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Distributions of vascular plants in the Czech Republic. Part 14

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Abstract: The fourteenth part of the series on the distributions of vascular plants in the Czech Republic includes grid maps of 103 taxa in the genera *Achnatherum*, *Adonis*, *Consolida*, *Corallorhiza*, *Cypripedium*, *Dianthus*, *Glaux*, *Inula*, *Juncus*, *Laser*, *Linum*, *Mahonia*, *Malaxis*, *Mercurialis*, *Nassella*, *Ononis*, *Pseudorchis*, *Pyracantha*, *Rosa*, *Rubus*, *Sagina*, *Samolus*, *Smyrnium*, *Spiranthes*, *Stipa* and *Traunsteinera*. These maps were produced by taxonomic experts based on examined herbarium specimens, literature and field records. The spectrum of taxa includes various ecological groups. Rare habitat specialists are represented by the halophytes *Glaux maritima*, *Juncus gerardii* and *Samolus valerandi*, psammophytes *Dianthus arenarius* subsp. *bohemicus* and *Stipa borysthenica*, petrophytes *Dianthus gratianopolitanus*, *D. lumnitzeri* and *D. moravicus* and the serpentinophyte *Dianthus carthusianorum* subsp. *capillifrons*. Additional rare and declining species are among orchids, weeds of arable land, and plants of dry grasslands, thermophilous oak forests and subalpine habitats. Three of the included taxa are Czech endemics (*Dianthus arenarius* subsp. *bohemicus*, *D. carthusianorum* subsp. *sudeticus* and *D. moravicus*) and two subendemics, with ranges extending into bordering countries (*Dianthus carthusianorum* subsp. *capillifrons* and *Rubus brdensis*). Altogether, half of the mapped taxa are on the national Red List. Alien species are also represented in this paper. The previously introduced neophytes *Mahonia aquifolium*, *Pyracantha coccinea*, *Sagina apetala* and *Smyrnium perfoliatum* have started to spread in recent decades. *Nassella tenuissima* has begun to escape from cultivation. In contrast, some formerly more common weeds of arable land have been declining in recent decades. Spatial distributions and often also temporal dynamics of individual taxa are shown in maps and documented by records included in the Pladias database and available in the Supplementary materials. The maps are accompanied by comments that include additional information on the distribution, habitats, taxonomy and biology of the taxa.

Keywords: alien species, central Europe, chorology, Czech Republic, distribution atlas, distribution patterns, endangered species, endemic, flora, grid maps, herbarium, phytogeography, plant records, vascular plants

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Introduction

The first part of the series of papers on the distributions of vascular plants in the Czech Republic was published 10 years ago (Kaplan et al. 2015), following the establishment of the Pladias Database of the Czech Flora and Vegetation (Wild et al. 2019, Chytrý et al. 2021). Since then, 1,186 grid-based distribution maps of vascular plants have been published (Kaplan et al. 2016a, b, 2017a, b, 2018a, b, 2019b, 2020, 2021, 2022, 2023, 2024). The records used for construction of these maps are further used for follow-up studies such as analyses of the changes in species occurrence frequency over time (Klinkovská et al. 2024) and exploring the relationship between dynamics in native occurrence frequencies and global naturalization (Paudel et al. 2025). Since the publication of the previous instalment, maps for a further 103 taxa have been finished by the mapping team and these are included in this paper. The total number of mapped taxa in this project has thus surpassed one third of the flora of the Czech Republic, which comprises 3713 species and subspecies (Kaplan et al. 2019a).

The spectrum of taxa treated is diverse in many ways. It includes species, subspecies and interspecific hybrids, both native and alien species with various residence times, widespread species as well as rare species restricted to small geographic areas, and plants from various types of habitats. The species growing in dry grasslands are the most represented (e.g. *Adonis vernalis*, *Dianthus pontederae*, *Inula ensifolia*, *Linum austriacum* and *Stipa pennata*). Rare habitat specialists are represented by the halophytes *Glaux maritima*, *Juncus gerardii* and *Samolus valerandi*, psammophytes *Dianthus arenarius* subsp. *bohemicus* and *Stipa borysthenica*, petrophytes *Dianthus gratianopolitanus*, *D. lumnitzeri* and *D. moravicus* and the serpentinophyte *Dianthus carthusianorum* subsp. *capillifrons*. They all are critically threatened or endangered. Not surprisingly, orchids are also among the most threatened plants, with *Corallorhiza trifida*, *Cypripedium calceolus*, *Malaxis monophyllos*, *Pseudorchis albida*, *Spiranthes spiralis* and *Traunsteinera globosa* included in this paper. Of the mapped taxa, altogether 50 are on the national Red List (Grulich 2012). *Linum perenne* has been extirpated from the Czech Republic and is classified as nationally extinct. *Sagina alexandrae* and *S. nodosa* have not been observed for more than three decades and are classified as missing. Three of the included taxa are Czech endemics (*Dianthus arenarius* subsp. *bohemicus*, *D. carthusianorum* subsp. *sudeticus* and *D. moravicus*) and two subendemics, with ranges extending into bordering countries (*Dianthus carthusianorum* subsp. *capillifrons* and *Rubus brdensis*).

In contrast, some previously introduced species have started to spread in recent decades (*Mahonia aquifolium*, *Pyracantha coccinea*, *Sagina apetala* and *Smyrnium perfoliatum*) and some species are beginning to escape from cultivation (*Nassella tenuissima*). Additional groups of alien species covered by this paper are weeds of arable land (*Adonis aestivalis*, *A. annua*, *A. flammea*, *Consolida hispanica* and *C. regalis*) and ornamental plants escaping from cultivation (*Dianthus barbatus*, *D. caryophyllus*, *D. chinensis*, *Rosa multiflora* and *R. rugosa*).

Maps based on critical examination of herbarium specimens and extensive field surveys are particularly important in taxonomically critical groups, because the literature and database records are unreliable, being contaminated with numerous misidentifications. *Rosa* is taxonomically complex due to its complicated evolutionary history, which involves hybridization and polyploidy, occurrence of partial apomixis resulting from the

unique canina-type meiosis and the existence of garden strains of unknown origin. *Rubus* includes numerous lineages with varying proportions of sexual and agamospermous reproduction. *Stipa* species are mutually highly similar, which make their identification difficult. Maps based on a critical evaluation of the records by taxonomic experts are the only ones that provide a faithful picture of the distribution of these species.

Hybrids were mapped in three genera (*Inula*, *Ononis* and *Sagina*), in which they occur fairly frequently, can persist for long periods of time as clonally reproducing individuals and are morphologically distinct enough to allow their identification.

Materials and methods

Taxonomic scope

The following groups of vascular plants are mapped: native taxa, naturalized aliens, most casuals and certain hybrids. Distribution maps are produced for species and subspecies, and in exceptional cases also for varieties or infrageneric taxa (e.g. sections). Plants of species groups that are difficult to assign to species may be mapped as species aggregates. Field crops and plants deliberately cultivated in gardens and parks are not included in the mapping project. Nomenclature, taxonomic concepts and delimitation of species aggregates mostly follow Kaplan et al. (2019a), with differences indicated where necessary. For taxa not included in that source, a taxonomic reference is given. Publication of maps does not follow any alphabetical or systematic order, but mainly the maps resulting from recent revisions are included.

Data sources

All relevant floristic data sources are used. Major national herbaria and some local and foreign collections, incl. BRA, BREM, BRNL, BRNM, BRNU, CB, CBFS, CESK, CHEB, CHOM, DR, FMM, GM, GOET, HOMP, HR, LIM, LIT, LY, MJ, MMI, MP, MSTR, MZ, NJM, OL, OLM, OMJ, OP, OSM, OVMB, P, PL, PR, PRA, PRC, ROZ, S, SAV, SLO, SOKO, SUM, VM, VYM, W, WU, ZA and ZMT (acronyms follow NYBG 2024), were consulted as the main sources of taxonomically examined records. Most records for maps of common and easy-to-identify taxa came from the Pladias database (Wild et al. 2019, Chytrý et al. 2021), which has integrated data from five large national databases, several regional projects and unpublished field records from the maps' authors and regional contributors.

Mapping procedure

All records used for mapping are entered into the Pladias database and geographically sorted according to the traditionally used CEBA (Central European Basic Area) grid template (Niklfeld 1997, Schönfelder 1999) divided into quadrants of 5 × 3 arc minutes (corresponding to approximately 5.5 × 5.9 km). The territory of the Czech Republic is covered by 2551 quadrants, of which 2181 are completely within the borders of this country. Individual records and the whole distribution of each taxon are checked and evaluated by the author(s) of a particular map in a web-based mapping interface of the Pladias database. Maps of taxonomically critical groups are based solely or mainly on herbarium

specimens examined by taxonomic experts; these cases are indicated in the text accompanying the particular map. Maps of all other taxa are based on records from databases, literature and herbaria, which were scrutinized by the authors of the respective maps. Records used for producing maps are listed in Supplementary materials S1–S103. In selected maps, native versus introduced occurrences are distinguished, and corresponding records in the database classified accordingly. Draft distribution maps and the background records are released in a web-based review process for scrutiny by field botanists, regional collaborators and members of the Czech Botanical Society. Their comments and additional records are collected in the database and returned to the responsible specialists for consideration before producing the distribution maps.

Final maps and comments

The treatment of each taxon consists of a grid distribution map and accompanying text; the maps' authors, indicated in the figure captions, also had major roles in writing the first drafts of the texts for the subject taxa. Maps are displayed using a spherical Mercator projection (EPSG:3857) in which meridians and parallels appear as straight lines, and the fields of the mapping grid are thus displayed as squares. The background relief was derived from SRTM data (http://www2.jpl.nasa.gov/srtm/, the version provided by http://srtm.csi.cgiar.org) and the river network was adapted from data provided by CENIA (www.cenia.cz). When appropriate, different symbols are used on the maps to distinguish between the following alternative attribute states: (1) recent versus old records, (2) native occurrences versus introductions, and (3) records based on examined herbarium specimens versus all other records. These classifications of records are used only for those taxa where such distinctions provide important information and where the amount and quality of records are sufficient. The mapping symbols used to indicate the different attributes of the records in particular grid cells are shown in Table 1. Symbols specific to individual maps are explained in their captions. In the caption for each map, the counts of occupied quadrants are indicated according to the symbols used in the map; uncertain occurrences are not included in the counts. The accompanying text includes the accepted scientific name, a brief outline of the total distribution, information on habitats occupied by the species and a description of its distribution in the Czech Republic. Where appropriate, comments on taxonomy, biology and details of the spatial and temporal dynamics of the distribution are given.

Table 1. The symbols used in the distribution maps to indicate the different attributes of occurrence in particular grid cells.

Attribute distinguished	Symbol	Attribute state
None	●	All records
Time	●	Recent occurrence (at least one record since 2000)
	◍	Old occurrence (all records before 2000, or demonstrably extirpated from all localities after 2000, or all records undated)
Origin	●	Native (at least one record)
	×	Alien
Source of data	●	Examined herbarium specimen (at least one record)
	▲	All other
All	?	Only record(s) uncertain regarding identification and/or locality

Distribution maps and comments

Achnatherum calamagrostis (Fig. 1)

Achnatherum calamagrostis is native to the mountains of southern and central Europe, i.e. to the Pyrenees in Spain and France, the Cévennes and Jura in France, the Alps in France, Germany, Switzerland, Italy, Austria and Slovenia, as well as the Apennines, the mountain ranges of the Balkan Peninsula and the southern Carpathians in Romania (Meusel et al. 1965). In its primary range it grows on screes, rocks and slope erosion sites, as well as on gravel, usually limestone, deposits of rivers and streams. In the Czech Republic *A. calamagrostis* is cultivated in botanical gardens such as those in the cities of Brno and Olomouc. Only one record exists of its occurrence outside cultivation: in 1908 this species was collected near the village of Vrbátky in central Moravia. It may have been introduced there with limestone used for sugar refining, probably from the Eastern Alps. *Achnatherum calamagrostis* is classified as a casual neophyte (Pyšek et al. 2022).

