

## ***Rubus silvae-norticae*, a new species from Bohemia, Austria and Bavaria and the significance of brambles for regional migrations**

***Rubus silvae-norticae*, nový druh ostružiníku z Čech, Rakouska a Bavorska a význam ostružiníků pro regionální migrace**

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A new bramble species, *Rubus silvae-norticae*, section *Rubus*, subsection *Hiemales* E. H. L. Krause in Prah, series *Micantes* Sudre, which occurs in S Bohemia, Upper Austria and Lower Bavaria, is described. It is recorded at 130 localities. The distance between the most remote localities is ca 100 km. The species grows most frequently in forest habitats (as a distinctly nemophilous ecoelement) such as ditches and edges of forest roads, plantations, forest margins and clearings. It mainly grows in mesic, acid and mineral-poor soils. Like, for example, *R. clusii* or *R. ser. Glandulosi* and unlike other relatively thermophilous *Rubus* species, it is able to grow and propagate itself at rather high altitudes, up to the mountain vegetation belt. The diagnostic characters that separate *R. silvae-norticae* from its most similar and sympatrically occurring species, *R. clusii* and *R. muhelicus*, are provided. In Austria *R. silvae-norticae* and some other brambles were mistakenly considered as *R. helveticus*, a bramble (probably a single biotype) described from Switzerland in 1870. The lectotype of *Rubus helveticus* is designated here and a photograph of the specimen presented. Also included is a distribution map of *R. silvae-norticae*, a list of revised herbarium specimens, a photograph of the type specimen and a pen drawing of the species. The significance of regional brambles for plant migrations and phytogeography is shown, based on the distribution of selected regional *Rubus* species occurring in the Czech and Austrian border area, which is a known mountain barrier to migration. The distribution patterns of the brambles support a theory about the routes of plant migration and the florogenetic connection between Austria and the Czech Republic. *Rubus silvae-norticae*, *R. muhelicus* and *R. vestitus* f. *albiflorus* are regarded as Danubian migrants (distributed from Upper Austria to S Bohemia), whereas *R. gothicus* s. l. (“south Moravian type”) and *R. austromoravicus* are considered to be Dyje-Kamp migrants (distributed from Moravia and Lower Austria to S Bohemia) within the Bohemian flora. *Rubus kletensis* is supposed to be a Vltava migrant within the Austrian flora (distributed from S Bohemia to Upper Austria).

**Key words:** Austria, batology, Czech Republic, ecology, Germany, migration, phytogeography, *Rosaceae*, *Rubus*, taxonomy

### **Introduction**

Pseudogamous blackberries (*Rubus fruticosus* agg.) provide challenging opportunities for studying biogeographical and ecological processes related to distribution dynamics and migration. The extent and structure of *Rubus* distribution are very well studied. It is widely accepted that the taxonomic value of a bramble is determined by the size of its distribution area. Only brambles with a regional [i.e., ca (20–) 50–250 km in diameter] or widespread distribution are accepted as species. Individual plants (single bushes) and local biotypes

(i.e., occupying an area smaller than 20 km in diameter) are not taxonomically evaluated (Bijlsma & Haveman 2007, Holub 1997, Weber 1981, 1987b, 1996). It is hypothesized that the extent of a distribution area is directly proportional to the age and biological fitness of a blackberry species (Matzke-Hajek 1997). Bijlsma & Haveman (2007) suggested five types of distribution range that differ in size and internal structure and postulated a close connection between the structure of a distribution area and the ecological requirements of a *Rubus* species, abiotic conditions, and historical and current landscape management.

The distribution and diversity of brambles is also strongly influenced by climatic conditions: the number of species decreases with increase in altitude (Holub 1999, Lepší & Lepší 2004, Newton & Randall 2004, Oklejewicz 2006). Holub (1999) suggests that this relationship be used to delimit mountain phytogeographical units on the basis of absence or rare occurrence of *Rubus* species in mountain areas. The above-mentioned facts imply that mountains represent distinct migration barrier especially for the gradual (step-by-step) spreading of blackberries. They cross the mountains either via relatively common long-distance dispersal, or through regional gradual spread along mountain passes or along coasts (Matzke-Hajek 1997, Newton & Randall 2004). Other plants have also used these routes to migrate in different periods of the postglacial era. But today they are usually commonly and widely distributed, and it is therefore impossible to use their current distribution to determine where they originated from (Fér et al. 2007). In such cases, regional *Rubus* species seem to be useful for detecting or confirming migration routes and florogenetic connections between regions separated by migration barriers. Generally, brambles were not included in phytogeographic studies (e.g., when delimiting phytogeographical units or migration routes) in the past because there was little knowledge about their taxonomy and distribution.

This paper attempts to underline the significance of regional brambles in phytogeographic studies with particular reference to the barrier to their migration posed by the mountains between S Bohemia, Austria and Moravia. Furthermore, a new regional species is described, which was distinguished in the field by the authors during a study of the flora of the Novohradské hory Mts (Lepší & Lepší 2004) and the *Rubus* flora of S Bohemia (Lepší & Lepší 2006).

## Methods

The description of the species was based on 20 specimens. Each set of morphological characters was measured 20 times. Only mature and well developed individuals were described. Revised herbarium specimens from the Czech Republic were sorted according to the regional-phytogeographical classification system (Skalický 1988) and subsequently according to the quadrant numbers of the Central European grid mapping system (Ehrendorfer & Hamann 1965). Revised herbarium specimens from Austria and Bavaria were classified according to administrative regions and subsequently according to the quadrant numbers of the Central European mapping grid. Altitudes and geographic coordinates (WGS-84) were determined using Garmin eTrex instruments. Information on the herbarium labels was translated into English except when written in Latin or German. Information not included on the labels (e.g., coordinates, altitude) were obtained from elec-

tronic maps ([www.mapy.cz](http://www.mapy.cz), Anonymus 2001) and added in square brackets. Names of the most frequent collectors were abbreviated: JD = Josef Danner, ML = Martin Lepší, PL = Petr Lepší, VŽ = Vojtěch Žíla. For abbreviations of names of public herbaria see Holmgren et al. (1990). Species nomenclature was unified according to Kubát et al. (2002) except for *Rubus vestitus* f. *albiflorus* Kretzer in Baenitz, *R. muhelicus* Danner, *R. kletensis* M. Lepší et P. Lepší and *R. helveticus* Gremli.

## Results and discussion

### *Rubus silvae-norticae* M. Lepší et P. Lepší, **spec. nova** (Figs 1–2)

**Descriptio:** Turio arcuato-decumbens usque decumbens, semirotundatus usque obtuse angulatus cum faciebus planis, viridis vel in partibus insolatis subvinosus, sparse pilosus glandulosusque glandulis dissimilibus, sessilibus usque stipitatis, pro 1 cm lateris (2–) 6–11 (–20) pilis fasciculatis patentibus atque (2–) 5–22 (–29) glandulis stipitatis obsitus, disperse aculeatus, aculeolis et aciculis (saepe glanduliferis) disperse instructus. Aculei turionis in numero (10–) 14–21 (–26) ad 5 cm, (4.1–) 5.0–6.0 (–6.9) mm longi, plus minusve conformes et aequilongi, graciles, reclinati, recti, fulvi usque subvinacei, basi compressi. Folia turionis digitato-quinata, supra obscure viridia, cum 0–1 (–7) pilis simplicibus ad 1 cm<sup>2</sup>, subtus viridia usque leviter cano-viridia, pilis stellatis et fasciculatis atque pilis longioribus simplicibus disperse obsita, ad tactum parum perceptibilibus pilosa; foliola terminalia modice longe petiolulata [longitudo petioluli (33–) 36–40 (–42)% longitudinis laminulae], late elliptica interdum late oblonga elliptica (raro late obovata vel late ovata), basi cordata vel subcordata raro usque truncata, in apicem (2.0–) 2.4–2.9 (–3.3) cm longum subabrupte acuminate attenuata; margine dentibus cuspidatis grosse periodiceque duplicato-serrata cum dentibus principalibus magnis, apice cuspidatis, incisurae (3.0–) 3.5–4.0 (–5.0) mm profundae; foliola infima (0.5–) 0.6–0.7 (–1.0) cm petiolulata. Petiolus cum (18–) 21–26 (–30) aculeis, pilis fasciculatis, stellatis et pilis longioribus simplicibus, glandulis stipitatis atque aciculis glanduliferis disperse obsitus; aculeis subcurvatis, (3.5–) 4.0–4.5 (–5.0) mm longis; stipulae filiformes, 0.3–0.6 (–1.0) mm latae, margine pilis longioribus glandulis longius stipitatis obsitae. Inflorescentia pyramidalis, ± pauciflora, apice truncata cum floribus ± accumulatis, usque ad apicem foliosa; folia in parte superiori inflorescentiae simplicia, cetera 3 (–5) nata (foliolis terminalibus obovatis usque ovalibus), supra pilis longioribus simplicibus sparse pilosa vel glabriuscula, subtus viridia usque cano-viridia, pilis stellatis et simplicibus disperse pilosa usque tomentosa (pilis ad tactum parum perceptibilibus pilosa), margine dentibus acuminatis grosse periodiceque (duplicato-)serrata; rachis pilis stellatis fasciculatisque et pilis longioribus simplicibus pubescens usque paulo tomentosa, cum glandulis stipitatis et aciculis glanduliferis disperse obsita; aculei rachidis subaequales (aculeis brevibus saepe intermixtis), recti, reclinati, fulvi usque subvinacei, in numero (6–) 7–10 (–13) ad 5 cm longitudinis, (3.5–) 4–5 (–7) mm longi. Pedicelli (12–) 14–16 (–20) mm longi, pilis fasciculatis stellatisque sparse tomentosi, cum glandulis stipitatis fulvis usque rubris (0.2–) 0.4–0.6 (–0.8) mm longis et aciculis glanduliferis obsiti, item cum (7–) 12–17 (–22) aculeis leviter reclinatis dilute fulvis (1.2–) 1.5–2.1 (–2.8) mm longis muniti; bracteolae filiformes usque anguste lanceolatae, pilis fasciculatis et stellatis disperse pilosae, margine pilis longioribus simplicibus et glandulis stipitatis ciliatae. Sepala post anthesin reclinata, viride-canescens, albomarginata, intra dense tomentosa, externe tomentosa pilisque longioribus dispersis, glandulis rubris stipitatis, aciculis glanduliferis atque aculeolis rectis dilute fulvis disperse obsita, breve appendiculata, appendices filiformes. Petala late ovalia, (7.5–) 8.8–9.9 (–10.5) mm longa, 5.0–5.5 (–6.5) mm lata, alba (in sicco dilute rosacea), externe sparse villosa, intra ad basin modo sparse villosa, breve unguiculata; apice emarginata. Stamina stylos albovirescentes superantia; antherae glabrae, viridulae; filamenta glabra, alba. Ovaria raro pilis singulis obsita. Receptaculum sparse longe pilosum, pilis ex ovariis exsertis. Fructus subglobosus, niger. Floret VI–VII.

