uppermost 1–2 (but sometimes even 4–5) leaves of the inflorescence unlobed or 3-lobed, the lower ones 3-foliolate with similar serration as on the leaves on the primocane. Inflorescence axis densely hairy with many adpressed silky and simple hairs up to 1 mm long, and with many (sub)sessile glands not longer than 0.1 mm. Prickles yellow or purplish, 4–8 per 5 cm length of axis, slightly declining, rather slender, straight or slightly curved, 1–3(–4) mm long. Inflorescence branches mostly 1–2 flowered, only the lower ones 3 or more flowered. Pedicels (5–) 10–20 mm long, densely hairy and with scattered sessile glands; bracts with few stalked glands (up to 0.1 mm long) among scattered longer hairs. Prickles on the pedicels 1–4, yellowish, slender, straight, 0.5–1.5 (–2) mm long. Sepals usually reflexed after anthesis, 5–8 mm long, greyish-felted, without pricklets, with few sessile and subsessile glands near the apex.

Petals hairy, touching each other, light pink, 8–12 mm long. Stamens longer than the green styles; anthers glabrous, light pink or whitish. Carpels glabrous, receptacle hairy. Flowering VI–VII (–VIII).

Taxonomic remarks

Rubus venosus is classified as a typical species of the ser. *Sylvatici* and differs significantly from other species in the series and Maurer (1981) does not mention any similar taxa in the protologue. *Rubus salzmannii*, which has a similar growth form (with a tendency for developing a large clones), has more and stronger prickles, leaves with deeper