Adonis aestivalis (Fig. 2)

Adonis aestivalis is probably native to the Mediterranean part of Europe and western Asia, now extending as far as the province of Xinjiang in north-western China, Pakistan and northern India (Kashmir); it is also found in north-western Africa. In western, central and south-eastern Europe as well as in central Ukraine and southern European Russia, it occurs as an archaeophyte or, in the north, as a neophyte, spreading through the cultivation of cereals. More recently, it was introduced into and has become naturalized in western

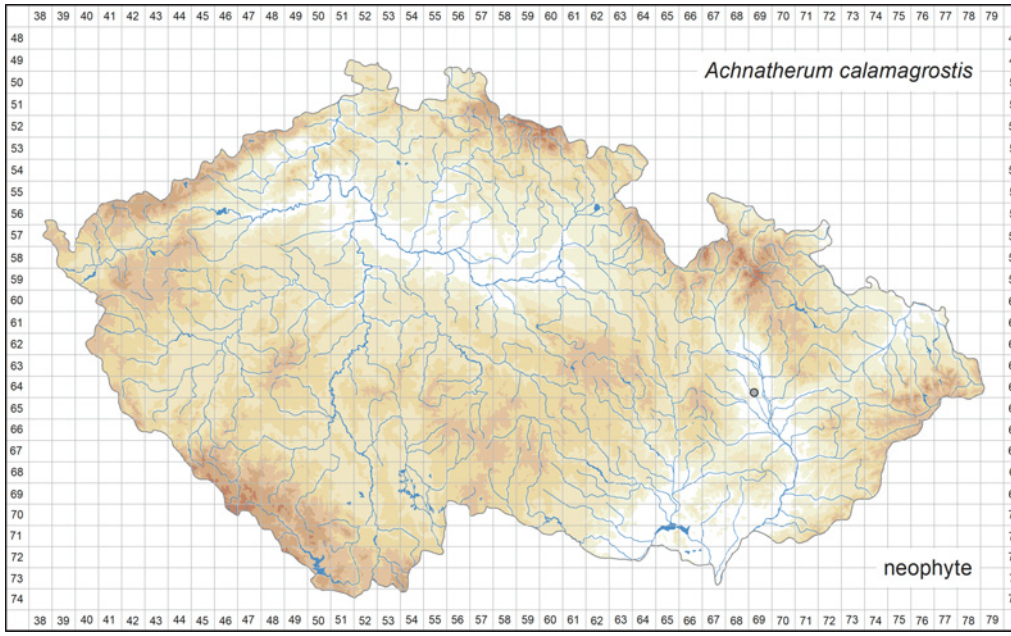

Fig. 1. Distribution of *Achnatherum calamagrostis* in the Czech Republic: ● pre-2000 records only (1 quadrant). Prepared by Jiří Danihelka.

China and some parts of the western USA (Meusel et al. 1965, Jalas & Suominen 1989, Parfitt 1997, Fu & Robinson 2001). Two subspecies are recognized, of which subsp. *squarrosa* is restricted to the Mediterranean part of this species' range and Crimea (Raab-Straube et al. 2014), while the plants found in central Europe represent the typical subspecies. In the Czech Republic *A. aestivalis* occurs as a weed of winter cereals, on fallow land and in disturbed grasslands along field margins, less frequently also as a casual at various ruderal sites. The soils are usually dry to moderately humid, rich to moderately rich in calcium and moderately supplied with nutrients. In this country, it occurs in the warm lowlands and adjacent hilly areas in north-western, central and eastern Bohemia, as well as in central and southern Moravia. Stable occurrences also exist on calcareous soils near the towns of Horažďovice and Strakonice in south-western Bohemia. The records elsewhere in the country represent casual occurrences both on arable land (due to introduction with crop seeds) and in ruderal habitats. Most of the stable occurrences are situated at elevations below 500 m, with an elevational maximum at about 560 m near the village of Podmokly in south-western Bohemia. *Adonis aestivalis* has declined strongly due to the changes in agriculture: whereas some occurrences completely disappeared, many other populations were reduced in abundance. In the Czech Republic it is considered a naturalized archaeophyte (Pyšek et al. 2022) and classified as vulnerable (Grulich 2012).

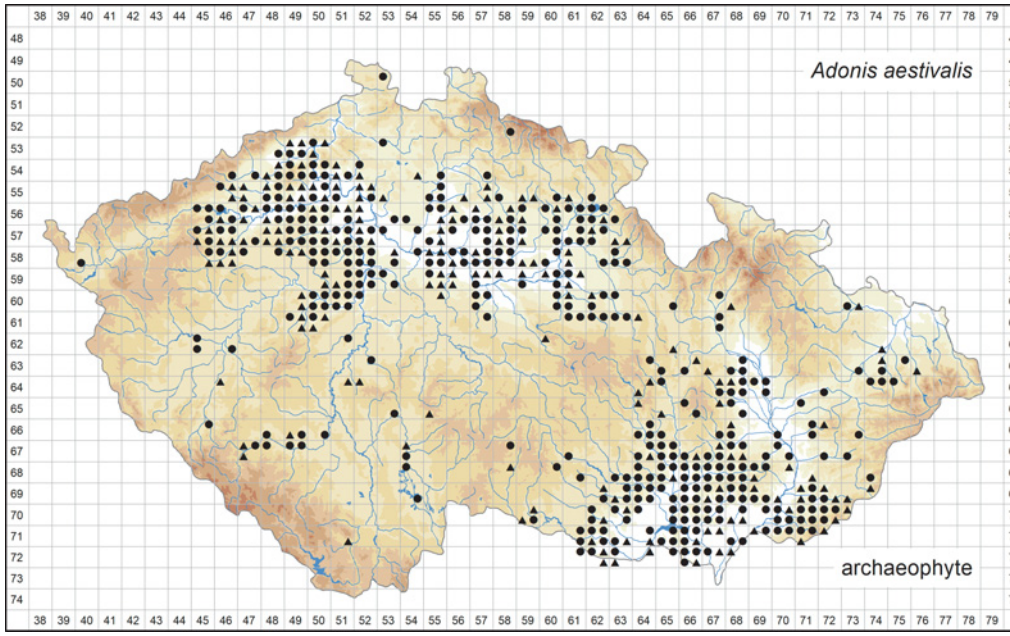

Fig. 2. Distribution of *Adonis aestivalis* in the Czech Republic: ● occurrence documented by herbarium specimens (363 quadrants), ▲ occurrence based on other records (186 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

Adonis annua (Fig. 3)

Adonis annua is native to the Mediterranean part of Europe, westernmost Asia and northern Africa. In western Europe it occurs throughout the Iberian Peninsula and France and reaches as far as southern England, where it is considered an established alien (Meusel et al. 1965, Jalas & Suominen 1989). Two subspecies are sometimes recognized (Steinberg 1971, Jalas & Suominen 1989), with subsp. *cupaniana* confined to the Apennine Peninsula, Sicily, Corsica and the Balearic Islands. *Adonis annua* was introduced into the southern USA, where it has become locally established (Parfitt 1997). In the Czech Republic *A. annua* is cultivated as an ornamental plant. However, it was first recorded by Presl & Presl (1819, as *A. autumnalis*) as a weed in cereal fields, but the specimen that may have documented this literature record is an admixture with a gathering of *A. aestivalis*. *Adonis annua* was distributed in the exsiccate collection Herbarium florae Bohemicae universale by I. F. Tausch as occurring in arable fields around Prague; the plants were collected in the late 1820s or early 1830s (the whole exsiccate collection was offered for sale in 1832). The earliest dated herbarium specimens of escaped plants were collected in Prague and Děčín in 1851 and 1852, respectively. Since then *A. annua* has been repeatedly collected both from arable land (accidentally introduced with crop seeds) and ruderal habitats as escaped from cultivation, but it has never become truly established. The number of records may increase in the future because the species is distributed as part of various commercial seed mixtures used to improve the ornamental value of meadows and field margins, both in and outside settlements. *Adonis annua* is classified as a casual neophyte (Pyšek et al. 2022).

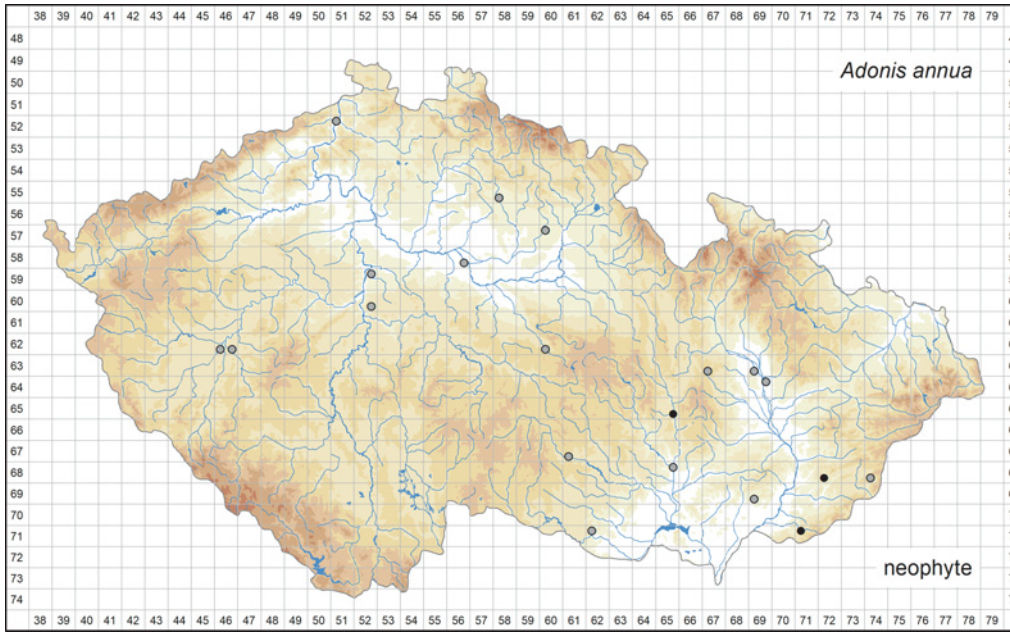

Fig. 3. Distribution of *Adonis annua* in the Czech Republic: ● at least one record in 2000–2024 (3 quadrants), ● pre-2000 records only (17 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

Adonis flammea (Fig. 4)

Adonis flammea is native to the Mediterranean area, extending eastward as far as Transcaucasia and north-western Iran (Meusel et al. 1965, Jalas & Suominen 1989). Two subspecies are recognized, with subsp. *cortiana* confined to Italy, Istria and Anatolia (Steinberg 1971, Raab-Straube et al. 2014). The European occurrences of this species outside the Mediterranean area are secondary: *A. flammea* has been spread as a weed of winter cereals since the Neolithic. In the Czech Republic *A. flammea* occurs as a weed in the margins of arable fields. It grows on dry to moderately humid, usually calcareous soils that are relatively poor in nutrients. It is found in the lowlands and hilly areas of north-western Bohemia and southern Moravia, with isolated occurrences in the southern part of the Bílé Karpaty Mts. The Bohemian localities are at the northern limit of this species' range. The scattered records in other parts of the country refer to temporary occurrences, mainly from introductions with cereal seeds to arable land, and very rarely to waste places. While most records are from elevations below 300 m, the species reaches its elevational maxima of 390 m near the village of Biskoupky in southern Moravia and 380 m near the village of Malíkovice in central Bohemia. Although *A. flammea* is considered an archaeophyte, its earliest record in Bohemia dates to 1832, and in Moravia to 1857. However, this may have been due to its rarity around Prague and Brno, the centres of botanical exploration. *Adonis flammea* strongly declined due to intensification of farming, but there are still sustainable populations at a few places in southern Moravia and north-western Bohemia. This species is classified as a casual archaeophyte (Pyšek et al. 2022) and as critically threatened (Grulich 2012) due to its decline.