### *Rubus* subgen. *Rubus* sect. *Rubus* subsect. *Hiemales* ser. *Micantes* Sudre

**H o l o t y p u s:** Bohemia meridionalis, distr. Český Krumlov, pagus Rožmberk nad Vltavou (7352a): ca 3.1 km situ sept.-occidentali a pago, ad viam in silva, solo gneissiaceo; 750 m s. m.; 48°40'37.7"N, 14°20'31.3"E; 17. 8. 2007 M. Lepší & P. Lepší; CB (No. 64747) (Fig. 2). – **I s o t y p u s:** PR (No. 64747a).

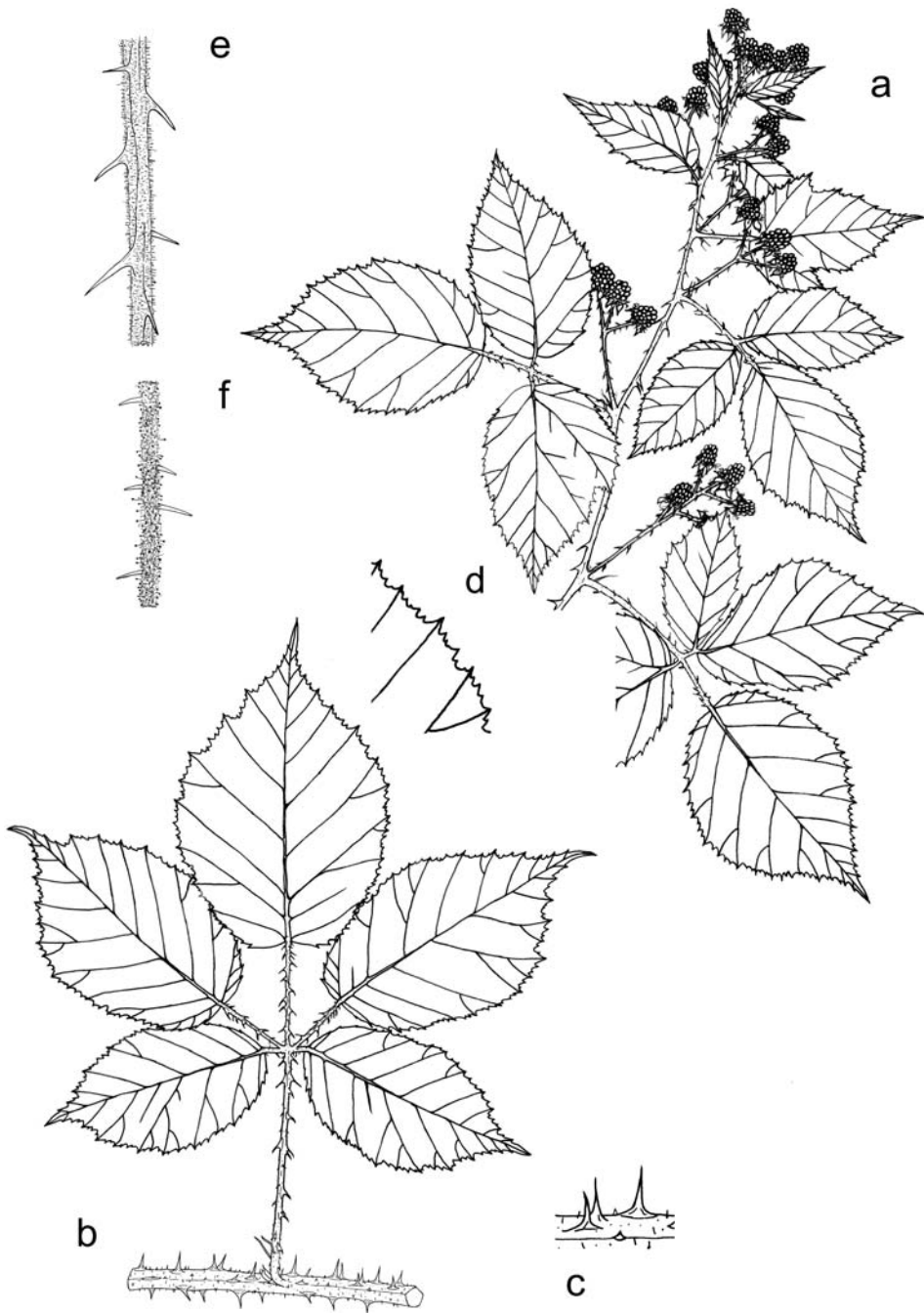
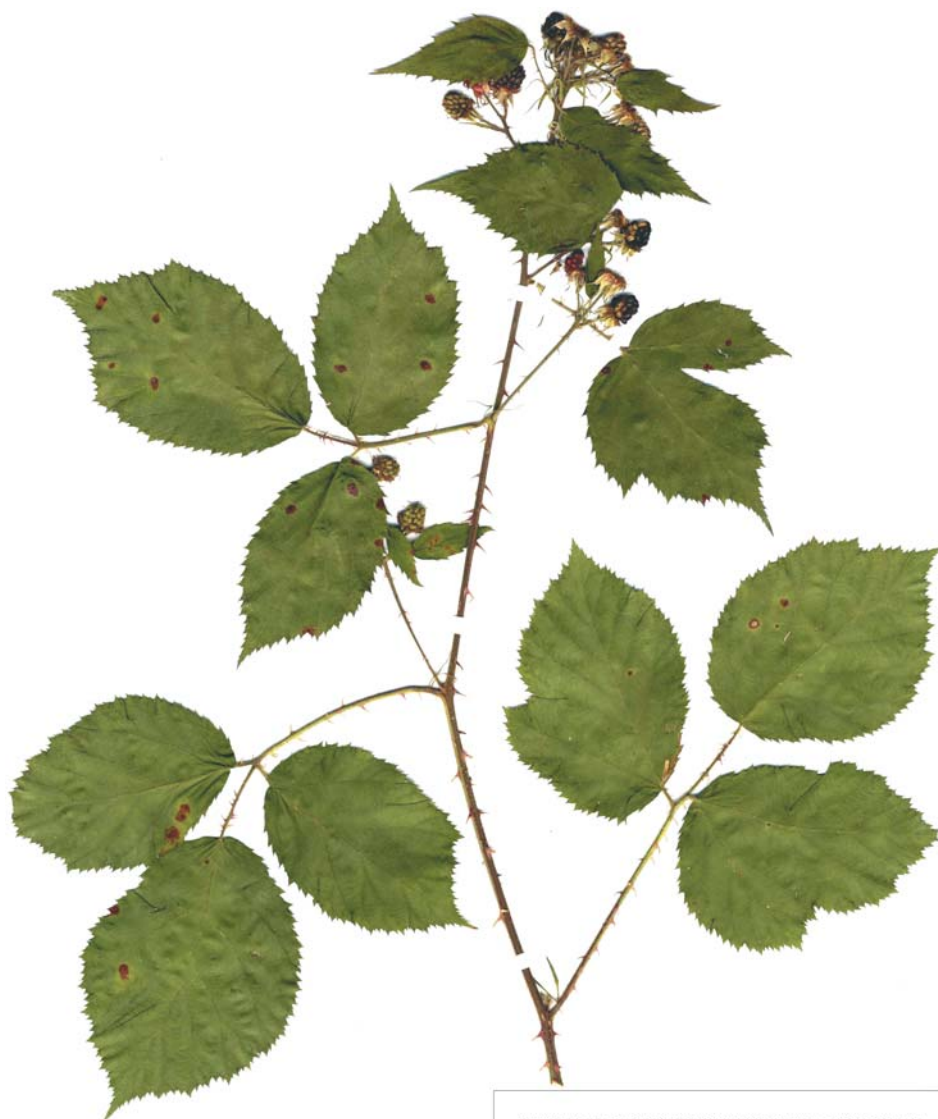


Fig. 1. – *Rubus silvae-norticae*: a – inflorescence; b – leaf; c – detail of sterile branch with prickles; d – indentation on the margin of the terminal leaflet; e – detail of inflorescence axis; f – detail of peduncle. Del. P. Lepší.



HERBARIUM MUSEI REGIONALIS BOHEMIAE MERIDIONALIS  
ČESKÉ BUDĚJOVICE

Flora: Bohemia meridionalis

**HOLOTYPUS**

No. 64747

Pars 1

***Rubus silvae-norticae* M. Lepší et P. Lepší**

Habitat:

distr. Český Krumlov, pagus Rožmberk nad Vltavou (7352a): ca 3.1 km  
situ sept.-occidentali a pago, ad viam in silva, solo gneissiceo; 750 m s.  
m., 48°40'37.7"N, 14°20'31.3"E.

Die: 17. 8. 2007

Legit: Martin Lepší et Petr Lepší

Fig. 2a. – *Rubus silvae-norticae* M. Lepší et P. Lepší. Holotypus (CB), herbarium sheet 1 (the infructescence of the holotype) (photo M. Lepší).