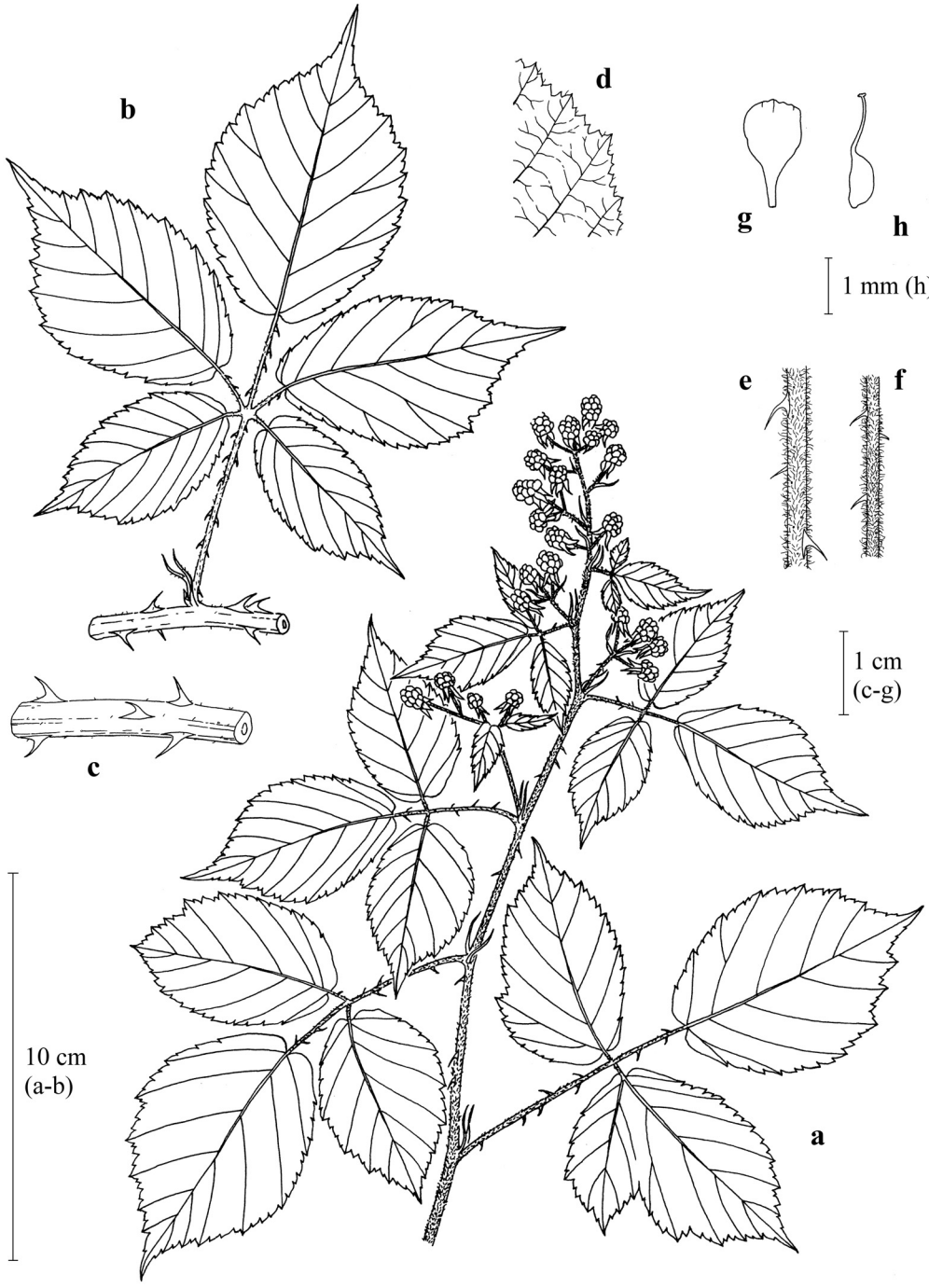

Fig. 6. – *Rubus venosus*: a – infructescence, b – first-year stem with a leaf, c – part of the first-year stem, d – margin of the terminal leaflet, e – inflorescence axis, f – peduncle, g – petal, h – carpel. Drawn by J. Táborská.

serration and a very different shaped inflorescence. The inflorescences of *R. venosus* often wither early, however, the remaining vegetative clones are easily separable from some members of the ser. *Discolores* by the lack of a dense, whitish tomentum on the undersurface of the leaves, and from those in the ser. *Micantes* by the lack of stalked glands on the first-year stem.

Notes on distribution and ecology

Rubus venosus was originally treated as a regional species of south-eastern Styria and the bordering northern Slovenia (Mauer 1981). Maurer & Drescher (2000) report it also from Hungary, however, without locality data and it is not included in the distribution map in their paper (whereas data from Slovenia are mapped). Because Maurer did not make any documented field excursions to Hungary, we believe he only hypothesized its occurrence there. After 2010, we also found this species at a few sites also in south-western Hungary and northern Croatia. It is worth noting that Maurer only collected few specimens of *R. venosus* and recorded only few occurrences in detail. Nevertheless, he mapped several otherwise unpublished records that are not supported by voucher(s), therefore, our map, is based solely on seen specimens (Electronic Appendix 5) and includes fewer locations than those in Maurer (1981) and Maurer & Drescher (2000).

This species usually grows on low hills, sometimes in submontane regions; the recorded localities range from 180 to 600 m a.s.l. The lowermost localities are situated in the Mura valley near Murska Sobota, whereas it occurs up to over 500 m in central Slovenia. It is reported by Kurtto et al. (2010) from 6 grids of the AFE system, furthermore we recorded it in the grid 33TXM2. As for its altitudinal distribution, *R. venosus* is most often growing in brown forest soils in Illyrian oak-hornbeam forests, and rather scattered in beech forests, usually in mesic to semi-wet sites. Furthermore, it occurs on high terraces of alluvial soils in forests of hardwood trees and black alder. Its localities are mainly rich in other bramble species (incl. other sub-Mediterranean taxa, typically from the ser. *Discolores* and ser. *Micantes*). Due to its strong ability to reproduce vegetatively this species is often dominant in forests.

Rubus wimmerianus (Sprib. ex Sudre) Sprib., Jahresber. Schles. Ges. Vaterl. Cult. 87: 57, 1910.

≡ *R. rhombifolius* microgen. *wimmerianus* Sprib. ex Sudre, Bat. Eur. 71, 1907.
Loc. typ. cit.: "Silesie". Type (designated by Zieliński 2004: 98): "Ratibor. Brzezie. Weg nach der Aussicht" (Spribille, 29 VII 1899, KOR 22739!, lectotype, see Electronic Appendix 2).

– *R. wimmeri* Sprib., Verh. Bot. Ver. Prov. Brandenburg 42: 166, 1900, non Weihe 1829, nom. illeg.
Illustrations: Holub 1995: 127, Weber 1995: 413, Trávníček & Maurer 1998: 95, 102, Maurer & Drescher 2000: 165, Zieliński 2004: 99–100.
Distribution maps: Zieliński 2004: 101, Kurtto et al. 2010: 121, Kaplan et al. 2018: 511.