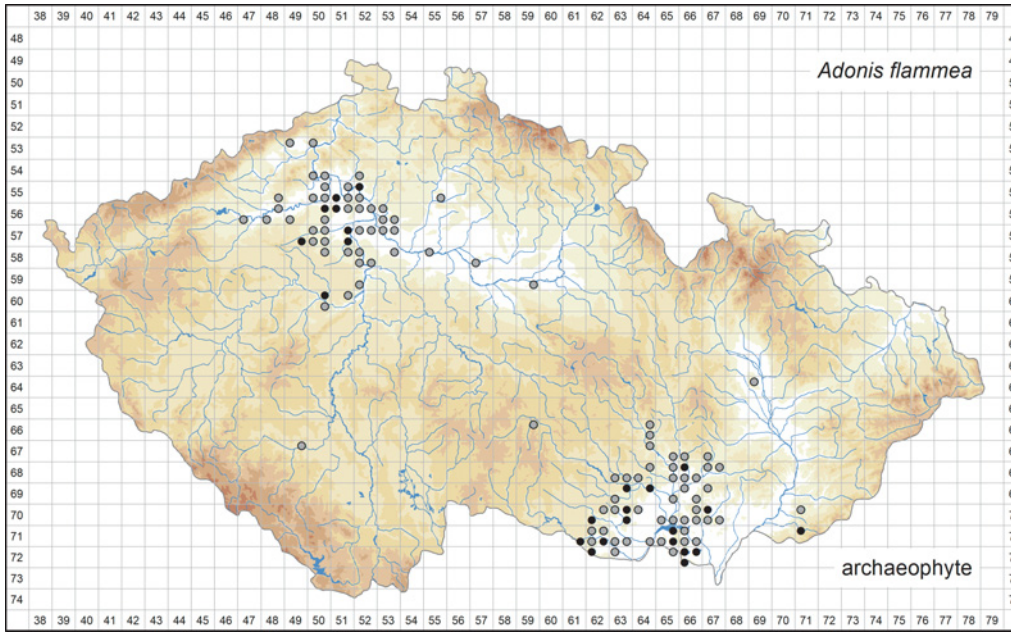

Fig. 4. Distribution of *Adonis flammea* in the Czech Republic: ● at least one record in 2000–2024 (24 quadrants), ● pre-2000 records only (91 quadrants). Prepared by Jiří Danihelka, Hana Galušková & Zdeňka Lososová.

Adonis vernalis (Fig. 5)

Adonis vernalis is a Euro-Siberian species distributed from the western part of the Iberian Peninsula in the west as far as the Western Sayan Mts in the east. In western and central Europe its range is very discontinuous, and the species is absent from large parts of the Mediterranean area; towards the north it reaches central Germany and north-western Poland, as well as south-eastern Sweden (the islands of Öland and Gotland; Meusel et al. 1965, Jalas & Suominen 1989). It is sometimes cultivated as an ornamental and escapes: records of escaped plants exist from the western USA (Parfitt 1997). In the Czech Republic *A. vernalis* occurs in narrow-leaved and broad-leaved dry grasslands, thermophilous forest fringe vegetation, open scrub and thermophilous oak forests. The soils are dry to moderately humid, slightly acidic to basic and poor in nutrients. In the Czech Republic *A. vernalis* is found mainly in hilly areas with the warmest climates. In Bohemia it is locally common in the České středohoří Mts, in the hilly landscapes along the Labe and Vltava rivers between the town of Litoměřice and Prague, as well as in the Český kras karst area, while some rather isolated occurrences exist also on Cretaceous hills and slopes in eastern central Bohemia. In Moravia it is found in the hilly areas south and south-east of Brno, with some isolated occurrences elsewhere, including the surroundings of the town of Miroslav and the southern part of the Bílé Karpaty Mts. At a couple of sites where *A. vernalis* was discovered only recently, its occurrence may be secondary due to planting. In contrast, some occurrences have vanished, mainly due to inappropriate forest management as well as vegetation succession in abandoned pastures. Some other populations have been reduced by illegal transfer of plants from the wild into gardens.

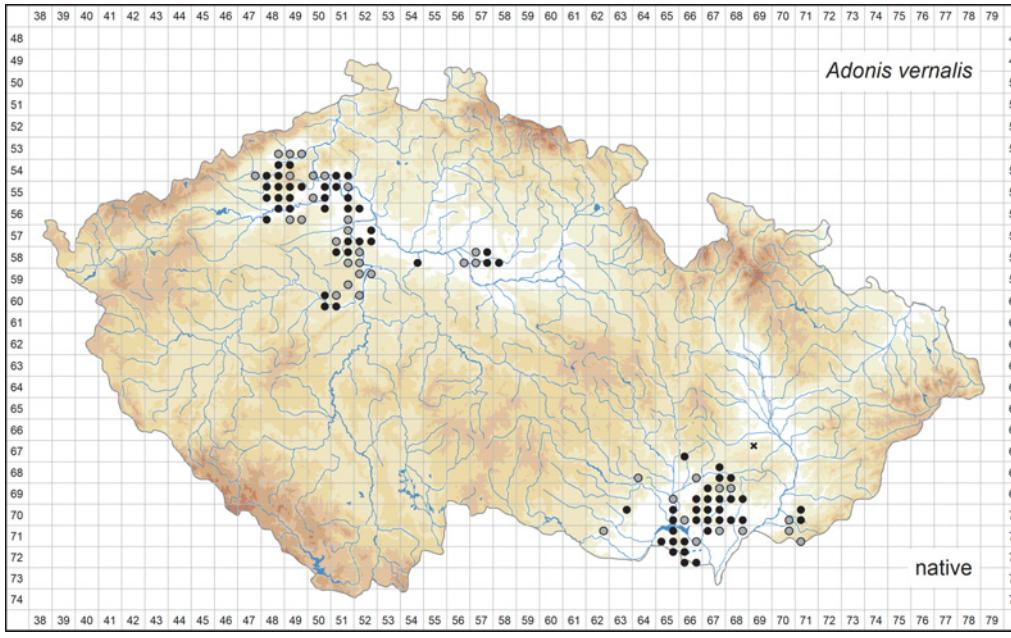

Fig. 5. Distribution of *Adonis vernalis* in the Czech Republic: ● native, at least one record in 2000–2024 (68 quadrants), ◍ native, pre-2000 records only (38 quadrants), × alien only (1 quadrant). Prepared by Jiří Danihelka & Hana Galušková.

Still, this species' decline has been only moderate, and many extant populations are at protected sites with appropriate management. *Adonis vernalis* is classified as endangered due to its rarity and decline (Grulich 2012).

Consolida ajacis (Fig. 6)

Consolida ajacis is native to southern Europe and southern Asia, being distributed from France through the Apennine and Balkan Peninsulas, Anatolia, the Caucasus and south-western Asia, eastwards to India. It is perhaps also native to northern Africa. It is widely cultivated as an ornamental annual in many cultivars with flowers of various colours and is reported to have been introduced into many parts of the world, including central and northern Europe, North America, Australia and New Zealand (Munz 1967–1968, Raab-Straube et al. 2014, POWO 2024). In the Czech Republic *C. ajacis* is usually found escaped on road verges, waste grounds, pavement cracks and in other ruderal habitats, mostly in settlements. It usually occurs as a small number of individuals and does not persist on its sites for more than one growing season. In this country *C. ajacis* was for the first time found escaped in 1870 near the bank of the Svratka river in the city of Brno. It was most frequently recorded in lowlands as well as in moderately warm parts of southern Bohemia, at elevations up to ~530 m. It is considered a casual neophyte (Pyšek et al. 2022). The number of escapes seems to have decreased recently compared to the past, probably due to less frequent cultivation of annuals.

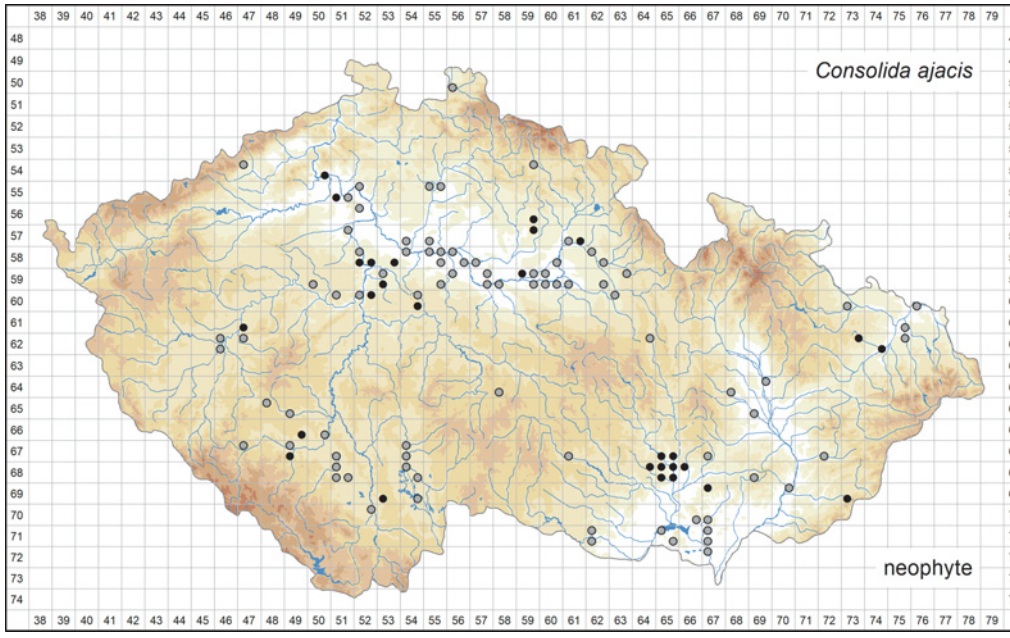

Fig. 6. Distribution of *Consolida ajacis* in the Czech Republic: ● at least one record in 2000–2024 (28 quadrants), ● pre-2000 records only (83 quadrants). Prepared by Jan Prančl.

Consolida hispanica (Fig. 7)

Consolida hispanica is native to the Iberian Peninsula, northern Africa, the eastern Mediterranean area and southern Asia from Anatolia to Tibet. It is sometimes grown as an ornamental annual, but much less frequently than *C. ajacis*, and its introductions outside the native range are usually associated with grain transport. It has been recorded as introduced in many European countries, the USA, south-western Siberia and the Korean Peninsula. In central and western Europe, it is now naturalized (Munz 1967–1968, Raab-Straube et al. 2014, Verloove 2017, POWO 2024). In the Czech Republic *C. hispanica* grows in the margins of arable fields, on fallow land and in other disturbed ruderal sites such as road verges, dirt roads, railway stations, waste land and soil heaps after excavation work. The soils are loamy or loamy clayey, basic, rather dry, usually rich in nutrients. In this country this species was first recorded in 1897 near the village of Radčice, now part of the city of Plzeň, in western Bohemia (a single individual), and in 1899 near the town of Unhošť in central Bohemia. The first undisputable record from Moravia is from 1911 near the town of Veverská Bítýška northwest of the city of Brno. Currently, *C. hispanica* is most abundant in the warmest parts of north-western Bohemia and around the city of Prague, where it is naturalized and sometimes forms extensive, abundant populations. It occurs less commonly in the lowlands of southern Moravia. The isolated occurrences elsewhere are mostly temporary. The elevational maximum was recorded at 580 m at the railway station in the town of Hlinsko in eastern Bohemia. *Consolida hispanica* is classified as a naturalized neophyte (Pyšek et al. 2022). It is sensitive to herbicides and is therefore characteristic of species-rich communities in less intensively managed fields, thus resembling many central European field archaeophytes in this respect.

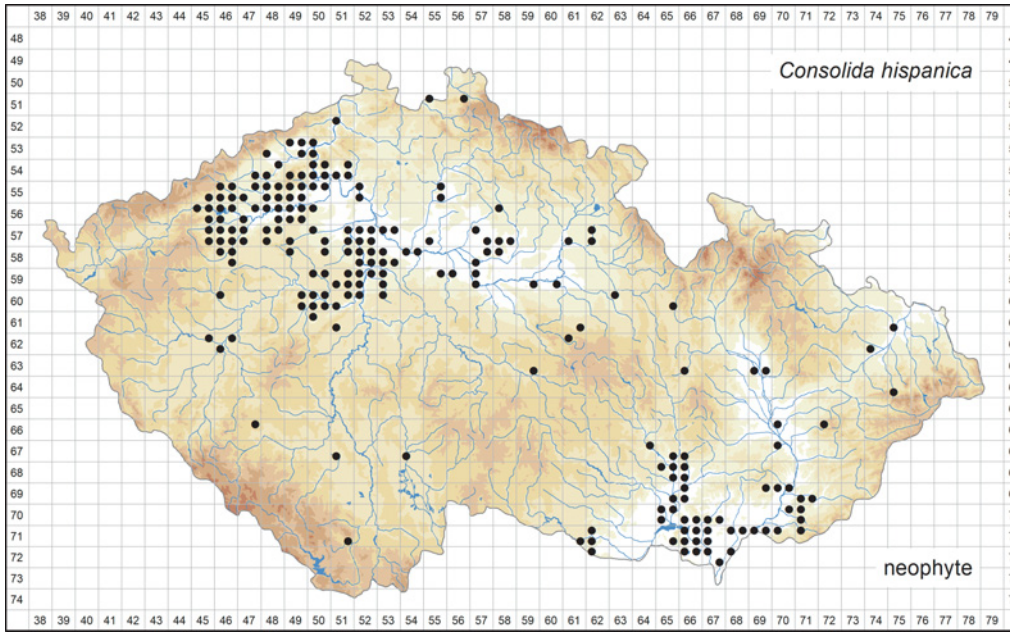

Fig. 7. Distribution of *Consolida hispanica* in the Czech Republic (205 occupied quadrants). Prepared by Jan Prančl.