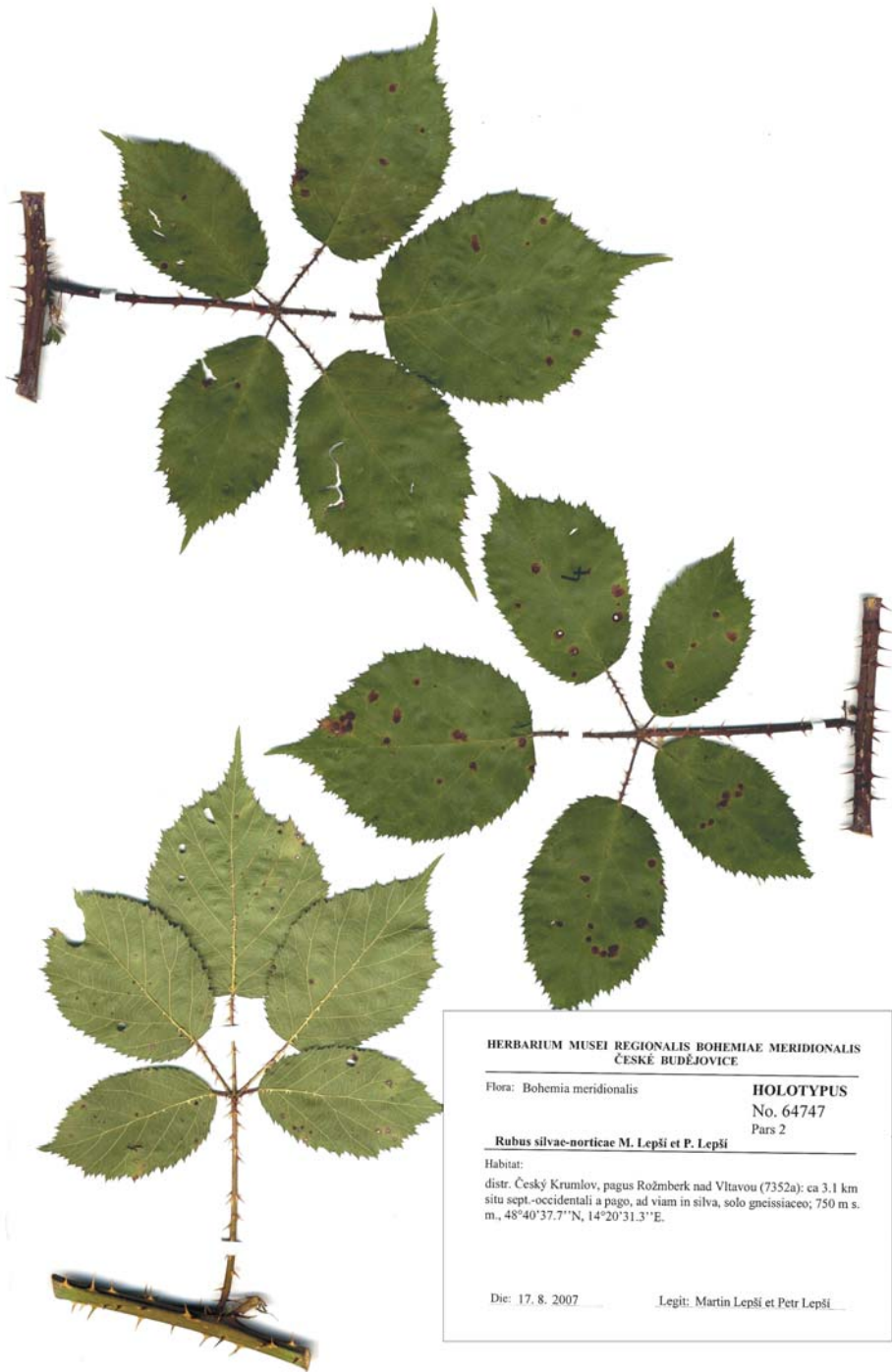


Fig. 2b. – *Rubus silvae-norticae* M. Lepší et P. Lepší. Holotypus (CB), herbarium sheet 2 (leaves of the holotype) (photo M. Lepší).

### Etymology

The name “*silvae-norticae*” derives from a historical name of the Austria-Czech border area “Silva nortica” (Mičková 2006), where this species occurs frequently and was recognized for the first time. The authors propose the epithet “novohradský” for the Czech name (the region Silva nortica includes the Novohradské hory Mts).

### Diagnostic characters

Stems half-rounded to bluntly angled with flat sides, coloured the same as *R. clusii*, at more shady sites green to dark green, in sunny places reddish tinted, with (10–) 14–21 (–26) prickles per 5 cm and with scattered small prickles, scattered acicles, sparsely scattered stipitate and sessile glands and rare fasciculate hairs; prickles (4.1–) 5.0–6.0 (–6.9) mm long,  $\pm$  uniform, slender, straight, declining, yellowish to reddish tinted, with flattened base; leaves dark green, almost glabrous above, with scattered stellate, fasciculate and long simple hairs beneath; terminal leaflet mostly broadly elliptical or broadly oblong elliptical to broadly obovate, with an elongated, ca (2.0–) 2.4–2.9 (–3.3) cm long apex; petiole of terminal leaflet (33–) 36–40 (–42)% as long as its lamina; indentation double-serrate, coarsely and remarkably regular; inflorescence pyramidal, premorse and with flowers  $\pm$  accumulated at the top, with leaves often on the most distal part; petals white (slightly pinkish after drying); stamens longer than styles; filaments and anthers glabrous; ovaries with few hairs; receptacle with hairs visible between the ovaries.

### Similar species

*Rubus clusii* and *R. muhelicus* often occur together with *R. silvae-norticae*. Untypical plants that develop due to extremely sunny or shaded conditions are sometimes especially difficult to distinguish from the new species. In general, the colouration, indument and stem characters of shaded individuals of *R. silvae-norticae* may resemble *R. clusii*, which can be distinguished by the triangular apex of its leaflets, leaves beneath more hairy to the touch, angled stems, thicker prickles and an inflorescence not having leaves up to the apex. Individuals of *R. silvae-norticae* from sunny sites may be confused with *R. muhelicus*, which has hairier stems, leaves with tomentosus undersides, fewer small prickles and acicles on its darker, usually purple stems, an inflorescence without leaves apically and pink petals (for details see Table 1).

### Confusion with *Rubus helveticus*

A revision of the herbarium material in Linz (LI) revealed that the new species was with other *Rubus* species (*R. tabanimontanus*, *R. epipsilos*) and different biotypes (*R. ser. Glandulosi*) mistakenly included in the Austrian flora (Danner & Fischer 2008) under the name *R. helveticus*. *Rubus helveticus* was described from Switzerland near the village of Hallau (formerly Unterhallau) in the Schaffhausen canton (Gremli 1870), probably based on a single biotype and therefore of no taxonomic value (Weber 1987a). Our revision of the type material revealed many distinct characters that clearly distinguish *R. helveticus* from the new species (see Fig. 3 and Table 1).

There are two specimens of *R. helveticus* that correspond to the protologue: one is deposited in G and the other in Z. Both specimens probably originate from Gremli’s herbarium, as is written (G, without a date) or printed (Z, with a date) on the labels. H. E. Weber selected the specimen from Z as the lectotype in 1986, but this lectotypification was not published.

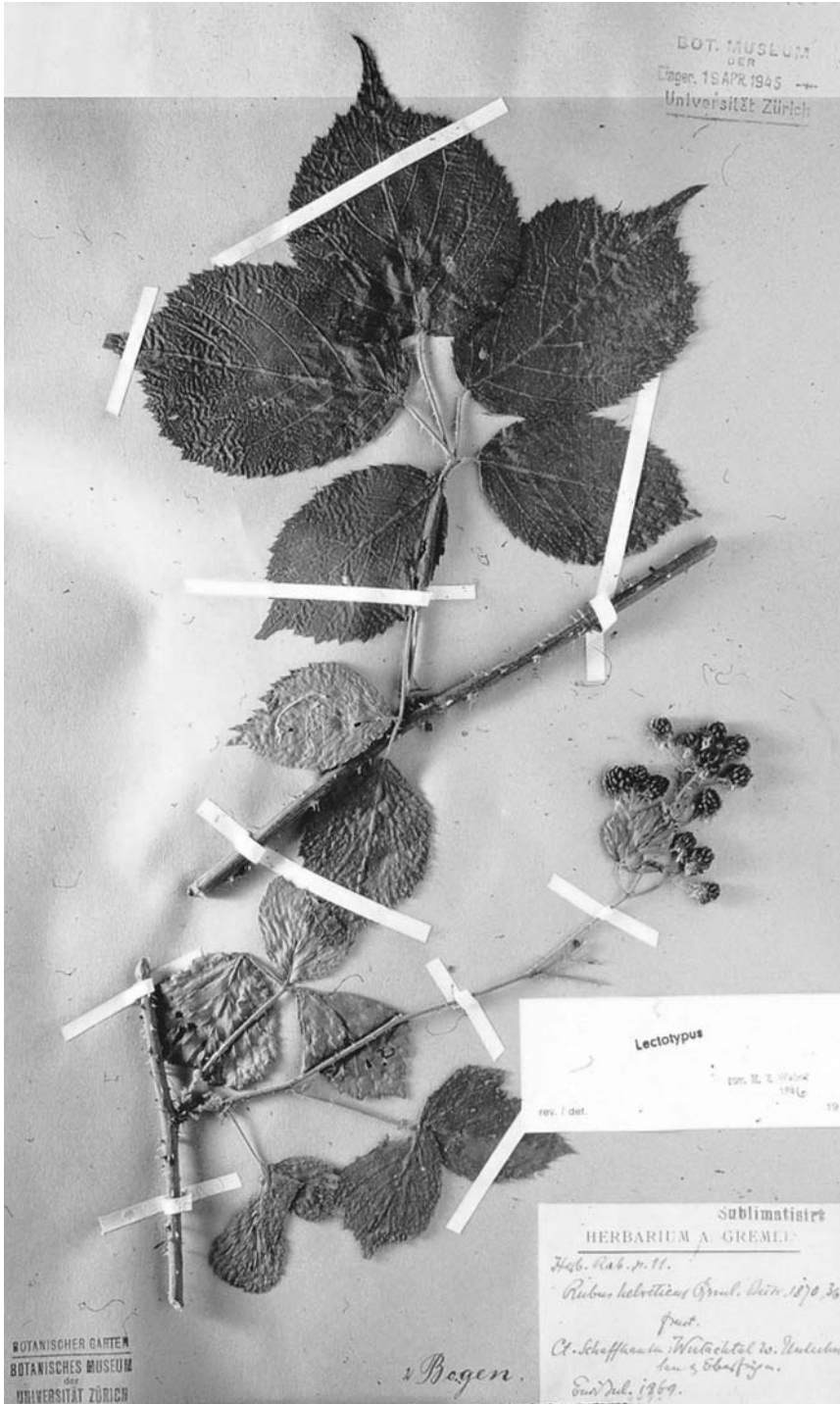


Fig. 3. – Lectotype of *Rubus helveticus* Greml. (Z) (photo H. E. Weber).



Table 1. – Morphological differences between *Rubus clusii*, *R. silvae-norticae*, *R. mulholicus* and *R. helveticus*. The morphological characters of *Rubus clusii*, *R. mulholicus* and *R. helveticus* are taken from Holub (1995), Danner (2003) and Gremlí (1870), respectively. Asterisks indicate the characters recognized by the authors of this paper.

Character	<i>R. silvae-norticae</i>	<i>R. clusii</i>	<i>R. mulholicus</i>	<i>R. helveticus</i>
Form of stem	half-rounded to angled with flat sides	angled with flat sides	angled with flat sides	rounded or angled with flat sides
Indument of first-year stems	rare to sparsely scattered hirsute	scattered hirsute	scattered hirsute	hirsute*
Small prickles and acicles on first-year stems	scattered	(scattered to) abundant	missing or very rare	small prickles missing*, acicles rare
Colour of first-year stems	on shady sites green, on sunny sites vinaceous tinted	on shady sites green, on sunny sites slightly vinaceous tinted*	on shady sites slightly vinaceous tinted, on sunny sites dark purple*	?
Prickles	± uniform, slender, straight, slightly declining, yellowish to vinaceous tinted, with flattened base	± uniform, thick, straight to slightly curved, declining, yellowish to vinaceous tinted, with flattened and broad base	± uniform, slender, straight, slightly declining, vinaceous tinted to dark purple, with slightly flattened base	± uniform, slender, acicular or narrowly conical, straight, slightly declining, colour is unknown, with slightly flattened base
Number of prickles per 5 cm stem length	(10–) 14–21 (–26)	8–12	8–20	ca 15–20*
Indument of leaf undersides	scattered hirsute, with scattered stellate, fasciculate and sparsely scattered simple hairs, almost not hairy to the touch	scattered hirsute, with rare fasciculate and scattered simple hairs, hairy to the touch*	tomentous, with very abundant stellate, fasciculate and simple hairs, distingly hairy to the touch*	scattered hirsute, with rare fasciculate hairs and with sparsely scattered simple hairs, not hairy to the touch*
Shape of terminal leaflet	broadly elliptic or broadly oblong elliptic	oblong to broadly ovate	broadly ovate to rounded	broadly ovate or almost rounded
Base of terminal leaflet	cordate to rarely straight	cordate	almost straight to slightly cordate	cordate
Apex of terminal leaflet	acuminate	acute triangular	acuminate	acuminate*
Length of terminal leaflet apex	(20–) 24–29 (–33) mm	8–15 mm	8–14 mm	ca 25–31 mm*
Indentation of leaflet margin	coarse double serrate, remarkable periodic	coarse ± double serrate, periodic	slightly double serrate, periodic	slightly double serrate, slightly periodic*
Depth of leaf margin incisions	(3.0–) 3.5–4.0 (–5.0) mm	2–4 (–5) mm	(1.0–) 2.0–2.5 (–3.0) mm*	ca 2–3 mm*
Inflorescence	with flowers accumulated at top, with leaves distributed often to the top	with ± evenly distributed flowers, leaves presented as far as 3–8 cm below top*	with ± evenly distributed flowers, leaves presented as far as 6–13 cm below top*	?
Petals colour	white (after drying slightly pinkish)	white to greenish-white	slightly pink	white
Indument of ovaries surface	with sporadic short hairs	glabrous	with sporadic short hairs*	with long hairs

Type of *R. helveticus*: “Herbarium A. Gremlí; Herb. Rub. n. 11. *Rubus helveticus* Greml. Beitr. 1870, 36. fruct. Ct. Schaffhausen: Wutachthal zw. Unterhallau u. Eberfingen; End. Jul. 1869” (**lectotype: Z, designated here by M. Lepší & H. E. Weber**). See Fig. 3.