Distribution and biogeography in the region

The known range of *Rubus wimmerianus* covers southern Poland with few occurrences in bordering Ukraine, most of Czechia (with few sites in bordering Austria), Slovakia and north-eastern Hungary (Kurtto et al. 2010). Occurrences in Poland are presented in detail by Zieliński (2004), those in Czechia by Kaplan et al. (2018) and in Austria by Trávníček

& Maurer (1998), respectively. During recent investigations, we found it in the Transdanubian Mts, as well as in two small regions on the foothills of the Alps near Sopron and Szentgotthárd in Hungary, and in the latter area also in Slovenia, which considerably extends its known distribution area. The longest diameter of its range (along a SW-NE axis) is more than 750 km (see Electronic Appendix 5). The species is mentioned by Kurtto et al. (2010) as occurring in several grid cells of the AFE system in the Northern and North-Eastern Carpathians. Additional records based on our recent study are for: 33TWM3, 33TXM3, 33TXN1, 33TXN4, 33TXN2, 33TYN1, 33UXP2.

In the Pannonian Basin, *R. wimmerianus* mainly occurs in shady, nutrient-rich mesic to wet forest fringes in submontane and montane beech forests, rarely also in oak-hornbeam stands. It is a rather basiphilous species in the area studied, with fewer stands on base-rich volcanic bedrocks and is rare on loose tertiary sediments.

Additional taxa of the ser. *Sylvatici* in the area studied

Earlier floras based on the monograph of Sudre (1908–1913) report many species belonging to the ser. *Sylvatici*, nevertheless, based on the lack of any supporting herbarium vouchers, and their recently known distribution (according to Kurtto et al. 2010), none of these records can be accepted as they are in all likelihood nomenclatural misinterpretations or misidentifications.

The most important species reported mistakenly from the area studied: Austria (Danner & Fischer 2008): *R. gremlii* Focke (confused with *R. clusii* Borbás, see Király et al. 2014); Hungary (Kiss 1966): *R. gratus* Focke and *R. silvaticus* (specimens revised by Kiss in BP under these names belong to taxa from other series); Romania (Nyárády 1956, Ciocârlan 2009): *R. gremlii*, *R. macrophyllus* and *R. silvaticus*; Slovakia (Marhold & Hindák 1998): *R. macrophyllus.*

See www.preslia.cz for Electronic Appendices 1–5.

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Souhrn

Práce přináší taxonomicko-chorologickou revizi skupiny *Rubus* ser. *Sylvatici* (P. J. Müll.) Focke v oblasti Panonské nížiny a přilehlých územích severního Balkánu, Karpat a Alp založenou na rozsáhlém terénním výzkumu a studiu vybraných herbářů. První moderní taxonomická zkoumání této série v území započal rakouský botanik W. Maurer v 60. letech minulého století, který popsal 3 nové druhy ze ser. *Sylvatici* (*R. juennensis* Leute et W. Maurer, *R. salzmannii* W. Maurer a *R. venosus* W. Maurer), objasnil postavení dříve popsaného druhu *R. ferox* Vest a publikoval první spolehlivější data o výskytu *R. macrophyllus* Weihe et Nees. Další druh této skupiny, *R. wimmerianus* (Sudre) Sprib., byl uváděn více autory v moderní batologické literatuře ze severní

části studovaného území od 90. let 20. století. Na základě studia originálního materiálu Maurerem popsaných druhů, a po prostudování dalších veřejných herbářů a uskutečněného terénního výzkumu, lze konstatovat, že tyto taxony jsou dobře definované i taxonomicky zařazené. Totéž platí pro další 2 výše zmíněné druhy. Ve studijním území jsme však nalezli ještě šestého, dosud vědecky nepopsaného zástupce ser. *Sylvatici*, který byl dříve občas zaměňován s *R. macrophyllus*. V práci je popisován jako nový druh pro vědu a nazván na počest W. Maurera jako *R. maureri* Király, Trávn. et Žíla; vyskytuje se v území od sev. Itálie přes Slovinsko a severní Chorvatsko po jihozápad Maďarska. Dále v článku uvádíme synonyma nejdříve z území popsaného druhu (*R. ferox*), včetně potřebných typifikací. Rovněž výrazně doplňujeme a zpřesňujeme znalosti o rozšíření a ekologii všech zástupců ser. *Sylvatici* v dané oblasti. U druhů, kde to bylo potřebné, doplňujeme jejich morfologickou charakteristiku, vyobrazení (perokresby typických rostlin, fotografie živých rostlin z terénu, případně fotografie studovaného typového materiálu). V práci je rovněž diskutováno taxonomické zařazení dalších dvou druhů vyskytujících se ve studovaném území, tj. *R. angustipaniculatus* Holub a *R. solvensis* W. Maurer, které byly někdy řazeny rovněž k ser. *Sylvatici*. Na základě rozboru jejich morfologických znaků podporujeme zařazení prvního z nich do *R.* ser. *Rhamnifolii* (Bab.) Focke a druhého do *R.* ser. *Vestiti* (Focke) Focke.