Consolida regalis (Fig. 8)

Consolida regalis occurs in most of Europe and western Asia, being distributed from southern France in the west to Iran, the Caucasus and southern Siberia in the east. It is mainly found in areas with temperate to sub-Mediterranean climates. It has been introduced into eastern parts of North America. Three subspecies are distinguished, of which subsp. *regalis* probably grows throughout the species' whole range including central Europe, whereas subsp. *paniculata* occurs in southern Europe, Turkey and the Caucasus, and subsp. *divaricata* is distributed from the northern Balkan Peninsula to Iran and the Caspian Sea (Munz 1967–1968, Hultén & Fries 1986, Raab-Straube et al. 2014). In the Czech Republic *C. regalis* grows in the margins of arable fields, on fallow land, on road verges, at railway stations, on railway embankments, soil heaps, rubble dumps and at other disturbed ruderal sites. It prefers loamy or loamy-clayey, neutral to basic, rather dry soils usually rich in nutrients. It is common in warm areas of this country; its frequency decreases towards higher elevations, with it being absent from the mountains. At higher elevations it prefers basic substrates. The elevational maximum of the species was recorded at 805 m near the settlement of Kosmo in the foothills of the Šumava Mts in south-western Bohemia. *Consolida regalis* has declined, like the vast majority of arable field weeds, due to intensification of farming, yet it is still locally common in the Czech Republic. It is considered a naturalized archaeophyte (Pyšek et al. 2022).

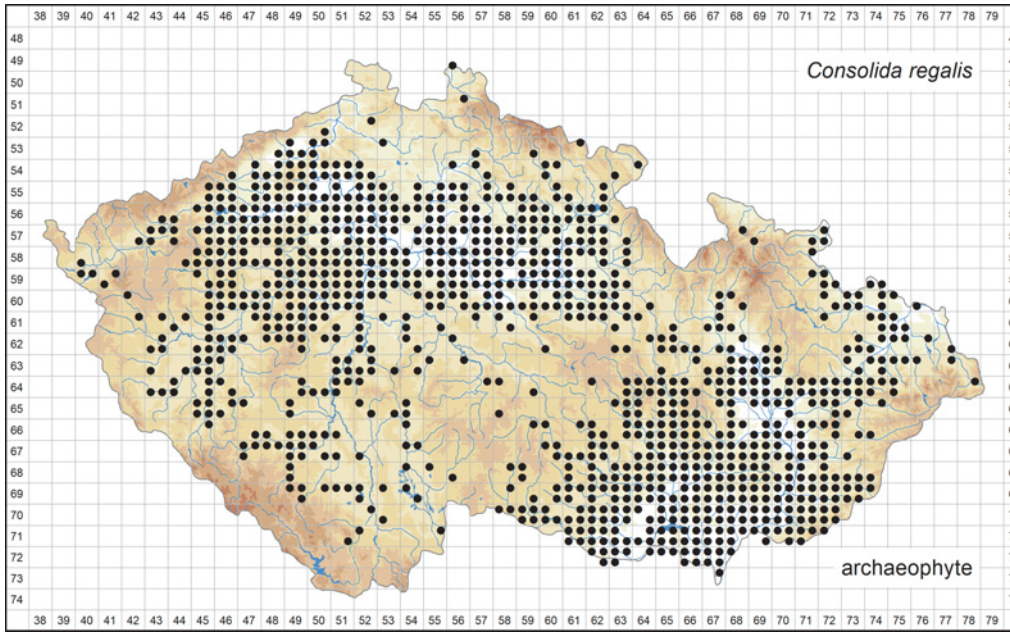

Fig. 8. Distribution of *Consolida regalis* in the Czech Republic (1,038 occupied quadrants). Prepared by Jan Prančl.

Corallorhiza trifida (Fig. 9)

Corallorhiza trifida is a circumpolar species distributed mainly in the temperate and boreal zones in Eurasia and North America, in southern parts of the range being confined to mountains. In Europe its range extends northwards to Iceland and northern Scandinavia and southwards to the eastern Pyrenees, Apennines, Dinarids and Rhodope Mts. It is absent from most of western and south-eastern Europe, with occurrences in the mountains of Crimea and the northern foothills of the Caucasus Mts isolated from the rest of the species' European range. In Asia the species extends through Siberia as far as the Russian Far East and Japan, with outposts in the Caucasus Mts themselves, central Asia and China. In North America it is distributed from Alaska, British Columbia and Oregon in the west to Labrador, Newfoundland and the Appalachian Mts in the east, with isolated occurrences on the south-western coast of Greenland (Meusel et al. 1965, Baumann & Künkele 1982, Hultén & Fries 1986). In the Czech Republic *C. trifida* grows in deciduous, mixed and coniferous forests, often in humid places covered by mosses around springs and along small streams, less frequently in bogs and mires with scattered trees. The soils are fresh to wet, acidic to slightly basic and mostly rich in humus. In montane bogs it grows in sunny places whereas elsewhere it is hidden in shade. *Corallorhiza trifida* had a dispersed distribution almost throughout this country but has been absent from some areas of western, central and southern Bohemia, as well as north-eastern Moravia and Silesia. However, mainly during the second half of the 20th century this species has vanished from large areas mainly at middle elevations, probably because of changes in forestry practices and general eutrophication and acidification of the landscape that suppress symbiotic fungi. *Corallorhiza trifida* is therefore classified as endangered (Grulich 2012).

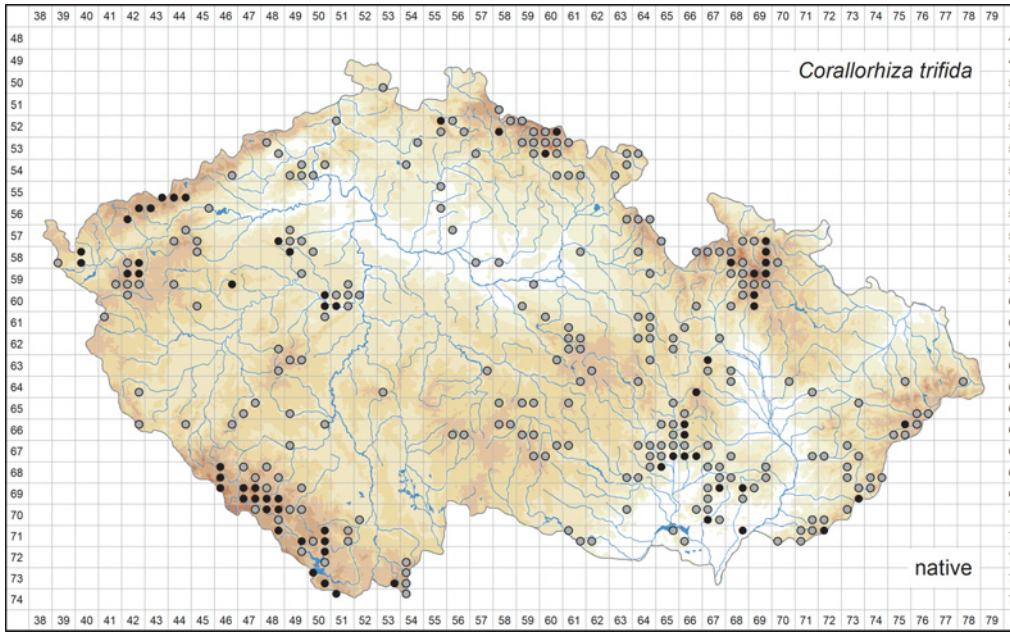

Fig. 9. Distribution of *Corallorhiza trifida* in the Czech Republic: ● at least one record in 2000–2024 (64 quadrants), ● pre-2000 records only (225 quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

Cypripedium calceolus (Fig. 10)

Cypripedium calceolus is distributed mainly in the temperate zones in Europe and Asia. In Europe it extends to central Great Britain and central Spain in the west, to northern Scandinavia in the north, to the central Balkan Peninsula in the south and to the Ural Mts in the east. It is absent from the warmest parts of the Mediterranean area and south-eastern Europe. In Asia it is mainly found in the southern parts of western and central Siberia, in north-easternmost China and the southern Russian Far East (Meusel et al. 1965, Baumann & Künkele 1982, Hultén & Fries 1986). North American populations, previously included in *C. calceolus*, are now distinguished as *C. parviflorum* (Sheviak 2002a). In the Czech Republic it grows in shaded to moderately sunny places in mainly oak-hornbeam and beech forests, less frequently in shrub communities including abandoned orchards. The soils are usually fresh but may dry out during summer; they are rich in humus and mineral nutrients, often developed over base-rich bedrock, particularly marlstone, limestone and flysch. The populations of *C. calceolus* are scattered in north-central and eastern Bohemia and the adjacent part of Moravia from which it extends to south-western and south-eastern Moravia. Isolated occurrences are in west-central and southern Bohemia and in easternmost Silesia. Numerous occurrences have vanished, while many of the surviving populations consist of only a few individuals. The decline was probably due to intensification of forestry management that involved large-scale clearing and conversion of deciduous forests to spruce plantations, as well as general eutrophication of the landscape. In addition, because of its attractive appearance and showy flowers, this species has been plucked for bouquets and transplanted into gardens. *Cypripedium calceolus* is classified as endangered because of its rarity and decline (Grulich 2012).

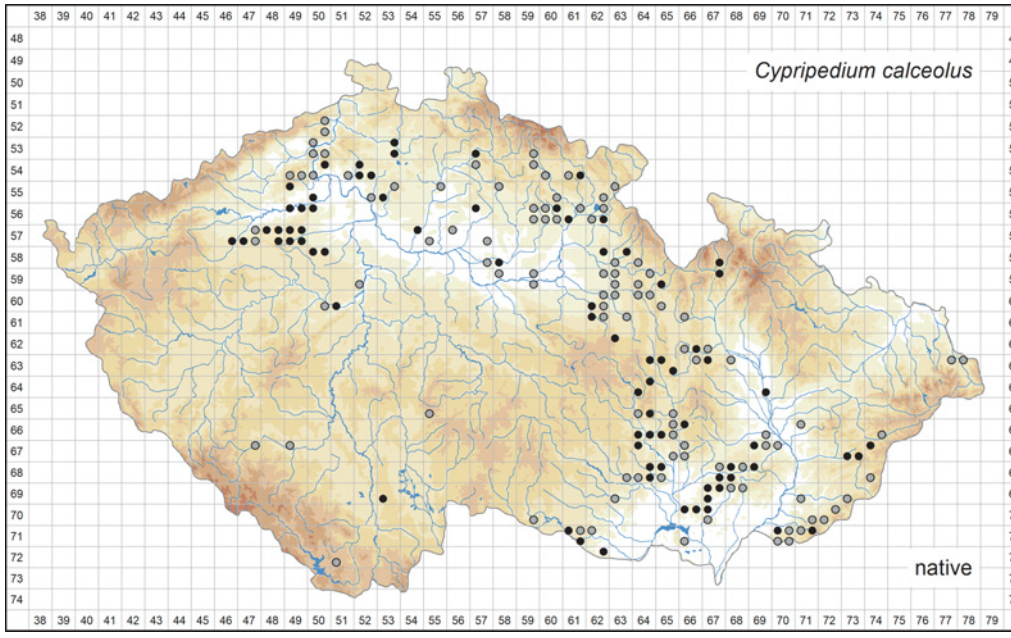

Fig. 10. Distribution of *Cypripedium calceolus* in the Czech Republic: ● at least one record in 2000–2024 (77 quadrants), ● pre-2000 records only (101 quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