### Ecology

*Rubus silvae-norticae* most frequently grows in forest habitats (as a distinctly nemophilous ecoelement) such as edges of ditches and along forest roads, sparse plantations of *Picea abies*, *Pinus sylvestris* or *Alnus glutinosa*, forest margins and clearings. It rarely occurs outside forests, for example, in *Galio-Urticetea* communities along margins of roads or around meadows and scrub. This species is very often accompanied by *R. clusii* and unstabilized biotypes of *R. ser. Glandulosi*. Less often it is recorded together with other bramble species such as *R. bifrons*, *R. muhelicus*, *R. nessensis* s. str., *R. apricus*, *R. plicatus*, *R. dollnensis* and *R. montanus*. It usually inhabits mesic acid soils and soils poor in minerals, which developed from granites, gneisses and Quaternary and Tertiary sediments. Like *R. clusii* or *R. ser. Glandulosi*, it is able to grow and propagate at relatively high altitudes (up to the mountain vegetation belt), where other *Rubus* species do not or only very exceptionally occur (Lepší & Lepší 2004). *Rubus silvae-norticae* probably grows at higher altitudes in Austria than in Bohemia because it is very abundant in the Weinsberger Wald Mts and the foothills of other mountains in Austria. The mean annual temperature within this species distribution area ranges from 5°C (Novohradské hory Mts, Weinsberger Wald Mts) to 9°C (Linz), and mean annual precipitation ranges from 550 mm (Budějovická pánev basin) to 1000 mm (Novohradské hory Mts, Weinsberger Wald Mts) (Tolasz et al. 2007, Pils 1979).

### Distribution

This species has been found at 130 localities in S Bohemia, Upper Austria and Lower Bavaria. The centre of its known distribution range lies in the Mühlviertel region in Austria (see Fig. 4). The relatively high number of records from adjacent S Bohemia reflects intensive field research rather than the real abundance of the species in this region. There are four isolated localities: one south of the town of Wels in Hausruckviertel (Austria) and two near the town of Passau and one by Bad Füssing (Bavaria). The distance between the two furthest apart localities exceeds 100 km. *Rubus silvae-norticae* is an example of a regional species (range diameter ca 50–250 km, sensu Weber 1996) with a fuzzy range margin and several outliers (sensu Bijlsma & Haveman 2007). The species was found in 30 basic squares (10' × 6') of the Central European mapping grid, and in the Czech Republic occurs in nine phytogeographical units (districts and sub-districts). The recorded localities are in the colline and mountain vegetation belt and between 290 m a. s. l. (Linz) and 990 m a. s. l. (Sandl). The oldest herbarium specimen was collected in 1889 by A. Topitz near the town of Rožmberk nad Vltavou (Bohemia).

### Herbarium specimens:

**Czech Republic, Bohemia:** Mesophyticum: **37j. Blanský les.** Chvalšiny village, ca 0.6 km W of the summit of Kněžík hill, 7151a, [48°51'57.0"N, 14°14'00.0"E], 680 m a. s. l. (leg. ML 24. 10. 2002, CB 34297). **37l. Českokrumlovské Předšumaví.** Český Krumlov town, Dubík hill SW of the town, ca 0.25 km SE of the summit of the hill, along a forest road, 7251b, [48°47'35.0"N, 14°17'45.0"E], 630 m a. s. l. (leg. PL 23. 9. 2007, herb. P. Lepší No. 1799). **37m. Vyšebrodsko.** Vyšší Brod village, ca 1.0 km SE of Kraví hora hill, a gap in a *Picea abies* plantation, 7351d, 48°37'37.6"N, 14°19'43.7"E, 630 m a. s. l., rarely (leg. ML & PL 17. 8. 2007, CB 64860). –

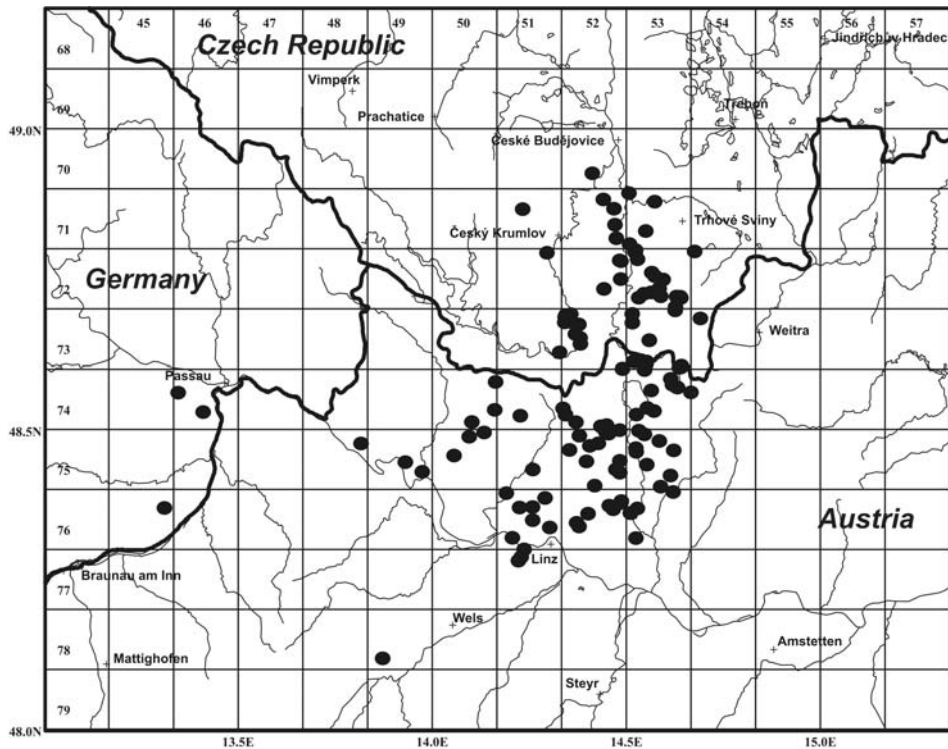


Fig. 4. – Map of the distribution of *Rubus silvae-norticae*.

Rožmberk nad Vltavou village, ca 0.3 km NE of the summit of Velenecký vrch hill, along a forest road, 7352a, 48°41'09.3"N, 14°20'33.6"E, 760 m a. s. l. (leg. ML & PL 17. 8. 2007, CB 64755). – Rožmberk nad Vltavou village, ca 1.7 km NE of the summit of Velenecký vrch hill, along the road in the Vltava valley, 7352a, 48°41'27.3"N, 14°21'27.5"E, 530 m a. s. l., abundant (leg. ML & PL 17. 8. 2007, CB 64753). – Rožmberk nad Vltavou village, ca 0.7 km NNE of the summit of Velenecký vrch hill, along a forest road, 7352a, 48°41'22.8"N, 14°20'41.7"E, 740 m a. s. l., scattered (leg. ML & PL 17. 8. 2007, CB 64754). – Vyšší Brod, pagus Rožmberk nad Vltavou, vicus Horní Jílovice, in silva ad viam publicam, ca 1.0 km situ orient. a vico, [7352a], 48°40'40.5"N, 14°21'27.6"E, 489 m s. m. (leg. VŽ 14. 10. 2001, herb. V. Žíla). – Bohemia meridionalis, Crescit in silvis prox. Rosenberg, [7352a, 48°39'28"N, 14°22'09"E, 550 m a. s. l.] (leg. A. Topitz 23. Julii 1889, LI). **37n. Kaplické mezihoří.** Netřebice village, ca 2.3 km SE of the chapel in the village, the margin of forest road, 7252b, 48°46'49.2"N, 14°29'00.6"E, 590 m a. s. l., one growth (leg. ML 10. 10. 2007, CB 64846). – Netřebice village, ca 2.8 km SE of the chapel in the village, in a *Picea abies* plantation, 7252b, 48°46'45.5"N, 14°29'12.8"E, 620 m a. s. l., one small growth (leg. ML 10. 10. 2007, CB 64847). – Kaplice town, in the ditch of the road between the villages of Omlenička and Omlenice, 7252d, 48°43'58.2"N, 14°26'33.6"E, 670 m a. s. l., one growth (leg. ML & PL 17. 8. 2007, CB 64750). – Kaplice town, the N margin of the town, in a *Picea abies* plantation S of the Jihostrój factory, 7252d, 48°44'57.5"N, 14°29'10.0"E, 550 m a. s. l., abundant (leg. ML 10. 10. 2007, CB 64849). – Kaplice town, ca 0.9 km NW of the summit of Hodonický vrch hill, along a forest roads, 7253c, 48°43'29.2"N, 14°32'44.3"E, 620 m a. s. l., abundant (leg. ML 24. 8. 2007, CB 64770). – Kaplice town, the N margin of Dobečov village, in scrubs along the road towards Hodonický vrch hill, 7253c, 48°43'05.9"N, 14°31'56.2"E, 570 m a. s. l., one large growth (leg. ML 24. 8. 2007, CB 64769). – Kaplice town, ca 1.3 km NE of the summit of Hodonický vrch hill, close Líčov settlement, along a forest road, 7253c, 48°43'37.5"N, 14°33'49.6"E, 620 m a. s. l., scattered (leg. ML 24. 8. 2007, CB 64779). – Benešov nad Černou village, ca 0.8 km SW of the centre of the village Dluhošů, the margin of *Picea abies* plantation, 7253d, 48°44'00.9"N, 14°35'06.7"E, 610 m a. s. l., several growths (leg. ML & PL 18. 8. 2007, CB 64745). – Rožmberk nad Vltavou village, in the forest ca 0.3 km S of the hamlet of Kvasov, 7352a, [48°40'25.0"N, 14°22'42.0"E], 730 m a. s. l. (leg. ML & PL 22. 7. 2002, CB 34295). – Rožmberk nad Vltavou village, along the