References

Beek A. van de (1974) Die Brombeeren des Geldrischen Distriktes innerhalb der Flora der Niederlande. – Mededelingen van het Botanisch Museum en Herbarium van de Rijksuniversiteit te Utrecht 415: 1–112.

Beek A. van de, Bijlsma R.-J., Haveman R., Meijer K., de Ronde I., Troelstra A. S. & Weeda E. J. (2014) Naamlijst en verspreidingsgegevens van de Nederlandse bramen (*Rubus* L. subgen. *Rubus*) [Checklist and distribution data of Dutch brambles]. – Gorteria 36: 108–171.

Beek A. van de, Matzke-Hajek G. & Royer J.-M. (2017) The types of the taxa of the genus *Rubus* (*Rosaceae* L.) described by Philipp Jakob Müller. – Gorteria 39: 5–45.

Ciocârlan V. (2009) Flora Ilustrată a României [Illustrated flora of Romania]. – Editura Ceres, Bucureşti.

Danner J. & Fischer M. A. (2008) Brombeere u. Himbeere u. Steinbeere / *Rubus*. – In: Fischer M. A. (ed.), Exkursionsflora für Österreich, Liechtenstein und Südtirol, p. 510–530, 3. Auflage, Land Oberösterreich, OÖ Landesmuseen, Linz.

Edees E. S. & Newton A. (1988) Brambles of the British Isles. – The Ray Society, London.

Gáyer Gy. (1921) Prodromus der Brombeerenflora Ungarns. – Magyar Botanikai Lapok 20: 1–45.

Gáyer Gy. (1924–1925) *Rubus* L. Szeder. – In: Jávorka S. (ed.), Magyar flóra (Flora Hungarica), p. 485–518, Studium, Budapest.

Hartl H., Kniely G., Leute G.-H., Niklfeld H. & Perko M. (1992) Verbreitungsatlas der Farn- und Blütenpflanzen Kärntens. – Verlag des Naturwissenschaftlichen Vereines für Kärnten, Klagenfurt.

Hayek A. von (1908–1911) Flora von Steiermark 1. – Bornträger, Berlin.

Henker H. & Kiesewetter H. (2009) Rubus-Flora von Mecklenburg-Vorpommern. – Botanischer Rundbrief für Mecklenburg-Vorpommern 44, Steffen.

Heslop-Harrison Y. (1968) *Rubus* L. – In: Tutin T. G., Heywood V. H., Burges N. A. et al. (eds), Flora Europaea 2: 7–25, Cambridge University Press, Cambridge.

Holub J. (1991) Eight new *Rubus* species described from Czech Republic. – Folia Geobotanica & Phytotaxonomica 26: 331–340.

Holub J. (1992) A preliminary checklist of *Rubus* species occurring in the Czech Republic. – Preslia 64: 97–132.

Holub J. (1995) *Rubus* L. – ostružiník (maliník, moruška, ostružinec, ostružiníček). – In: Slavík B. (ed.), Květena České republiky [Flora of the Czech Republic] 4: 54–206, Academia, Praha.

Jogan N. (ed.) (2001) Gradivo za atlas flore Slovenije [Materials for the atlas of flora of Slovenia]. – Center za Kartografjo Favne in Flore, Miklavž na Dravskem polju.

Kaplan Z., Danihelka J., Chrtek J. Jr., Prančl J., Ducháček M., Ekrt L., Kirschner J., Brabec J., Zázvorka J., Trávníček B., Dřevojan P., Šumberová K., Kocián P., Wild J. & Petřík P. (2018) Distributions of vascular plants in the Czech Republic. Part 7. – Preslia 90: 425–531.

Király G., Trávníček B. & Žíla V. (2013) Revision of *Rubus* ser. *Micantes* occurring in Hungary and re-evaluation of the neglected *Rubus balatonicus*. – Preslia 85: 505–526.