Dianthus arenarius subsp. *bohemicus* (Fig. 11)

Dianthus arenarius includes four or five geographically more or less vicariant subspecies, of which subsp. *arenarius* is confined to southern Sweden and the Baltic countries, subsp. *borussicus* to north-central, north-eastern and eastern Europe, subsp. *pseudosquarrosus* to the Dnieper river basin in Ukraine and subsp. *pseudoserotinus* to central-western Ukraine (Jalas & Suominen 1986, Tutin & Walters 1993, POWO 2024). Populations from central-north Bohemia were distinguished as *D. arenarius* var. *bohemicus* (Novák 1915), and later raised to the subspecies level. However, this subspecies is not generally accepted, and Czech plants are sometimes assigned to subsp. *borussicus* (POWO 2024). *Dianthus arenarius* subsp. *bohemicus* occurs in dry open grasslands on permeable, sandy or gravelly, slightly acidic to acidic soils that are rather poor in nutrients. It is now confined to a single natural site in the vicinity of the village of Kleneč in central-north Bohemia at elevations 210–220 m. At a nearby locality near the village of Vražkov it became extinct around the middle of the 20th century due to tree planting (Kovanda 1990). In the late 1980s, a few plants grown from seeds collected at Kleneč were planted near the village of Kyškovice. Hybridization between *D. arenarius* subsp. *bohemicus* and *D. carthusianorum* subsp. *carthusianorum* was identified at Kleneč, but the hybrids are considerably less fertile than their parents, producing largely aborted pollen grains and no seed. Interspecific hybridization has thus had only a minor effect on the genetic integrity of this endemic subspecies (Vítová et al. 2015). Morphologically similar plants have been recently planted in a sandpit near the village of Františkov in southern Bohemia (Lepší et al. 2024). *Dianthus arenarius* subsp. *bohemicus* is classified as critically threatened (Grulich 2012).

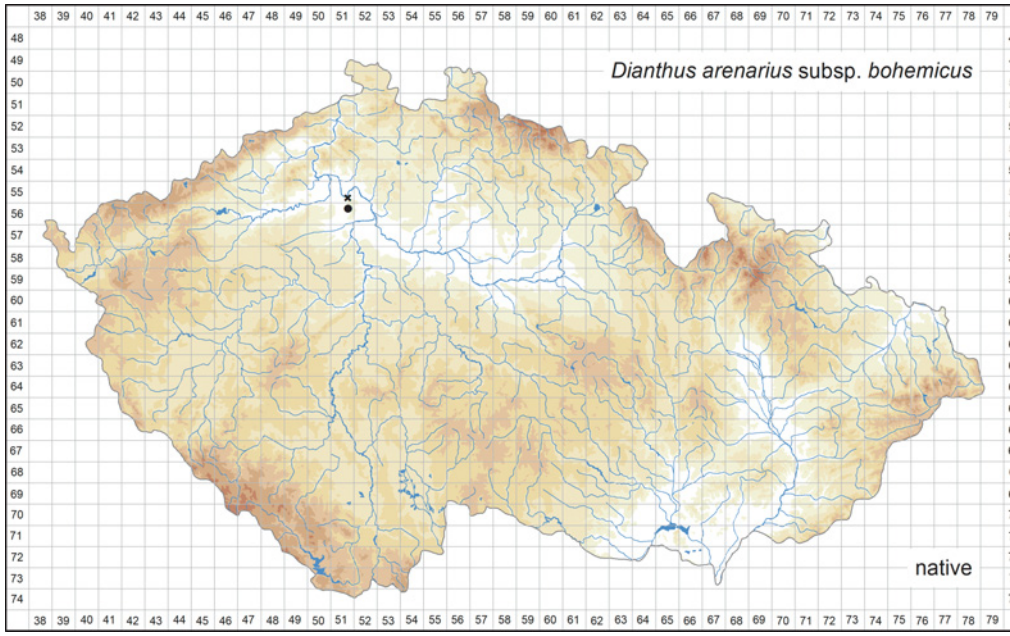

Fig. 11. Distribution of *Dianthus arenarius* subsp. *bohemicus* in the Czech Republic: ● native (1 quadrant), × alien (1 quadrant). Prepared by Jindřich Chrtek Jr.

Dianthus armeria (Fig. 12)

Dianthus armeria is mainly a European species, with its range extending northwards to England, southern Sweden, northern Poland and Lithuania, eastwards to the Dnieper river basin and Crimea in Ukraine, the Caucasus Mts and Iran, and southwards to central Spain, Sicily and northern Greece. It has been introduced into North America, where it has become widely naturalized, as well as to the Russian Far East (Primorye), Korea, Japan, New Zealand, Tasmania, Argentina and Chile (Jalas & Suominen 1986, Rabeler & Hartman 2005, POWO 2024). In the Czech Republic *D. armeria* grows mainly on stony slopes, in dry grasslands (very often semi-natural), open-canopy forests and forest fringes, shrub communities, edges of arable fields and on railway embankments. It prefers loamy or loamy-sandy, slightly acidic to slightly basic, nutrient-poor soils, often free of calcium carbonate. *Dianthus armeria* is scattered to rare in warm to moderately warm hilly landscapes and lowlands of north-western, central and eastern Bohemia, and scattered to locally common in hilly landscapes, less often in lowlands and lower mountains of south-western, southern, south-eastern (especially in the Bílé Karpaty Mts), central and north-eastern Moravia. Elsewhere it is very rare, and its occurrences are often temporary. *Dianthus armeria* has declined somewhat due to scrub encroachment and intensification of land use; it is classified as lower risk – near threatened in this country (Grulich 2012).

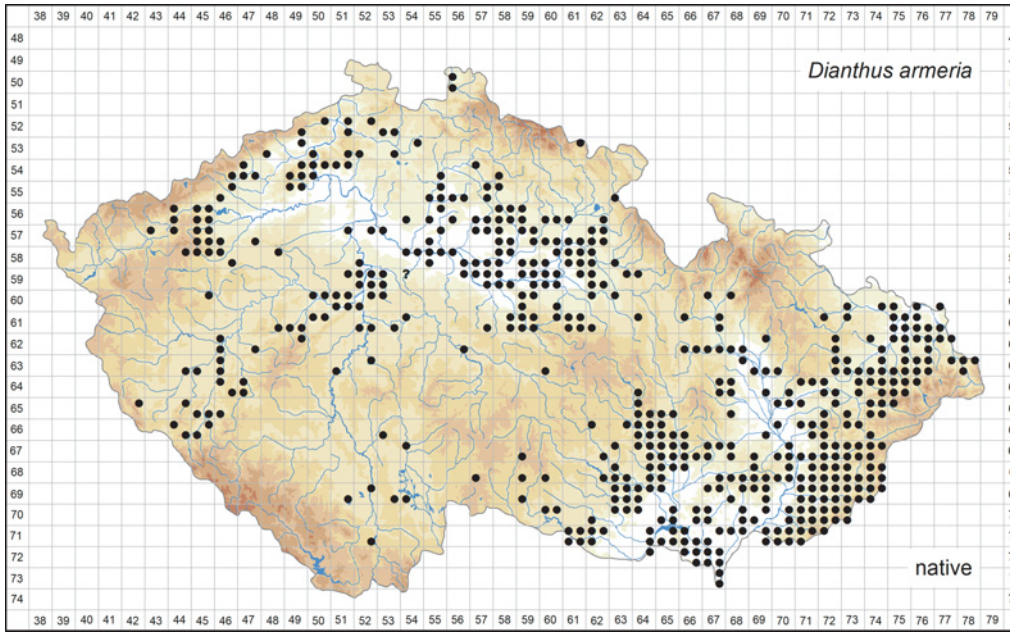

Fig. 12. Distribution of *Dianthus armeria* in the Czech Republic (515 occupied quadrants). Prepared by Jindřich Chrtek Jr.

Dianthus barbatus (Fig. 13)

Dianthus barbatus is native to the Pyrenees, southern France, the Italian Peninsula, south-eastern Alps, northern part of the Balkan Peninsula and Southern and Eastern Carpathians, and in a slightly different form (var. *asiatica*) to China, Korea and the Russian Far East (Jalas & Suominen 1986, Lu & Turland 2001). It is a popular, widely cultivated ornamental garden plant both persisting at former places of cultivation and sometimes escaping from cultivation across Europe, in North America, Bolivia and in some parts of Asia (POWO 2024). In the Czech Republic, escaped plants have rarely been found around gardens and cemeteries, at various ruderal places in settlements, on road verges and on disturbed meadows throughout the country. *Dianthus barbatus* is classified as a naturalized archaeophyte or neophyte (Pyšek et al. 2022).

Dianthus carthusianorum agg. (Figs 14–20)

Dianthus carthusianorum agg. is widely distributed from the north-eastern part of the Iberian Peninsula in the west to the Dnieper river basin in Ukraine in the east. Two species are represented in the Czech Republic: *D. carthusianorum* and *D. pontederae*. Besides the typical plants discussed below, transient forms are found where these species co-occur in warm hilly areas in south-western and central Moravia.

Dianthus carthusianorum is a European species, with its range extending from north-eastern Spain in the west to the Dnieper river basin in Ukraine in the east and from northern Germany, Poland and Baltic countries in the north to the southern part of the Italian

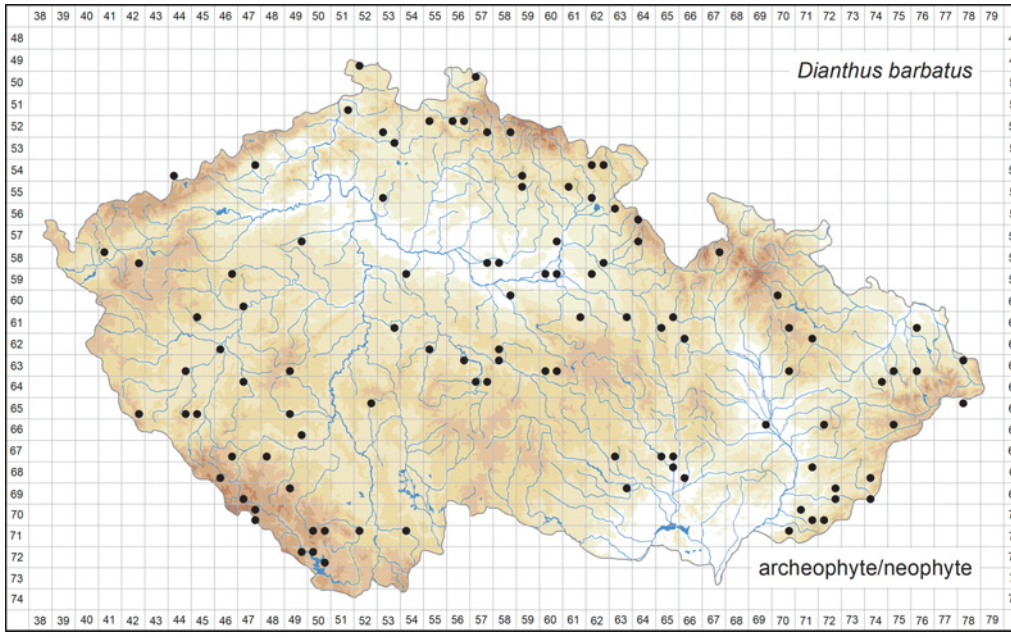

Fig. 13. Distribution of *Dianthus barbatus* in the Czech Republic (104 occupied quadrants). Prepared by Jindřich Chrtek Jr.