forest road ca 1.1 km SE of the church in the village, 7352a, 48°39'04.8"N, 14°22'52.9"E, 740 m a. s. l. (leg. ML & PL 22. 7. 2002, CB 34293). – Rožmberk nad Vltavou village, ca 0.3 km W of the summit of Babín hill, along forest road, 7352c, [48°38'29.0"N, 14°22'56.0"E], 760 m a. s. l. (leg. ML & PL 22. 7. 2002, CB 34292, CB 34306). – Dolní Dvořiště village, ca 0.5 km NE of the summit of Hřib hill by Budákov settlement, along forest road, 7353a, 48°40'36.0"N, 14°30'58.1"E, 670 m a. s. l., one growth (leg. ML 24. 8. 2007, CB 64763). – Dolní Dvořiště, ca 2.0 km NNE of the summit of Hřib hill by Budákov settlement, margin of forest road, 7353a, 48°41'28.5"N, 14°30'56.5"E, 610 m a. s. l., scattered (leg. ML 24. 8. 2007, CB 64768). – Malonty village, ca 0.35 km SE of the church in the former village of Cetviny, slopes above the right-hand bank of the river Malše, the margin of meadow and balk, *Galio-Urticetea*, 7353c, 48°36'43.1"N, 14°33'09.5"E, 680 m a. s. l., one large growth (leg. ML 22. 8. 2007, CB 64882). – Malonty village, ca 2.1 km SW of the chapel in Bělá village, the margin of forest road, 7353c, 48°38'50.3"N, 14°33'34.2"E, 750 m a. s. l., scattered (leg. ML 26. 9. 2001, CB 34196; 22. 8. 2007, CB 64881). – Malonty village, ca 0.5 km SSE of the church in the former village of Cetviny, slopes above the right-hand bank of the river Malše, in scrubs along a forest road, 7353c, 48°36'33.5"N, 14°33'06.7"E, 650 m a. s. l., one small growth (leg. ML 22. 8. 2007, CB 64883). **37o. Kaňon Malše.** Doudleby village, ca 0.8 km SE of the centre of the village, a clearing in the valley of the Stropnice river, 7153a, [48°53'12.0"N, 14°30'31.0"E], 450 m a. s. l. (leg. PL & ML 28. 10. 2007, herb. P. Lepší No. 1822). **37p. Novohradské podhůří.** Římov village, ca 1.2 km ENE of the centre of the village Krásějovka, the ditch of forest road, 7152b, 48°52'00.1"N, 14°28'07.1"E, 510 m a. s. l., one growth (leg. ML 29. 9. 2007, CB 64889). – Velešín town, ca 1.4 km SE of the church in the village, along the road towards Dlouhá settlement, self-seedlings growths, 7152d, 48°49'02.5"N, 14°28'29.0"E, 480 m a. s. l., one large growth (leg. ML 10. 10. 2007, CB 64844). – Velešín town, ca 1.0 km NNE of the church in the village, along a forest road, 7152d, 48°50'24.2"N, 14°28'16.3"E, 500 m a. s. l., one growth (leg. ML 29. 9. 2007, CB 64894). – Svatý Jan village, W slopes of Chlumská hora hill, the margin of road in forest between the villages of Chlum and Svatý Jan, 7153c, 48°48'27.3"N, 14°30'31.3"E, 570 m a. s. l. (leg. ML 24. 8. 2007, CB 64776). – Trhové Sviny town, ca 1.8 km SSW of the summit of Todeňská hora hill, a forest margin along the road between the villages of Ločenice and Trhové Sviny, 7153c, 48°49'46.2"N, 14°33'01.7"E, 500 m a. s. l., one growth (leg. ML 4. 9. 2007, CB 64654). – Besednice village, ca 1.2 km SSW of the summit of Slabošovka hill, near the road from Besednice village towards Malče village, in a *Pinus sylvestris* plantation, 7253a, 48°46'56.3"N, 14°31'45.4"E, 550 m a. s. l., rarely (leg. ML 24. 8. 2007, CB 64771). – Besednice village, ca 1.0 km WNW of the summit of Slabošovka hill, along the road between the villages of Malče and Chlum, *Galio-Urticetea*, 7253a, 48°47'36.2"N, 14°31'25.4"E, 540 m a. s. l., one large growth (leg. ML 24. 8. 2007, CB 64773). – Besednice village, ca 1.0 km NW of the summit of Slabošovka hill, along the road in a forest between the villages of Malče and Chlum, 7253a, 48°47'51.0"N, 14°31'27.6"E, 540 m a. s. l., scattered (leg. ML 24. 8. 2007, CB 64774). – Trhové Sviny town, Žumberk village, ca 0.4 km W of the church in the village, along a forest road, 7253a, [48°47'43.0"N, 14°40'35.0"E], 540 m a. s. l. (leg. ML 21. 9. 2001, CB 34192). – Borovany town, Komařice village, ca 1.9 km E of the village, along the road near the weekend house village, 7153a, [48°52'42.0"N, 14°34'26.0"E], 440 m a. s. l. (leg. PL & ML 28. 10. 2007, herb. P. Lepší No. 1821). – Kamenný Újezd village, ca 2.0 km SSW of the church in the village, near the Jizba pond, a slope above railway, 7152b, [48°52'55.0"N, 14°26'29.0"E], 490 m a. s. l. (leg. PL 25. 8. 2007, herb. P. Lepší No. 1800). **37q. Soběnovská vrchovina.** Soběnov village, ca 1.6 km SSW of the summit of Kohout hill, along a forest road, 7253a, 48°45'15.6"N, 14°34'26.7"E, 670 m a. s. l., scattered (leg. ML 24. 8. 2007, CB 64777). – Soběnov village, ca 1.6 km SW of the summit of Kohout hill, along a forest road, 7253a, 48°45'36.1"N, 14°33'58.7"E, 660 m a. s. l., scattered (leg. ML 24. 8. 2007, CB 64762). – Benešov nad Černou village, Kamenice village, a clearing ca 1.3 km SW of the summit of Slepice hill, 7253d, [48°44'55.0"N, 14°35'43.0"E], 690 m a. s. l. (leg. ML 19. 9. 2001, CB 34221). **38. Budějovická pánev.** Boršov nad Vltavou village, ca 1.6 km WNW of the church in the village, near the crossing of the roads towards Vrábče village and towards Dvůr Koroseky settlement, in a *Pinus sylvestris* plantation, 7052c, 48°55'32.3"N, 14°24'45.9"E, 450 m a. s. l. (leg. PL & ML 12. 8. 2001, herb. P. Lepší No. 973; leg. ML 20. 8. 2007, CB 64873).

*Oreophyticum*: **89. Novohradské hory.** Benešov nad Černou village, ca 0.5 km SW of the centre of the dam of the Kancléřský rybník pond, the margin of a forest road, 7253d, 48°43'14.4"N, 14°35'20.9"E, 600 m a. s. l., one large growth (leg. ML 1. 8. 2007, CB 64925). – Benešov nad Černou village, Kuří settlement, S of the spot height 812 m, a forest margin, 7253d, 48°42'10.4"N, 14°37'38.5"E, 810 m a. s. l. (leg. ML & D. Zelený 31. 7. 2002, CB 34300). – Benešov nad Černou village, ca 0.85 km NE of the summit of Kuřský vrch hill, margin of a *Picea abies* plantation, by the bridge across the Černá brook, 7253d, 48°43'05.3"N, 14°38'28.6"E, 690 m a. s. l., one large growth (leg. ML 21. 8. 2007, CB 64857). – Benešov nad Černou village, ca 0.55 km NNW of the summit of Kuřský vrch hill, below the power line in a forest, 7253d, 48°43'12.7"N, 14°37'48.2"E, 700 m a. s. l., several growths (leg. ML 21. 8. 2007, CB 64855, CB 64856). – Benešov nad Černou village, ca 0.85 km NE of the summit of Kuřský vrch hill, clearing, 7253d, 48°43'11.9"N, 14°38'22.1"E, 700 m a. s. l., one growth (leg. ML 21. 6. 2007, CB 64858). – Pohorská Ves village, ca 1.8 km WNW of the summit of Lužnický vrch hill, the margin of

a forest road near the a crossing of forest roads, 7353b, 48°41'49.8"N, 14°37'35.6"E, 750 m a. s. l., one large growth (leg. ML 31. 7. 2007, CB 64926). – Pohorská Ves village, ca 1.1 km SSW of the summit of Točnick hill, a clearing, 7354a, 48°41'01.2"N, 14°41'28.5"E, 790 m a. s. l., two middle size growths (leg. ML 23. 8. 2007, CB 64880, herb. H. E. Weber).