Király G., Trávníček B. & Žíla V. (2014) A *Rubus* L. ser. *Micantes* Sudre magyarországi fajainak elterjedése és határozókulcsa [Distribution and identification key of *Rubus* L. ser. *Micantes* in Hungary]. – Kitaibelia 19: 56–68.

Kiss Á. (1966) *Rubus* L. Szeder. – In: Soó R., A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve [Taxonomic-geobotanical handbook of the Hungarian flora and vegetation] 2: 125–189, Akadémiai Kiadó, Budapest.

Krahulcová A., Trávníček B. & Šarhanová P. (2013) Karyological variation in the genus *Rubus*, subgenus *Rubus*: new data from the Czech Republic and synthesis of the current knowledge of European species. – Preslia 85: 19–39.

Kurtto A., Weber H. E., Lampinen R. & Sennikov A. N. (eds) (2010) Atlas Florae Europaeae. Distribution of vascular plants in Europe. Vol. 15. *Rosaceae* (*Rubus*). – The Committee for Mapping the Flora of Europea & Societas Biologica Fennica Vanamo, Helsinki.

Leute G. H. & Maurer W. (1977) Zur Verbreitung einiger Brombeerarten (*Rubus*, Sectio *Eufruticosi*) in Kärnten. – Carinthia II 167/87: 277–321.

Leute G. H. & Maurer W. (1983) *Rubus juennensis* Leute & Maurer, eine neue Brombeerart aus dem östlichen Kärnten. – Carinthia II 173/93: 237–244.

Marhold K. & Hindák F. (eds) (1998) Checklist of non-vascular and vascular plants of Slovakia. – VEDA, Bratislava.

Martensen H. O., Pedersen A. & Weber H. E. (1983) Atlas der Brombeeren von Dänemark, Schleswig-Holstein und dem benachbarten Niedersachsen (Gattung *Rubus* L.). – Naturschutz und Landschaftspflege in Niedersachsen, Beiheft 5, Hannover.

Martinčič A. (2007) *Rubus* L. – robida. – In: Martinčič A. (ed.), Mala flora Slovenije [Small flora of Slovenia], p. 264–273, Tehniška založba, Ljubljana.

Matzke-Hajek G. (1993) Die Brombeeren (*Rubus fruticosus* agg.) der Eifel und der Niederrheinischen Bucht. – Decheniana Beihefte, Suppl. 32: 1–212.

Matzke-Hajek G. (2001) Revision and typification of brambles (*Rubus* L., *Rosaceae*) described by P. J. Müller from the Weissenburg region and the Palatinate (France and Germany). – Candollea 56: 171–195.

Maurer W. (1964) Die Bienen-Brombeere (*Rubus ferox* Vest) und ihre Verbreitung am Ostrande der Alpen. – Mitteilungen der Abteilung Botanik am Landesmuseum Joanneum in Graz 18: 1–18.

Maurer W. (1972) *Rubus salzmannii*, spec. nov., eine neue Brombeere des südoststeirischen Hügellandes. – Oesterreichische Botanische Zeitschrift 120: 279–287.

Maurer W. (1976) *Rubus solvensis* spec. nov., eine neue Brombeere im Süden Österreichs und im nördlichen Jugoslawien. – Phyton (Austria) 17: 329–335.

Maurer W. (1979) Die Verbreitung einiger Brombeerarten (Gattung *Rubus*) in der nordwestlichen Steiermark und in angrenzenden Gebieten. – Mitteilungen des naturwissenschaftlichen Vereins für Steiermark 109: 137–150.

Maurer W. (1981) Pflanzenwelt der Steiermark und angrenzender Gebiete am Alpen-Ostrand. – Verlag für Sammler, Graz.

Maurer W. (1994) Brombeere, Himbeere u. Steinbeere, *Rubus*. – In: Fischer M. A. (ed.), Exkursionsflora von Österreich, p. 414–427, 1. Auflage, Verlag Eugen Ulmer, Stuttgart, Wien.

Maurer W. (1996) Flora der Steiermark 1. – IHW-Verlag, Eching.

Maurer W. & Drescher A. (2000) Die Verbreitung einiger Brombeerarten (*Rubus* subgen. *Rubus*) in Österreich und im angrenzenden Slowenien. – Mitteilungen des naturwissenschaftlichen Vereins für Steiermark 130: 141–168.