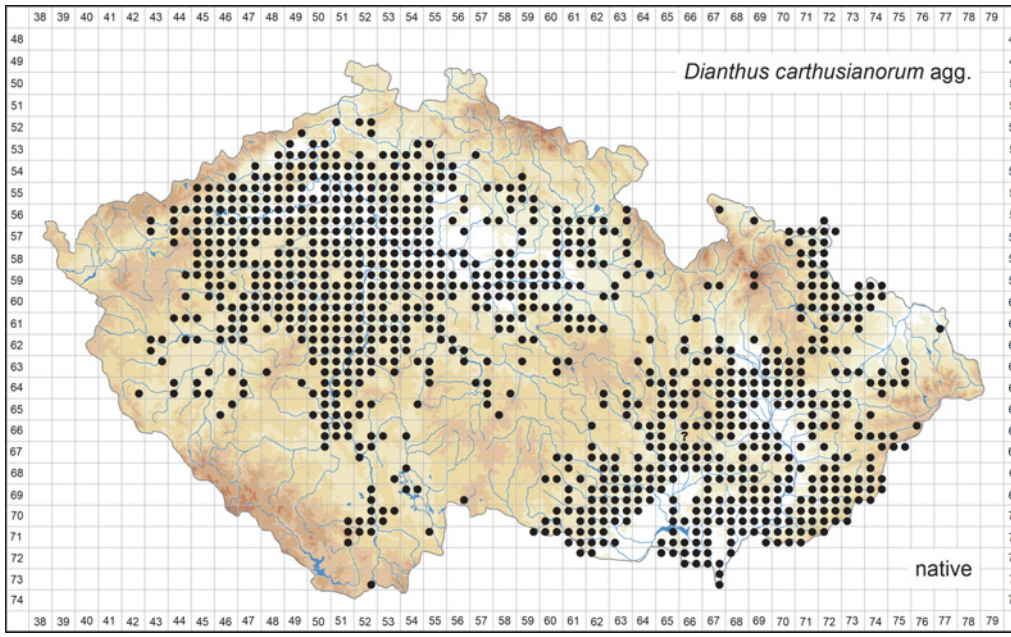

Fig. 14. Distribution of *Dianthus carthusianorum* agg. in the Czech Republic (987 occupied quadrants). Prepared by Jindřich Chrtek Jr.

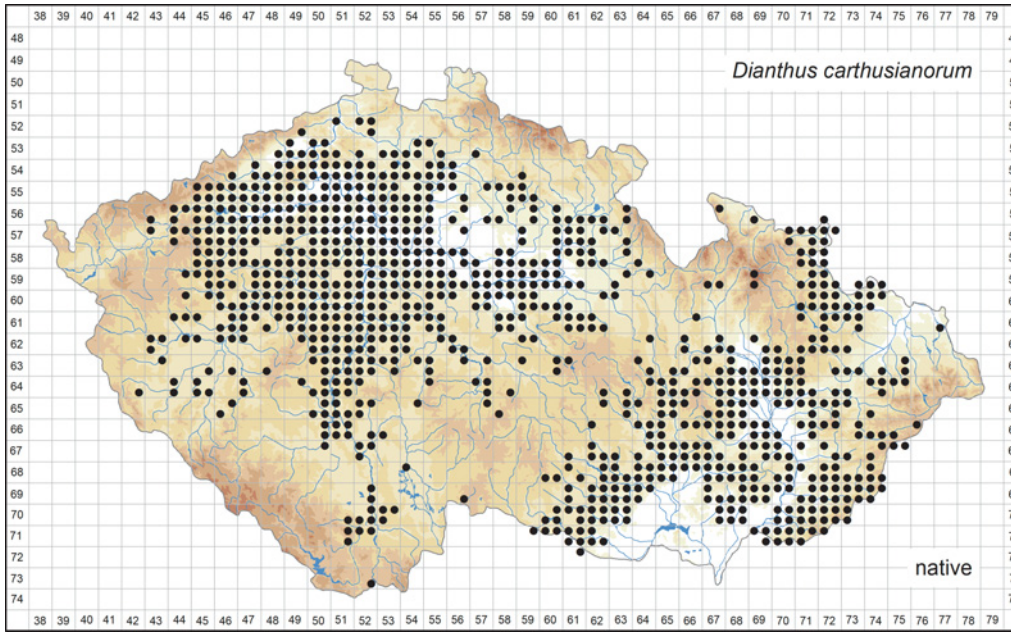

Fig. 15. Distribution of *Dianthus carthusianorum* in the Czech Republic (938 occupied quadrants). Prepared by Jindřich Chrtek Jr.

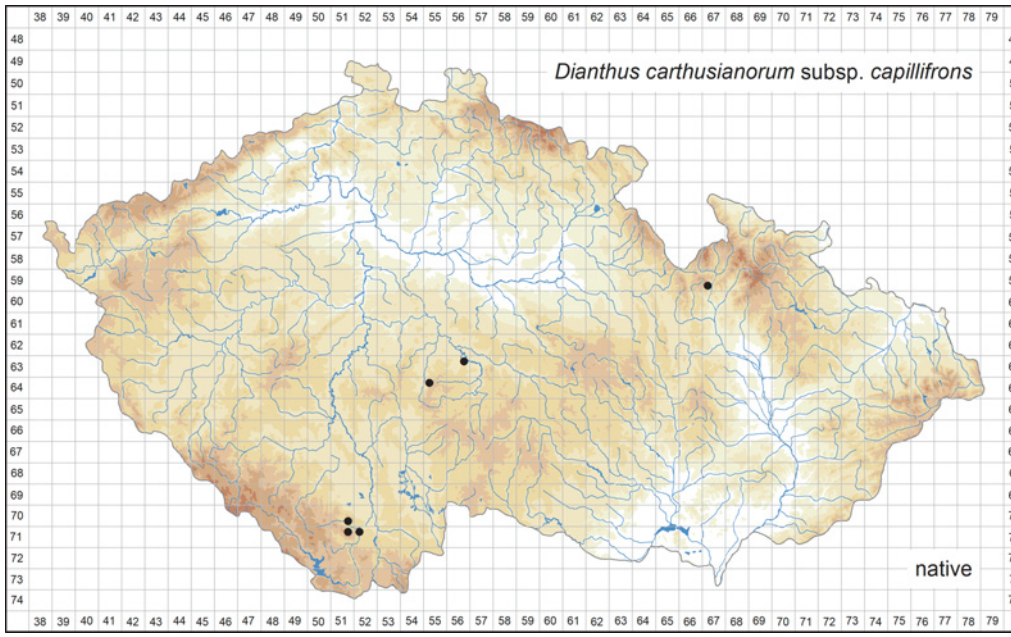

Fig. 16. Distribution of *Dianthus carthusianorum* subsp. *capillifrons* in the Czech Republic (6 occupied quadrants). Prepared by Jindřich Chrtek Jr.

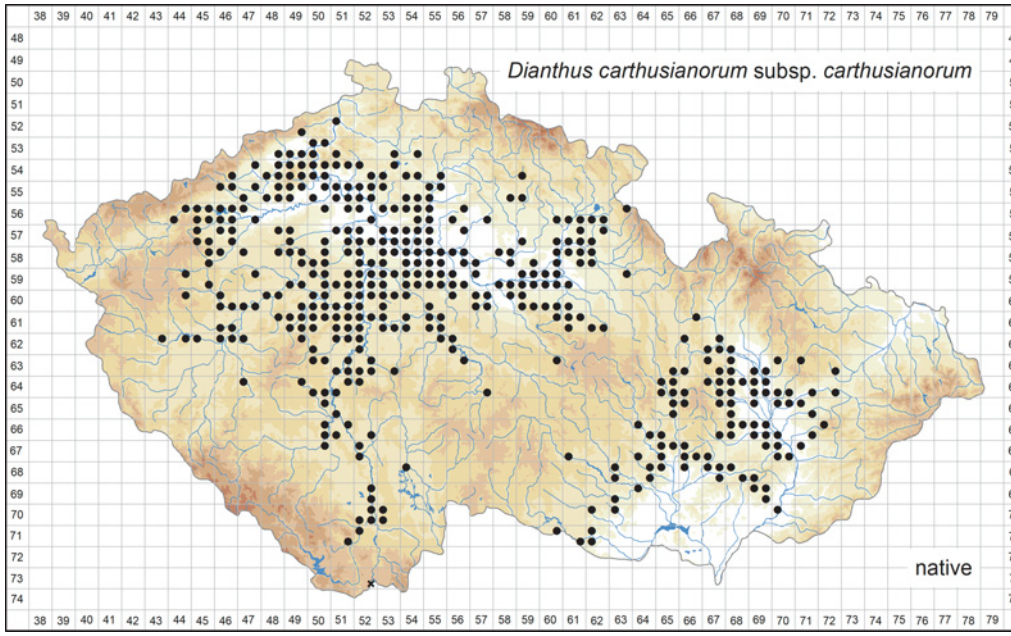

Fig. 17. Distribution of *Dianthus carthusianorum* subsp. *carthusianorum* in the Czech Republic: ● native (432 quadrants), × alien (1 quadrant). Prepared by Jindřich Chrtek Jr.

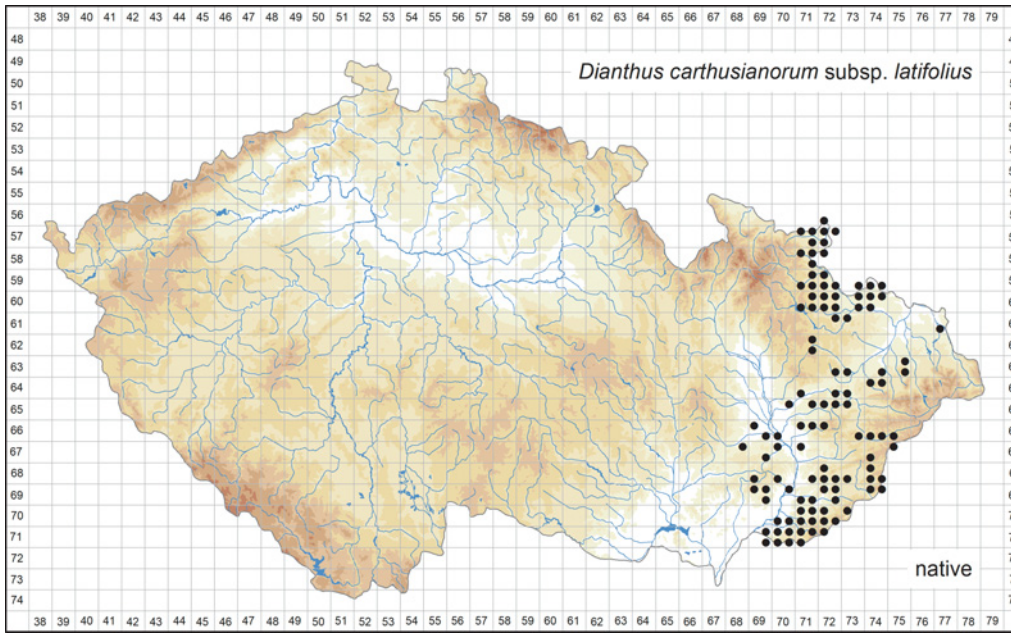

Fig. 18. Distribution of *Dianthus carthusianorum* subsp. *latifolius* in the Czech Republic (109 occupied quadrants). Prepared by Jindřich Chrtek Jr.

Peninsula (records from Sicily are erroneous), Albania and northernmost Bulgaria in the south. Outside Europe, there is one record from northern Anatolia. It has been introduced into Sweden and North America (Reeve 1967, Jalas & Suominen 1986, POWO 2024). The infraspecific taxonomy is complicated and still in a state of flux. Up to about 10 subspecies are recognized (POWO 2024), of which four are distinguished in the Czech Republic: subsp. *carthusianorum*, subsp. *latifolius*, subsp. *capillifrons* and subsp. *sudeticus*.

Dianthus carthusianorum subsp. *carthusianorum* is distributed almost throughout the range of the species. In the Czech Republic it occurs in dry and semi-dry grasslands, on rock outcrops and rocky slopes, in forest margins, less often in open-canopy oak and pine forests. It prefers shallow, dry, loamy, sandy or stony, slightly acidic to basic soils, rather poor in nutrients. *Dianthus carthusianorum* subsp. *carthusianorum* is scattered to common in warm and moderately warm, hilly landscapes, less often lowlands in central, north-western and partly also eastern Bohemia, and locally spreads into higher elevations, especially in deep river valleys. It reaches its elevational maximum of 725 m on the top of Mt Sedlo near the town of Úštěk in the České středohoří Mts (Fig. 17). In Moravia the subspecies is much rarer, and especially in its Carpathian part is replaced by *D. carthusianorum* subsp. *latifolius*.