**Austria, Upper Austria: Mühlviertel.** Leopoldschlag Dorf village, ca 1.5 km S of the centre of the village, scrubs along a road, 7352d, 48°36'00.7"N, 14°29'25.9"E, 710 m a. s. l., several large growths (leg. ML & PL 28. 8. 2007, CB 64821). – Mardetschlag village, ca 1.0 km N of the centre of the village, the valley of the Maltsch river, on the slope above a road, a margin of scrubs, 7353c, 48°36'51.5"N, 14°32'15.7"E, 680 m a. s. l., one growth (leg. ML & PL 14. 9. 2007, CB 64841). – Leopoldschlag, Forststr., 200 m OSO des „Martinstein“, reiches *Piceetum*, Lehm + Sand über Silikat, 7353.33, [48°36'47"N, 14°31'16"E], 700 m ü. NN. (leg. JD 19. 8. 1997, LI 304500). – Leopoldschlag, 1,6 km W von Mairspindt, gelichtetes reiches *Piceetum*, Lehm über Silikat, 7353.343, [48°35'56"N, 14°32'51"E], 911 m ü. NN. (leg. JD 28. 7. 1997, LI 304503). – Leopoldschlag, Mardetschlag, 600 m W des Kregl, reiches *Piceetum*, Silikat, 7353.343, [48°36'20"N, 14°32'56"E], 680 m ü. NN. (leg. JD 31. 7. 1997, LI 304525). – Sandl, 80 m südl. des Kohlerberg, Kreuzung Waldweg mit Forststr., *Fago-Piceetum*, Silikat, 7353.44, [48°36'12"N, 14°38'27"E], 890 m ü. NN. (leg. JD 29. 7. 1999, LI). – Sandl, Hacklbrunn, 300 m WSW des Kohlerberg, *Fago-Piceetum*, Silikat, 7353.444, [48°36'09"N, 14°38'13"E], 878 m ü. NN. (leg. JD 25. 8. 1997, LI 304527). – Sandl, Hacklbrunn, 800 m NW des Langenberg, *Fago-Piceetum*, Silikat, 7353.444, [48°36'19"N, 14°38'32"E], 922 m ü. NN. (leg. JD 22. 8. 1997, LI 304528). – Afiesl, 1,1 km S der Löfflersäge, *Piceetum*, Silikat, [7450b, 48°34'44"N, 14°09'49"E], 779 m ü. NN. (leg. JD 2. 8. 1997, LI 304526). – Ahorn, 1,3 km NW des Ortskerns, Straßengraben, 7450.42, [48°31'57"N, 14°09'41"E], 805 m ü. NN. (leg. JD 20. 9. 1994, LI 183523). – Sankt Peter am Wimberg., 300 m N „Zeigerwirt“, Mischwaldrand, an der Straße, Lehm über Granit, 7450.43, [48°30'44"N, 14°06'09"E], 710 m ü. NN. (leg. JD 2. 7. 1994, LI 183457). – Bad Leonfelden, pagus Bernhardschlag, ad marginem silvae, [7451c, 48°31'21.3"N, 14°13'37.9"E], 848 m s. m. (leg. VŽ 28. 9. 2002, herb. V. Žíla). – Bad Leonfelden village, ca 3.5 km NE of the centre of the town, on a clearing, 7452c, 48°32'05.9"N, 14°20'14.5"E, 790 m a. s. l., one growth (leg. ML & PL 28. 8. 2007, CB 64817). – Reichenthal, Hinterkönigschlag, Steinberg, 70 m O Kapelle, Haselgebüsch, Silikat, [7452c, 48°31'28"N, 14°20'38"E], 800 m ü. NN. (leg. JD 27. 9. 1998, LI 379131). – Scheukenfelden, Thierberg, 50 m O des Kalvarienkirche, 7452.33, [48°30'43"N, 14°22'15"E], 757 m ü. NN. (leg. JD 24. 8. 1994, LI 183314). – Waldburg bei Freistadt, 510 m NW Marreith, Wastrra [WaldStraßerand], 7452.43, [48°30'18"N, 14°26'06"E], 650 m ü. NN. (leg. JD 17. 8. 1994, LI 183320). – Waldburg bei Freistadt, 200 m W Bodenmühle, Waldrandgebüsch, Lehm über Granit, 7452.43, [48°30'25"N, 14°26'59"E], 630 m ü. NN. (leg. JD 4. 7. 1994, LI 183471). – Reichenthal, S-ende des Waldes vor Allhut, N Seite des Gipfels, Mischgestein, [7453a, 48°33'53"N, 14°33'53"E], 750 m ü. NN. (leg. JD 14. 7. 1994, LI 183511). – Sandl, 500 m NNW vom Lehner, Wastrara [WaldStraßerand], 7453.21, [48°35'03"N, 14°36'54"E], 915 m ü. NN. (leg. JD 5. 8. 1994, LI 183316). – Sandl, O des Luka-Wirtes [Luckawirt], Wastrara [WaldStraßerand], 7453.21, [48°34'28"N, 14°37'09"E], 955 m ü. NN. (leg. JD 5. 8. 1194, LI 183317). – Sandl, Luckerwald, Straße (WW 4), Strra. im Wald, Granit, 7453.24, [48°34'10.5"N, 14°37'55.6"E], 990 m ü. NN. (leg. JD 4. 8. 1994, 5. 8. 1994, LI 183380, 183525). – Sandl, Luckerwald, Waldstr. [WaldStraße], WW 4, 7453.24, [48°34'12"N, 14°37'51"E], 990 m ü. NN. (leg. JD 4. 8. 1994, LI). – Grünbach b. Fr., 1 km SW Heinrichschlag, Wald, neben der Str., 7453.32, [48°32'08"N, 14°33'16"E], 838 m ü. NN. (leg. JD 12. 8. 1994, LI 183319). – Sankt Michael ob Rauchenödt, 250 m W, Gebüsch, 7453.32, [48°31'50"N, 14°34'18"E], 905 m ü. NN. (leg. JD 24. 8. 1994, LI 183313). – Grünbach bei Freistadt, Schlag, 300 m NO des Hammerl, 7453.33, [48°31'29"N, 14°31'34"E], 655 m ü. NN. (leg. JD 24. 8. 1994, LI 183315). – Sandl, W von Schloss Rosenhof, Kastanienallee beim Hengstberg, [7454a, 48°33'42"N, 14°40'01"E], 970 m a. s. l.] (leg. JD 22. 2. 1995, LI 183435). – Hofkirchen im Mühlkreis, SO von Dorf, Waldwanderweg n. Au, Mischwald, Lehm, 7549.31, [48°28'35"N, 13°49'01"E], 370 m ü. NN. (leg. JD 9. 7. 1994, LI 183484). – 1 km von Kirchberg ob der Donau, Wald S Rand, 7549.41, [48°26'43"N, 13°55'52"E], 583 m ü. NN. (leg. JD 8. 8. 1992, LI 110654). – [Sankt Martin in Mühlkreis], 700 m NW von Untermühl, 7549.42, [48°25'45"N, 13°58'29"E], 360 m ü. NN. (leg. JD 8. 8. 1992, LI 110642). – Niederwaldkirchen, ad marginem silvae, ca 2.0 km situ occid.-bor.-occid. ab oppido, [7550a], 48°27'23.1"N, 14°03'23.3"E, 609 m s. m. (leg. VŽ 12. 9. 2003, herb. V. Žíla). – Sankt Peter am Wimberg, 2 km SO, *Piceetum*, Granit, 7550.21, [48°29'16"N, 14°05'45"E], 640 m ü. NN. (leg. JD 2. 8. 1992, LI). – Sankt Johan am Wimberg, 0,5 km N, Gesträuche, Granit, 7550.22, [48°29'41"N, 14°08'03"E], 720 m ü. NN. (leg. JD 2. 8. 1992, LI 110542). – Kirchsschlag i. M [Kirchsschlag bei Linz], 600 m SO Schiefegg, *Piceetum*-Rand, 7551.41, [48°25'59"N, 14°15'35"E], 760 m ü. NN. (leg. JD 2. 8. 1992, LI 110663). – Freistadt, pagus Ottenschlag, ad marginem silvae apud viam publicam, inter pagos Hirschbach et Ottenschlag, [7552a], in proximitate loci: 48°28'21.4"N, 14°24'23.1"E, 780 m s. m. (leg. VŽ 4. 9. 2004, herb. V. Žíla). – Schenkenfelden, 1 km N, Lichtenstein am WW 162, SW Waldrand, Granit, 7552.12, [48°29'22"N, 14°22'46"E], 780 m ü. NN. (leg. JD 10. 7. 1992, LI 106833). – Freistadt town, Hirschbach im Mühlkreis village, ca 3.0 km E of the centre of the village, a forest margin by the

road towards Freistadt town, 7552b, 48°29'43.9"N, 14°27'22.1"E, 620 m a. s. l. (leg. ML & PL 21. 7. 2006, CB 51242). – Freistadt, pagus Hirschbach, vicum Auerbach, ad marginem silvae apud viam publicam, haud procul a vico Auerbach, 7552b, in proximitate loci: 48°29'33.8"N, 14°27'17.7"E, 640 m s. m. (leg. VŽ 4. 9. 2004, herb. V. Žíla). – Freistadt, pagus Krempf, in silva ad marginem pagi, [7552b], 48°29'55.7"N, 14°29'00.3"E, 583 m s. m. (leg. VŽ 24. 8. 2002, herb. V. Žíla). – Waldburg bei Freistadt, 300 m SO von Marreitle, Waldrand an der Straße, [7552b, 48°29'45"N, 14°26'51"E], 580 m ü. NN. (leg. JD 17. 8. 1994, LI 183321). – Hirschbach im Mühlkreis, 400 m S Auerbach, Waldwägrand, 7552.21, [48°28'36"N, 14°25'42"E], 720 m ü. NN. (leg. JD 14. 9. 1994, LI 183524). – Ottenschlag, W Haid, Straßen-Waldrandgebüsch, Granit, 7552.32, [48°26'48"N, 14°23'51"E], 765 m ü. NN. (leg. JD 13. 7. 1992, LI 106864). – Reichenau in Mühlkreis, Gusen, 1 km NW des Abzweigung des WWü. Wintersdorf, Lehm, 7552.32, [48°27'56"N, 14°21'14"E], 580 m ü. NN., (leg. JD 14. 8. 1991, LI 069614). – Neumarkt in Mühlkreis, 2 km WSW Damm, Weggesträuch, sand. Lehm, 7552.324, [48°25'40"N, 14°29'02"E], 660 m ü. NN. (leg. JD 12. 9. 1995, LI 210346). – Freistadt town, Neumarkt im Mühlkreis village, ca 2.2 km N of the village, forest by Stadler village, [7552d, 48°26'51.0"N, 14°29'01.0"E, 590 m a. s. l.] (leg. PL & ML 5. 9. 2004, herb. P. Lepší No. 1643). – Neumarkt im Mühlkreis, ad marginem silvae ad viam publicam, pagum Alberndorf versus, 7552d, 48°25'58.8"N, 14°28'25.0"E, 544 m s. m. (leg. VŽ 20. 8. 2003, herb. V. Žíla). – St. Oswald village, ca 3.2 km SW of the centre of the village, a road margin, 7553a, 48°29'30.1"N, 14°32'50.1"E, 660 m a. s. l. (leg. ML & PL 28. 8. 2007, CB 64814). – Kefemarkt village, ca 2.5 km NW of the centre of the village, a forest road margin in a valley, close the road from Kefemarkt village towards Freistadt town, 7553a, 48°27'44.6"N, 14°31'32.9"E, 500 m a. s. l., several growths (leg. ML & PL 28. 8. 2007, CB 64822). – Freistadt town, ca 2.7 km SE of the centre of the town, along the road towards Gunnersdorf village, forest margin, 7553a, 48°29'51.8"N, 14°31'58.5"E, 680 m a. s. l., scattered (leg. ML & PL 28. 8. 2007, CB 64815). – Lasberg, 300 m N Ruine Dormach, Mischwald- Rand, Granit, [7553a, 48°28'07"N, 14°31'30"E], 550 m ü. NN. (leg. JD 29. 7. 1992, LI 110572). – Gutau village, ca 5.2 km NNE of the centre of the village, along the road from Gutau village towards March village, a forest margin, 7553b, 48°27'53.5"N, 14°37'21.3"E, 800 m a. s. l., one growth (leg. ML & PL 28. 8. 2007, CB 64820). – Sankt Oswald bei Freistadt, Braunberghütte, 70 m OSO, Mischwaldrand, Silikat, [7553b, 48°28'50"N, 14°35'08"E], 900 m ü. NN. (leg. JD 26. 9. 1998, LI 379132). – Kefemarkt village, ca 1.2 km ESE of the centre of the village, the margin of a forest road, close the road from Kefemarkt village towards Freistadt town, 7553c, 48°26'28.0"N, 14°33'12.2"E, 520 m a. s. l., several growths (leg. ML & PL 28. 8. 2007, CB 64823). – Gutau village, ca 0.9 km N of the centre of the village, a forest margin, 7553d, 48°25'23.4"N, 14°36'51.2"E, 670 m a. s. l., one growth (leg. ML & PL 28. 8. 2007, CB 64830). – Gramastetten, 0,5 km N Riefelshofer, Großhecke, Granit, 7651.11, [48°23'37"N, 14°11'28"E], 555 m ü. NN. (leg. JD 1. 8. 1992, LI 110561). – Gramastetten, Bach zw. Mühlberg u. Türkstetten, Mischwald, Lichtung, Granit, 7651.14, [48°22'11"N, 14°13'31"E], 606 m ü. NN. (leg. JD 1. 8. 1992, LI 110567). – Linz, pagus Kirchsschlag b. Linz, in clivis ad viam publicam, ca 8.0 km situ bor. ab urbe, [7651b], 48°23'07.9"N, 14°17'28.4"E, 545 m s. m. (leg. VŽ 25. 8. 2002, herb. V. Žíla). – Lichtenberg, N v. Ort, Feldhecke, Silikat, 7651.2, 48°22'14"N, 14°15'32"E, 720 m ü. NN. (leg. G. Kleesadl 6. 7. 1995, LI 259926). – Wälder am Kürnberg [Kürnberg Wald], [7651c, 48°19'09"N, 14°12'24"E] (leg. A. Schott 23. Aug. 1914, LI). – Kürnbergwald [Kürnberg Wald], Schattiger Standort, [7651c, 48°19'09"N, 14°12'24"E] (leg. A. Schott Juli 1913, 25. Juni 1916, 23. Juli 1919, LI). – Lichtenberg, SW Altlichtenberg an Strasskreuz., Mischwald-Rand, Granit, 7651.41, [48°20'55"N, 14°15'33"E], 460 m ü. NN. (leg. JD 1. 8. 1992, LI 110575). – Urfahr [part of Linz], St. Magdalena, Wolfauer Straße, Gebüsch, Lehm, 7651.42, [48°20'11"N, 14°18'11"E], 290 m ü. NN. (leg. JD 28. 6. 1994, LI 183475). – Linz town, Gallneukirchen village, ca 1.2 km NW of the church in the village, a forest along the road towards Altenberg bei Linz village, [7652a, 48°21'34.0"N, 14°24'07.0"E, 390 m a. s. l.] (leg. PL & ML 5. 9. 2004, herb. P. Lepší No. 1643). – Linz, oppidum Gallneukirchen, pagus Unterweikersdorf, ad marginem silvae ad viam publicam inter Linz et Freistadt, ca 2.0 km situ bor.-orient. a pago, [7652b, 48°22'38.0"N, 14°29'11.0"E, 420 m s. m.] (leg. VŽ 9. 8. 2001, herb. V. Žíla). – Neumarkt im Mühlkreis, pagus Loibersdorf, in silvula apud pagum Loibersdorf, [7652b], 48°22'49.3"N, 14°29'15.7"E, 524 m s. m. (leg. VŽ 1. 8. 2003, herb. V. Žíla). – Unterweikersdorf, Tiefenbachtal S Bergen, Waldschlagegebüsch, Lehm, [7652b, 48°22'22"N, 14°27'23"E], 386 m ü. NN. (leg. JD 11. 7. 1992, LI 34297). – Alberndorf in der Riedmark, nordwestl. d. Hochebeleälters, Granitgus, *Pino-Piceet. myrt.*, 7652.23, [48°24'22"N, 14°25'08"E], 485 m ü. NN. (leg. JD 3. 7. 1983, LI 040095, 069422). – Alberndorf in der Riedmark, südwest. v. Ahuesberg, Mi-Wa-Licht., Pseudogley, 7652.23, [48°24'22"N, 14°25'08"E], 430 m ü. NN. (leg. JD 26. 6. 1983, LI 069413). – Linz, pagus Mittertreffling, in silva ad viam publicam, pagus Gallneukirchen versus, [7652c], 48°20'17.2"N, 14°22'43.0"E, 386 m s. m. (leg. VŽ 25. 8. 2002, herb. V. Žíla). – Gallneukirchen, S Zinngießing, Mischwald, gelichtet, Lehmen, 7652.31, [48°20'39"N, 14°22'20"E], 340 m ü. NN. (leg. JD 1. 8. 1992, LI 110587). – Pregarten village, by the Kumpmühle mill N of the town, in the valley of the Feldaist brook, [7653a, 48°22'06.0"N, 14°31'44.0"E, 400 m a. s. l.] (leg. PL & ML 5. 9. 2004, herb. P. Lepší Nos. 1645, 1647). – Wartberg ob der Aist, Friensdorf 31, beim Kirschbäume, Lösslehm, 7653.13, [48°21'37"N, 14°30'41"E], 362 m ü.