Monasterio-Huelin E. (1999) *Rubus* L. – In: Castroviejo S. (ed.), Flora Iberica 6: 16–71, Consejo Superior de Investigaciones Científicas, Madrid.

Nyárády E. I. (1956) *Rubus* L. – In: Săvulescu T. (ed.), Flora Republici Populare Romîne [Flora of the People's Republic of Romania] 4: 276–580, Editura Academiei Republici Populare Romîne, Bucureşti.

Nybom H. (1996) DNA fingerprinting: a useful tool in the taxonomy of apomictic plant groups. – Folia Geobotanica & Phytotaxonomica 31: 295–304.

Pagitz K. (2013) Neues zur Brombeer-Flora der Ostalpen. – Gredleriana 13: 45–70.

Šarhanová P., Vašut R. J., Dančák M., Bureš P. & Trávníček B. (2012) New insights into the variability of reproduction modes in European populations of *Rubus* subgen. *Rubus*: how sexual are polyploid brambles? – Sexual Plant Reproduction 25: 319–335.

Sochor M., Vašut R. J., Sharbel T. F. & Trávníček B. (2015) How just a few makes a lot: speciation via reticulation and apomixis on example of European brambles (*Rubus* subgen. *Rubus*, *Rosaceae*). – Molecular Phylogenetics and Evolution 89: 13–27.

Stace C. (2010) New Flora of the British Isles. Ed. 3. – Cambridge University Press, Cambridge.

Starmühler W. (2003) Vorarbeiten zu einer „Flora von Istrien" Teil VI. – Carinthia II 193/113: 579–658.

Sudre H. (1908–1913) Rubi Europae vel Monographia Iconibus illustrata Ruborum Europae. – Librairie des sciences naturelles, Paris.

Thiers B. M. (2018) Index Herbariorum: a global directory of public herbaria and associated staff. – New York Botanical Garden's Virtual Herbarium. URL: http://sweetgum.nybg.org/ih (accessed 10 December 2018).

Tomaszewski D., Zieliński J. & Gawlak M. (2013) Foliar indumentum in central-European *Rubus* species (*Rosaceae*) and its contribution to the systematics of the group. – Nordic Journal of Botany 31: 1–10.

Trávníček B. & Havlíček P. (2002) *Rubus* L. – ostružiník. – In: Kubát K., Hrouda L., Chrtek J. jun., Kaplan Z., Kirschner J. & Štěpánek J. (eds), Klíč ke květeně České republiky [Key to the flora of the Czech Republic], p. 329–376, Academia, Praha.

Trávníček B. & Maurer W. (1998) Einige für Österreich beziehungsweise Niederösterreich neue Brombeer-Arten (Gattung *Rubus*). – Linzer biologische Beiträge 30: 81–104.

Weber H. E. (1972) Die Gattung *Rubus* L. (*Rosaceae*) im nordwestlichen Europa. – Phanerogamarum Monographiae 7: 1–504.

Weber H. E. (1985) Rubi Westfalici. Die Brombeeren Westfalens und des Raumes Osnabrück (*Rubus* L. Subgenus *Rubus*). – Abhandlungen aus dem Westfälischen Museum für Naturkunde 47/3: 1–452.

Weber H. E. (1995) *Rubus*. – In: Weber H. E. (ed.), Gustav Hegi, Illustrierte Flora von Mitteleuropa, Ed. 3, 4/2A: 284–595, Blackwell Wissenschafts-Verlag, Berlin, Oxford etc.

Weber H. E. (1996) Former and modern taxonomic treatment of the apomictic *Rubus* complex. – Folia Geobotanica & Phytotaxonomica 31: 373–380.

Weber H. E. & Maurer W. (1991) Kommentierte Checkliste der in Österreich nachgewiesenen Arten der Gattung *Rubus* L. (*Rosaceae*). – Phyton (Austria) 31: 67–79.

Weihe K. E. A. & Nees von Esenbeck C. G. (1822–1827) Rubi Germanici. Die deutschen Brombeersträuche. – Schönian'sche Buchhandlung, Elberfeld.

Zieliński J. (1991) *Rubus pyramidaliformis* (*Rosaceae*) – a new species of blackberry from SW Poland. – Fragmenta Floristica et Geobotanica 36: 267–271.

Zieliński J. (2004) The genus *Rubus* (*Rosaceae*) in Poland. – Polish Botanical Studies 16: 1–30.

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