Dianthus carthusianorum subsp. *latifolius* occurs in the south-eastern Alps and their foothills, the Carpathians and in the north-western part of the Balkan Peninsula (Jalas & Suominen 1986). In the Czech Republic it grows in broad-leaved semi-dry grasslands, mesophilous meadows and pastures on usually deep, loamy to clayey, slightly acidic to basic soils that are moderately rich in nutrients and often calcium-rich. It is widespread in the Bílé Karpaty Mts, from which it extends to northern and north-eastern Moravia and Silesia; westwards it reaches the vicinity of towns of Vyškov and Kojetín in central

Moravia (Fig. 18). The occurrences are at elevations of 210–1,050 m. *Dianthus carthusianorum* subsp. *latifolius* is classified as vulnerable (Grulich 2012).

Dianthus carthusianorum subsp. *capillifrons* is known from serpentine outcrops in eastern Austria (Styria, Burgenland) and the Czech Republic (Jalas & Suominen 1986). In the Czech Republic it is found in open-canopy pine forests and semi-dry grasslands on shallow, gravelly or stony soils with low levels of essential nutrients and high concentrations of heavy metals. It is confined to serpentine outcrops in the vicinity of the town of Křemže in southern Bohemia, the villages of Borovsko and Hrnčíře in south-east-central Bohemia and the village of Raškov in north-western Moravia, where it reaches its elevational maximum at ~600 m (Fig. 16). It is classified as endangered due to its rarity (Grulich 2012).

Dianthus carthusianorum subsp. *sudeticus* is endemic to subalpine grasslands and rocks (graphitic phyllite, schists) on avalanche tracks in the Velká kotlina glacial cirque in the Hrubý Jeseník Mts in northern Moravia at elevations 1,160–1,340 m (Fig. 19). The population comprises several dozen of plants and is threatened by grazing by introduced chamois. The taxon is classified as critically threatened (Grulich 2012).

Dianthus pontederae occurs in central and south-eastern Europe, from southern Moravia and eastern Austria in the north-west to Romania and northern Serbia in the south-east. In the eastern part of its range, there is a large contact zone with other similar taxa, classified as *D. giganteiformis* (or *D. giganteiformis* subsp. *giganteiformis*) and as *D. kladovanus* (or *D. giganteiformis* subsp. *kladovanus*; Jalas & Suominen 1986). The south-eastern limits of the range of *D. pontederae* thus still remain unclear. In the Czech Republic *D. pontederae* grows in dry grasslands, pastures, on forest-steppe slopes and in semi-ruderal grasslands along railways. It prefers dry, loamy to sandy, slightly acidic to basic, nutrient-poor soils. It is native to warm and dry hilly landscapes and less often lowlands in southern, south-eastern and south-western Moravia, reaching its northern distribution limit south of the city of Olomouc and its elevational maximum of 550 m on the top of Mt Děvín in the Pavlovské vrchy hills in southern Moravia (Fig. 20). It is classified as lower risk – near threatened in this country (Grulich 2012). Secondary occurrences are known along railways in southern Bohemia and also in the vicinity of the towns of Litoměřice in north-western Bohemia and Kolín in central Bohemia. Plants from southern Bohemia differ from those in southern Moravia in having a shorter calyx and shorter, dark red petals (in contrast to pink to bright red petals observed in Moravian populations) and correspond to the plants of *D. pontederae* from southern Slovakia and Hungary. Some populations from south-western and central Moravia are likely introgressed by *D. carthusianorum*, resulting in a chaotic situation, which cannot be treated well by conventional taxonomic categories (Kovanda 1984, Greimler & Gutermann 2008).

Seven distribution maps were prepared for *D. carthusianorum* agg. Five maps refer to *D. carthusianorum*. The maps of each subspecies are based on examined herbarium specimens and only selected reliable literature and database records, which renders the maps of *D. carthusianorum* subsp. *carthusianorum* and *D. carthusianorum* subsp. *latifolius* inevitably incomplete. The distribution map of the entire species (Fig. 15) derives from reliable literature and database records at the species level as well as all records accepted for the four subspecies. The distribution map of *D. pontederae* is based on examined herbarium specimens and selected reliable literature and database data. An additional map of *D. carthusianorum* agg. (Fig. 14) includes records assigned to *D. carthusianorum* (incl. its subspecies), *D. pontederae* and *D. carthusianorum* agg. and also covers records from the areas with morphologically intermediate plants.

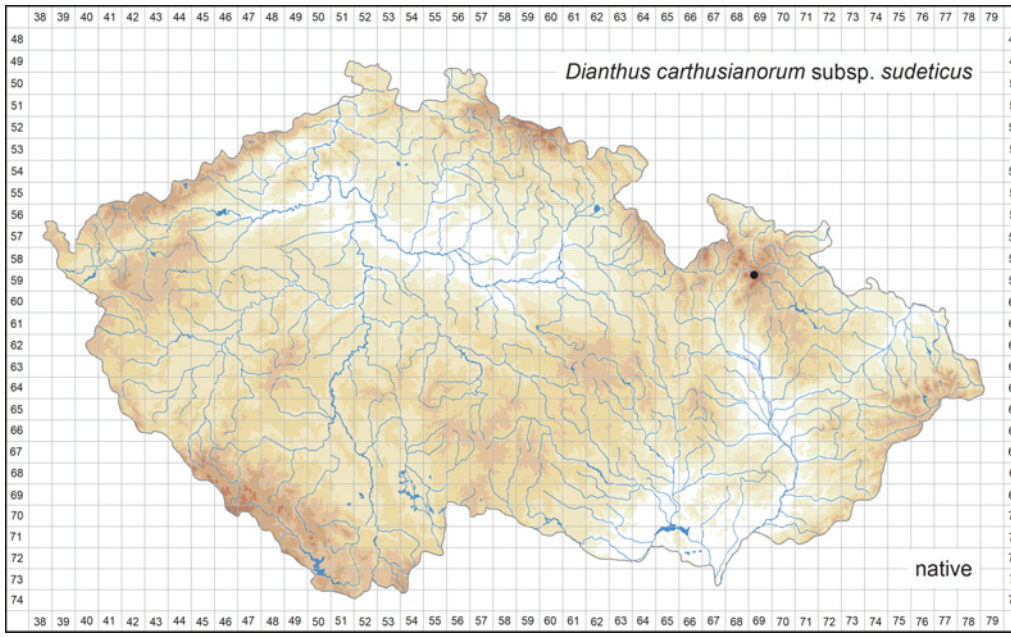

Fig. 19. Distribution of *Dianthus carthusianorum* subsp. *sudeticus* in the Czech Republic (1 occupied quadrant). Prepared by Jindřich Chrtek Jr.

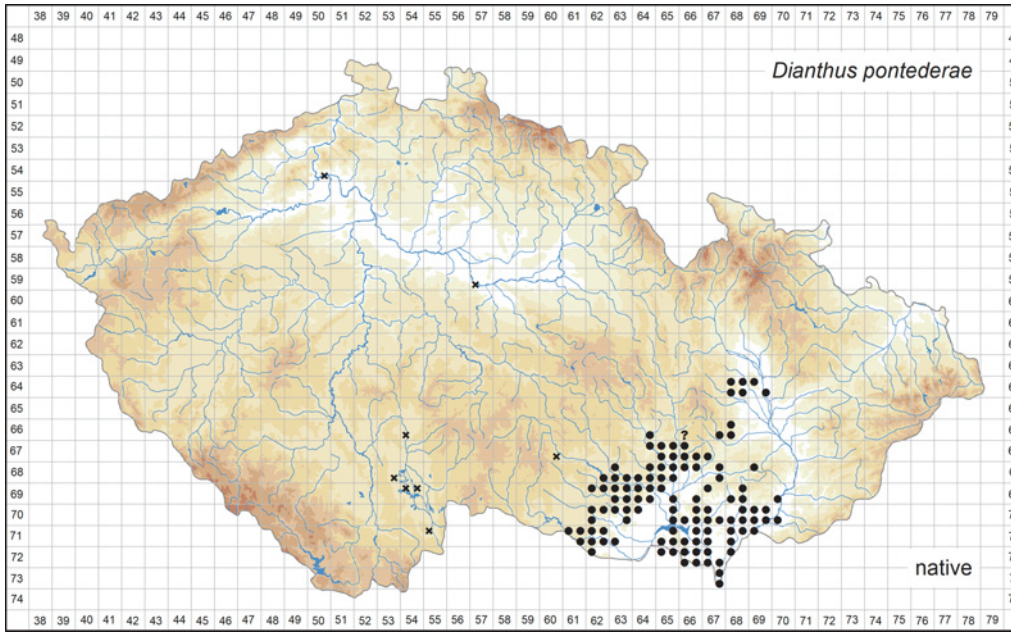

Fig. 20. Distribution of *Dianthus pontederae* in the Czech Republic: ● native (109 quadrants), × alien (8 quadrants). Prepared by Jindřich Chrtek Jr.

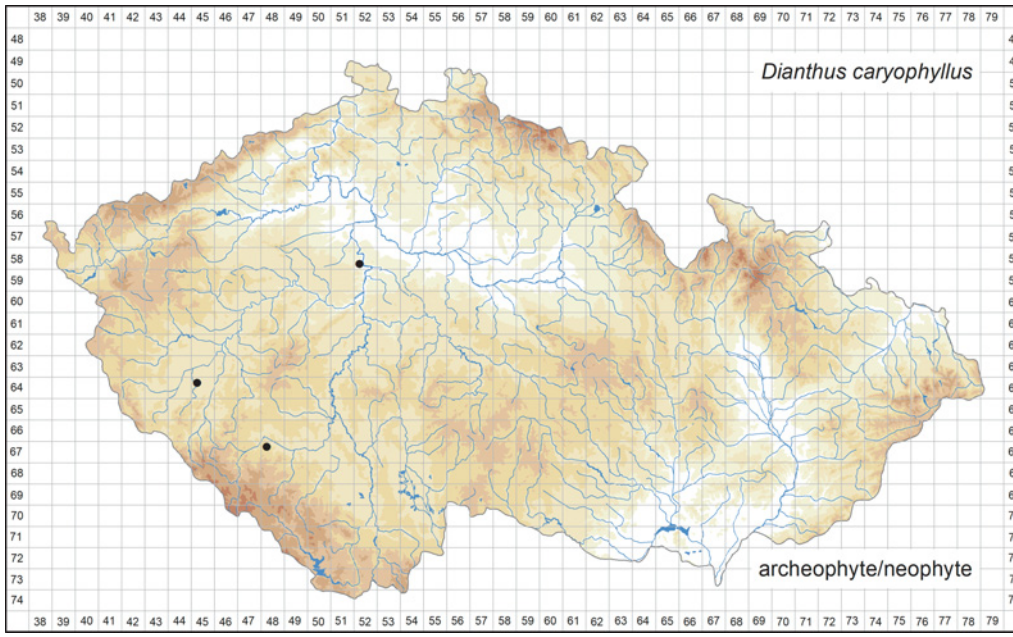

Fig. 21. Distribution of *Dianthus caryophyllus* in the Czech Republic (3 occupied quadrants). Prepared by Jindřich Chrtek Jr.

Dianthus caryophyllus (Fig. 21)

Dianthus caryophyllus is native to the Mediterranean area, but its exact natural range is uncertain due to extensive cultivation (Jalas & Suominen 1986). It is grown as an ornamental (carnations) in many cultivars; the wide range of colours and excellent keeping quality has made it one of the most demanding cut flowers in the world. Escapes from or relicts of cultivation are very rare and usually temporary. In the Czech Republic only a few cases have been recorded of plants that escaped to disturbed places in settlements. *Dianthus caryophyllus* is classified as a casual archaeophyte or neophyte (Pyšek et al. 2022).

Dianthus chinensis (Fig. 22)

Dianthus chinensis is native to northern China, Mongolia, Korea, south-eastern Russia and Kazakhstan (Lu & Turland 2001). Many cultivars are widely cultivated as ornamental garden plants across temperate regions of the world. In the Czech Republic *D. chinensis* is occasionally recorded as escaped on garden waste and at various disturbed sites in settlements and their surroundings. All these occurrences are short-lived. *Dianthus chinensis* is classified as casual neophyte (Pyšek et al. 2022).