NN. (leg. JD 12. 7. 1986, LI 069511). – Wartberg ob der Aist, Friendsdorf 31, Klon aus dem Mühlv., Lösslehm, 7653.13, [48°21'38"N, 14°30'39"E], 365 m ü. NN. (leg. JD 11. 7. 1986, LI 069507, 17. 7. 1989, LI 069566). – Gutau village, ca 2.5 km SSE of the centre of the village, the road margin in a forest, 7653b, 48°23'44.5"N, 14°37'16.5"E, 500 m a. s. l., several growths (leg. ML & PL 28. 8. 2007, CB 64828). – Gutau, nördl. v. Hundsdorf am Güterweg, Podsol, 7653.21, [48°24'16"N, 14°35'20"E], 615 m ü. NN. (leg. JD 21. 8. 1987, LI 069563). – Wartberg ob der Aist, pagus Frensdorf, ad marginem silvae ad viam publicam in proximitate pagi, 7653c, 48°19'07.9"N, 14°31'30.8"E, 400 m s. m. (leg. VŽ 20. 8. 2003, herb. V. Žíla). – Wald oberhalb Bergham, [7751a, 48°17'14"N, 14°13'47"E] (leg. A. Schott 6. Sept. 1916, LI). – Waldschlag bei Rufing (Steinerholz), [7751a, 48°16'55"N, 14°13'21"E] (leg. A. Schott 5. Juli 1915, LI). – Hinzenbachgraben, [7751a, 48°18'00"N, 14°14'14"E] (leg. A. Schott 2. Juli 1918, LI). **Hausruckviertel.** Wels, pagus Pennewang, ad marginem silvae apud viam publicam, prope vicum Schneiting, 7849c, in proximitate loci: 48°07'05.6"N, 13°52'20.7"E, 400 m s. m. (leg. VŽ 16. 10. 2004, herb. V. Žíla).

**Germany, Bavaria: Lower Bavaria.** Urbs Passau, oppidum Neuburg am Inn, pagus Fürstdobl, ad marginem silvae apud vicum Kälberbach, 7446c, in proximitate loci: 48°31'44.0"N, 13°24'36.5"E, 490 m s. m. (leg. VŽ 4. 9. 2005, herb. V. Žíla). – Urbs Passau, oppidum Fürstenzell, vicus Altenmarkt, ad marginem silvae, haud procul a vico, 7446a, in proximitate loci: 48°33'40.0"N, 13°20'43.5"E, 455 m s. m. (leg. VŽ 3. 9. 2005, herb. V. Žíla). – Bad Füssing, ad viam publicam inter oppida Pocking et Bad Füssing, 7645b, in proximitate loci: 48°22'08.3"N, 13°18'37.7"E, 340 m s. m. (leg. VŽ 10. 9. 2005, herb. V. Žíla).

### *Regional migrations of brambles*

In terms of the postglacial migration of relatively thermophilous plants S Bohemia is an isolated region. It is surrounded by mountains in the east, the south and the west (i.e., the Českomoravská vrchovina, Novohradské hory and Šumava Mts). Only in the north it is not clearly separated from the thermophytic regions of Central Bohemia (see Fig. 5). Thermophilous plants could have migrated from Central Bohemia southwards, especially along the Vltava river valley and the adjacent region W of the river, where climatic conditions are most favourable. The distribution pattern of many species supports this north-south migration – they are common in Central Bohemia and southwards their occurrence gradually declines. Usually they do not reach the southern part of S Bohemia (i.e., the foothills of the Šumava and Novohradské hory Mts), or they are rare or confined to limestone areas there (e.g., *Acer campestre*, *Carpinus betulus*, *Chondrilla juncea*, *Melittiss melissophyllum*, *Lathyrus niger*, *Sorbus torminalis*, Slavík 1990, 1998). It was therefore widely hypothesized that all thermophilous species migrated into S Bohemia in the postglacial era from the thermophytic region of Central Bohemia (e.g., Podpěra 1906, Dostál 1934, Vančurová 1935, Domin 1940). Mladý & Skalický (1955) hypothesized that many species probably penetrated into S Bohemia also from the south: from the thermophytic Danubian region along the Vyšebrodský průsmyk pass and that the thermophilous flora of the foothills of the Šumava and Novohradské hory Mts (especially in eastern parts) is more related (in composition) to the Danubian flora than to that of Central-Bohemian. A Danubian origin can be proved only by using species that have a hiatus in their distribution between the central- and south-Bohemian parts of their distributions. There are only a few species with such distribution patterns, for example, *Chamaecytisus supinus*, *Orobanche alba* subsp. *alba* or *Verbascum chaixii* subsp. *austriacum* (Holub & Skalický 1959). These species are called Danubian migrants (Holub & Skalický 1959). In different periods of the postglacial era, many other species could also have migrated in this way from the south, but now have a continuous distribution and it is, therefore, impossible to determine their florogenetic relationships solely on the basis of their current distribution. Most regional brambles are young species that have evolved and spread in more or less man-fragmented (deforested) landscapes and often in man-made habitats (i.e., clear-

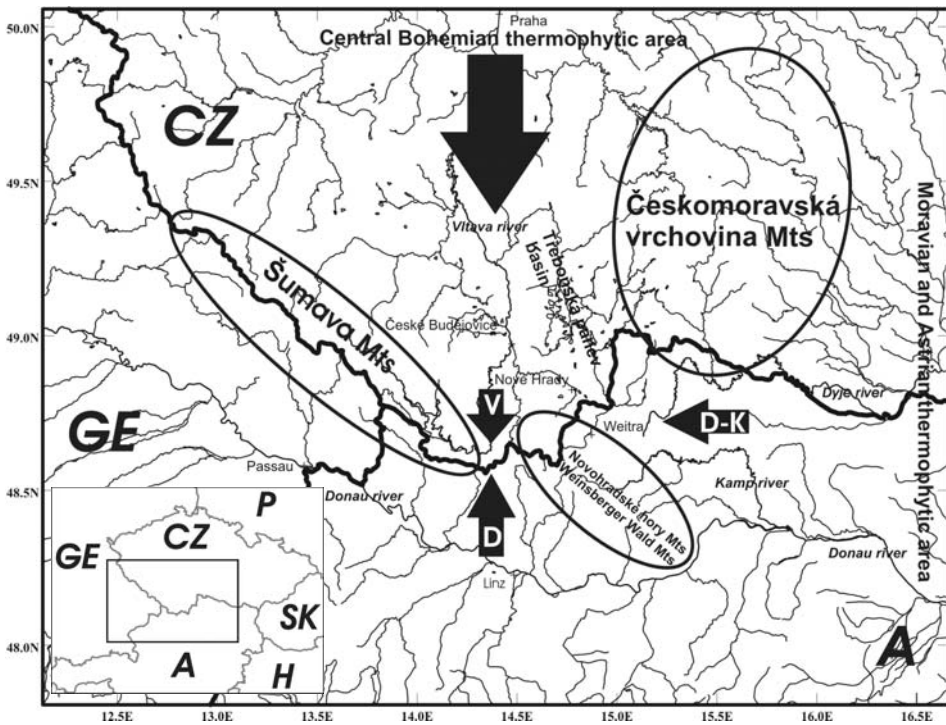


Fig. 5. – Map of the migration routes of *Rubus* species in the southern part of the Czech Republic (South Bohemia) (V – Vltava migrants, D – Danubian migrants, D-K – Dyje-Kamp migrants).

ings, edges of forest roads, sparse forest stands, forest margins etc.) since the Neolithic period (Matzke-Hajek 1997). It is, therefore, likely that most thermophilous species migrated earlier than brambles. Some of them, however, could have spread along the Vyšebrodský průsmyk at the same time as brambles, that is, after partial deforestation of the landscape by man, which, besides creating new favourable habitats, also resulted in an increase in the mean annual temperature and decrease in humidity.

The Bohemian *Rubus* flora has a similar distribution pattern to the thermophilous species mentioned above. For example, the distribution of *Rubus* ser. *Discolores* is centered in Central Bohemia and extends southwards as far as the warm part of the S Bohemian foothills of the Šumava and Novohradské hory Mts, where further spread southwards is prevented by the high altitude of these mountain ranges (see distribution maps in Trávníček & Zázvorka 2005). The migration barrier posed by S Bohemian mountain ranges is also reflected in the different compositions of the Upper Austrian and S Bohemian *Rubus* floras (P. Lepší & M. Lepší, unpublished). Only Danubian migrants and widely distributed species (e.g., *R. clusii*, *R. bifrons*) are present in both floras.

*Rubus vestitus* forma *albiflorus* was the first bramble considered to be a Danubian migrant (Lepší 2002). It is widely distributed in the surroundings of the city of Linz, and in S Bohemia it occurs in an isolated sub-area (15 localities in the surroundings of Český Krumlov), probably a result of long-distance dispersal. Other localities for *R. vestitus* in Bohemia are as far away as Stará Boleslav NW of Prague, but these plants belong to the form



*vestitus* (Lepší 2002, Lepší & Lepší 2005). The newly described *R. silvae-norticae* seems to be an example of a Danubian migrant distributed step by step by regional spread. It is widely distributed in Upper Austria, especially in the Mühlviertel region from where it penetrates into S Bohemia between the Šumava Mts and the Novohradské hory Mts (through the Vyšebrodský průsmyk pass). It then follows the direction of the rivers Vltava and Malše as far as to the southern surroundings of České Budějovice (Fig. 4). We consider *R. muhelicus* as a Danubian migrant as well. It is a regional species with a centre of distribution in Upper Austria (Danner 2003). *Rubus muhelicus* is distributed in the same manner as *R. silvae-norticae*, that is, along the Vyšebrodský průsmyk pass and as far as the northern surroundings of České Budějovice. Currently it is known from 30 localities in S Bohemia (P. Lepší & M. Lepší, unpublished). *Rubus kletensis* is another species connecting the Czech and Austrian floras. This regional species is abundant in the S Bohemian foothills of the Šumava Mts and has been found at three localities in Austria: two in the Mühlviertel region and one very isolated one in the Innviertel region (Lepší & Lepší 2006, P. Lepší & M. Lepší, unpublished). Its currently known distribution pattern implies that this species is a Bohemian migration element within the Austrian flora, which we call a “Vltava migrant”.

Mladý & Skalický (1955) and Kučera (1966) suggest yet another route along which migrants could reach S Bohemia: from the thermophytic region of Podyjí along the southern margin of the Českomoravská vrchovina Mts, along the river Dyje and partly the river Kamp, and through the Weitra region into S Bohemia (in particular, the regions of Třeboň and Nové Hrady; see Fig. 5). *Chamaecytisus ratisbonensis* and *Daphne cneorum* are examples of species that migrated along this route. Research into the *Rubus* flora has revealed two other “Dyje-Kamp migrants”: *R. gothicus* s. l. (the “south Moravian type”) and *R. austromoravicus* (Lepší & Lepší 2004). Both are abundant in S Moravia (Holub 1995, Trávníček & Maurer 1998, Trávníček et al. in litt. 2008) and are distributed through Lower Austria to S Bohemia – to the surroundings of the town of Nové Hrady [*R. gothicus* s. l. (“south Moravian type”)] and in the southern part of the Třeboňská pánev basin (*R. austromoravicus*; Lepší & Lepší 2004). The distributions of the Danubian and Dyje-Kamp *Rubus* migrants do not overlap and are well isolated from each other by the Novohradské hory and Weinsberger Wald Mts.

Despite the fact that brambles are endo-ornithochorous plants, which are easily transported over long distances by birds, regardless of mountains or other barriers, they also have a regional, gradual (step by step) mode of spreading. Only this type of spreading creates the distribution areas (or parts of them) that may be used to confirm supposed migration routes, as illustrated above by the distribution patterns of *R. muhelicus*, *R. silvae-norticae* and *R. gothicus* s. l. (the “south Moravian type”). *Rubus kletensis*, *R. vestitus* f. *albiflorus* and *R. austromoravicus* are long-distance migrants, which support the close florogenetic relationship between S Bohemia and Austria or Moravia.

The description of the distribution of brambles in the Czech Republic is very nearly complete, thanks to our detailed floristic research and finished field work on the Atlas of brambles in the Czech Republic (B. Trávníček, personal communication 2008), and lends support to previous phytogeographical conclusions. In addition, new crucial chorological records (in support of our hypothesis) can be expected to come from Austria where relatively little is known about the distribution of the *Rubus* flora. Our distribution records from Austria are based on only a few field excursions and revisions of the specimens in the Linz and V. Žíla herbaria.

One obvious advantage of regional brambles for regional phytogeographical studies is the relatively small extent of their distribution ranges and their high species diversity. Conversely, too small a distribution area may be disadvantageous as a species may occur only within the migration corridor, and its distribution thus may not provide any phytogeographical insight other than the conditions there are suitable for the growth of *Rubus* species. Only with a certain probability and in specific cases is the direction of a migration revealed. Our previous hypotheses dealing with the directions of migrations are generally based on the assumption that brambles in question originated or started to spread from a region where they are abundant and extended to a region where they are rather rare at present. However, it is possible that a species could have evolved (i) in an area where they are currently rare and migrated to where they are now abundant, or (ii) they originated directly in a migration corridor and spread unevenly in both directions. Both of these options are less likely than our hypothesis but cannot be refuted.

Apomictic microspecies have been insufficiently evaluated for studies of regional phytogeography. Poor knowledge of their taxonomy and distribution over wide areas are the main reason (see e.g., Trávníček et al. 2008). Such studies can only be done in countries with a long tradition of research into apomictic taxa, as is well illustrated by a study of the genus *Hieracium* in Scandinavia (Tyler 2000). This author revealed, based on phenetic distance methods and multivariate statistics, that geographical distribution patterns of apomictic *Hieracium* species reflect historical migration routes and barriers and that apomictic taxa may provide important phylogeographic insights. He also suggested using distribution patterns of apomictic microspecies in historical biogeography as an alternative tool to molecular markers. Our conclusions support his findings and imply that *Rubus* species may be also used in similar studies. The relatively well known *Rubus* flora of Central Europe (see Weber 1981, Pedersen et al. 1999, Zieliński 2004, Trávníček & Zázvorka 2005) is suitable for such a phytogeographical synthesis.

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## Souhrn

V příspěvku je popsán nový druh ostružiníku *Rubus silvae-norticae* M. Lepší et P. Lepší (ostružiník novohradský) ze série *Micantes*. Druh má tyto diagnostické znaky: Prýty polooblé až hranaté, se stranami plochými, stejně zbarvené jako u *R. clusii*, zastíněné zelené, osluněné vínově naběhlé, s (10–)14–21(–26) ostny na 5 cm délky, s roztroušenými ostěnky a štětinami, s řídce roztroušenými přisedlými a stopkatými žlázkami a se vzácnými svazečkovitými chlupy. Ostny (4,1–)5,0–6,0(–6,9) mm dlouhé, ± stejnotvaré, štíhlé, skloněné, rovné, žlutavé až vínově naběhlé, se zploštělou bází. Listy na líci tmavozelené, lysé až olysálé, na rubu zelené až slabě šedozelené, na dotek slabě chlupaté; odění tvořeno hvězdovitými, svazečkovitými a jednoduchými chlupy. Koncový lístek široce eliptický, někdy podlouhle eliptický, vzácně široce obvejčitý nebo až široce vejčitý, na bázi srdčitý, vzácně až utatý, na vrcholu s protaženou, nasazenou, zašpičatělou špičkou. Zoubkování listového okraje hrubě periodicky 2× pilovité. Květenství jehlancovité, víceméně řídkokvěté, na vrcholu ufaté a s ± nahlučeným květy, až k vrcholu

proliténé. Korunní lístky bílé (sušením slabě růžovějící), chlupaté. Tyčinky převyšují gyneceum; nitky a prašníky lysé. Semeníky s ojedinelými chlupy; květní lůžko řídko dlouze chlupaté, s chlupy mezi semeníky vyčnívajícími.

V rakouském klíči (Danner & Fischer 2008) je *R. silvae-norticae* chybně považován za *R. helveticus*, který byl popsán ve Švýcarsku v roce 1870, jedná se pravděpodobně o singulární typ, který soudobá batologie taxonomicky nehodnotí. Pro jméno *R. helveticus* je zde vybrán lectotypus. *Rubus silvae-norticae* byl zaznamenán v ČR, Horním Rakousku a Dolním Bavorsku (130 lokalit). V ČR je vázán na východní část Šumavsko-novohradského podhůří odkud přesahuje do okrajových částí navazujících fytochorionů, Českobudějovické pánve a Novohradských hor. Většina lokalit leží v suprakolinním a submontánním stupni mezofytika, vzácně se vyskytuje i v montánním stupni oreofytika. Druh nejčastěji roste v lesních biotopech.

V příspěvku je také diskutován význam ostružiníků pro regionální fytogeografii a migrace rostlin. Rozšíření regionálních druhů ostružiníků podpořilo dříve předpokládané migrační cesty mezi ČR a Rakouskem a úzké florogenetické souvislosti těchto dvou území oddělených horskými migračními bariérami (Šumava, Novohradské hory, Weinsberger Wald, Českomoravská vrchovina). Druhy *R. silvae-norticae*, *R. muhelicus* a *R. vestitus* f. *albiflorus* považujeme za danubiální migranty v české flóře rozšířené z Horního Rakouska do jižních Čech tzv. Vyšebrodským průsmykem, *R. gothicus* s. l. („jihomoravský typ“) a *R. austromoravicus* za kamsko-dyjské migranty rozšířené z Moravy a Dolního Rakouska do jižních Čech přes Vitorazsko a *R. kletensis* je pravděpodobně vltavský migrant v rakouské flóře rozšířený z jižních Čech do Horního Rakouska.

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