Dianthus deltoides (Fig. 23)

Dianthus deltoides is native to most of Europe except its southernmost and northernmost parts and the meadow-steppe zone in Ukraine and the southern part of Russia, and its range extends eastwards to western Siberia. It has been introduced into North America,

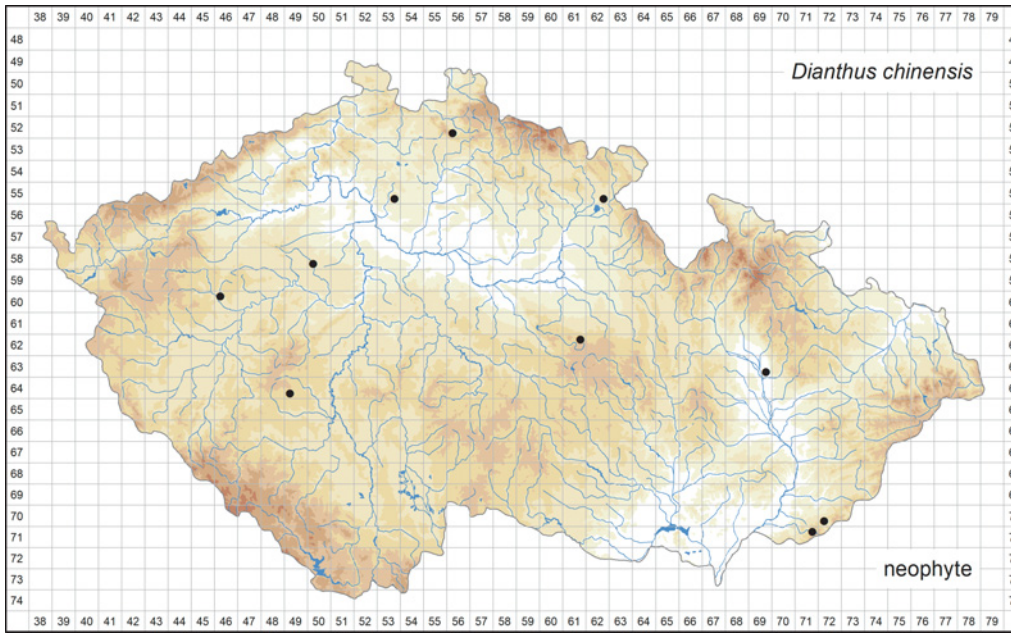

Fig. 22. Distribution of *Dianthus chinensis* in the Czech Republic (10 occupied quadrants). Prepared by Jindřich Chrtek Jr.

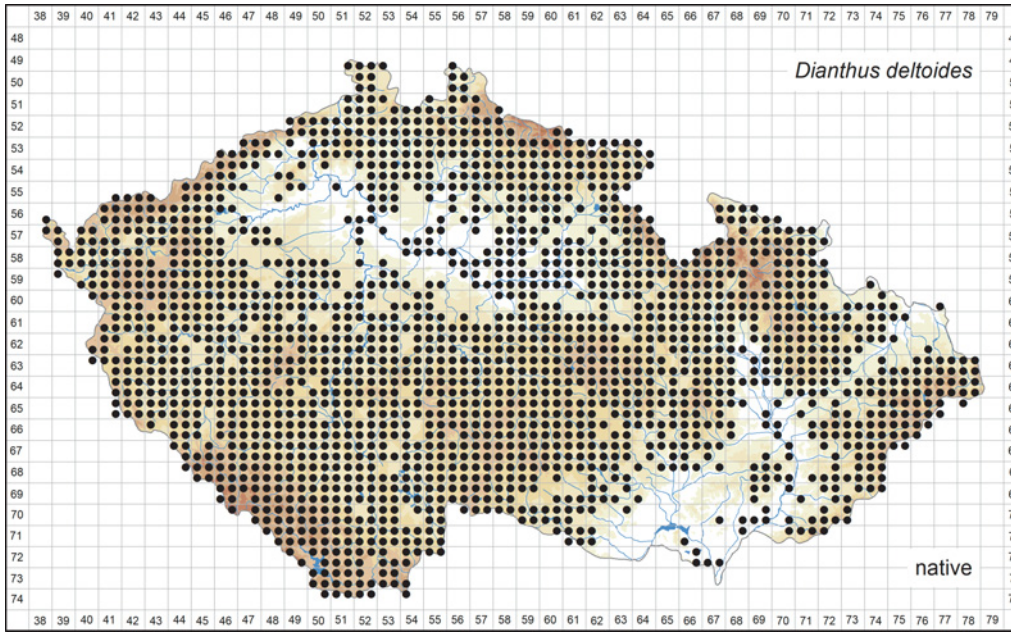

Fig. 23. Distribution of *Dianthus deltoides* in the Czech Republic (1,884 occupied quadrants). Prepared by Jindřich Chrtek Jr.

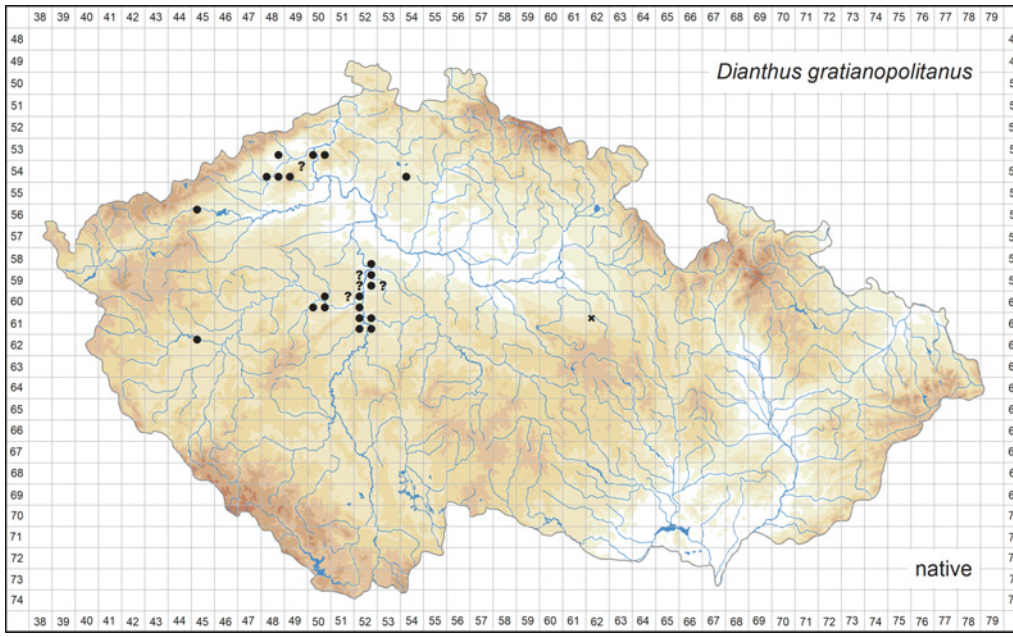

Fig. 24. Distribution of *Dianthus gratianopolitanus* in the Czech Republic: ● native (21 quadrants), × alien (1 quadrant). Prepared by Jindřich Chrtek Jr.

southern Argentina, Transcaucasia, the Russian Far East (Primorye) and New Zealand (Jalas & Suominen 1986, POWO 2024). In the Czech Republic it occurs in dry grasslands, heathlands and pastures, on the edges of dirt roads and on fishpond dams, usually on loamy to sandy, moderately dry, acidic soils, rich in humus and poor in calcium. *Dianthus deltoides* is widespread from the hilly areas to low mountains, especially in Bohemia, but is rare in or locally absent from warm and dry agricultural landscapes in north-western Bohemia and southern Moravia. It is rare to scattered in the mountains, reaching its elevational maximum at 1,320 m in the Hrubý Jeseník Mts.

Dianthus gratianopolitanus (Fig. 24)

Dianthus gratianopolitanus has its core areas of distribution in the French, Swiss and German Jura, from which its highly fragmented range extends to northern forelands of the Alps, southern Belgium and eastwards to the Czech Republic and central Poland; isolated outposts are in southern England and western Ukraine (Meusel et al. 1965, Jalas & Suominen 1986, Putz et al. 2015). In the Czech Republic *D. gratianopolitanus* is a rare thermophilous species occurring on sunny or semi-shaded rocks and steep rocky slopes on dry, slightly acidic to basic, rather nutrient-poor soils developed over basalt, phonolite, schist and limestone. It occurs in the northern part of the Doupovské vrchy hills, the České středohoří Mts, on Bezděz hill, in the Český kras karst area, in the river valleys of the Vltava and its tributaries in Prague and its southern surroundings and in the Mže river valley near the village of Těchoděly at elevations 200–690 m. It has been deliberately planted near the village of Střemošice in eastern Bohemia. *Dianthus gratianopolitanus* is classified as endangered in this country because of its rarity (Grulich 2012).

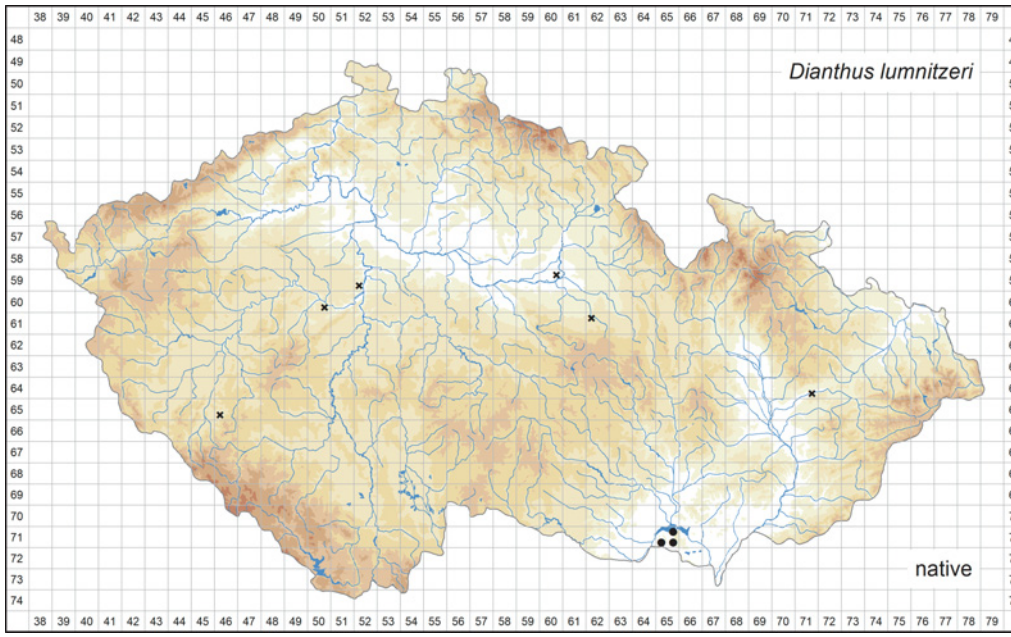

Fig. 25. Distribution of *Dianthus lumnitzeri* in the Czech Republic: ● native (3 quadrants), × alien (6 quadrants). Prepared by Jindřich Chrtek Jr.

Dianthus lumnitzeri (Fig. 25)

Dianthus lumnitzeri occurs in warm hilly landscapes in southernmost Moravia, Lower Austria (Hainburger Berge hills), south-western Slovakia and north-western Hungary (Kmeťová 1985, Jalas & Suominen 1986). In the Czech Republic it grows on limestone rock outcrops and steep rocky slopes on dry, basic soils, rather poor in nutrients. It is native to the Pavlovské vrchy hills in southernmost Moravia, reaching there its elevational maximum at ca 550 m. It has been deliberately planted near the village of Bolešiny in south-western Bohemia, in the Český kras karst area and near the village of Střemošice in eastern Bohemia. Morphologically similar plants have been planted at the Kunětická hora hill in eastern Bohemia and on the ruins of the Helfštýn castle in eastern Moravia. *Dianthus lumnitzeri* is classified as critically threatened due to its rarity (Grulich 2012).

Dianthus moravicus (Fig. 26)

Dianthus moravicus, a species closely related to *D. gratianopolitanus*, is endemic to valleys of the Rokytná, Jihlava (surroundings of the town of Moravský Krumlov), Dyje (near the village of Chvalatice) and Želetavka (near the village of Lubnice) rivers in south-western Moravia (Kovanda 1982, Čeřovský & Grulich 1999). It is confined to rock outcrops and rocky slopes built of carboniferous conglomerates, schist or granodiorites; soils are dry, stony, and poor in nutrients. The sites are situated at elevations of 240–460 m. *Dianthus moravicus* is classified as endangered due to its rarity (Grulich 2012).

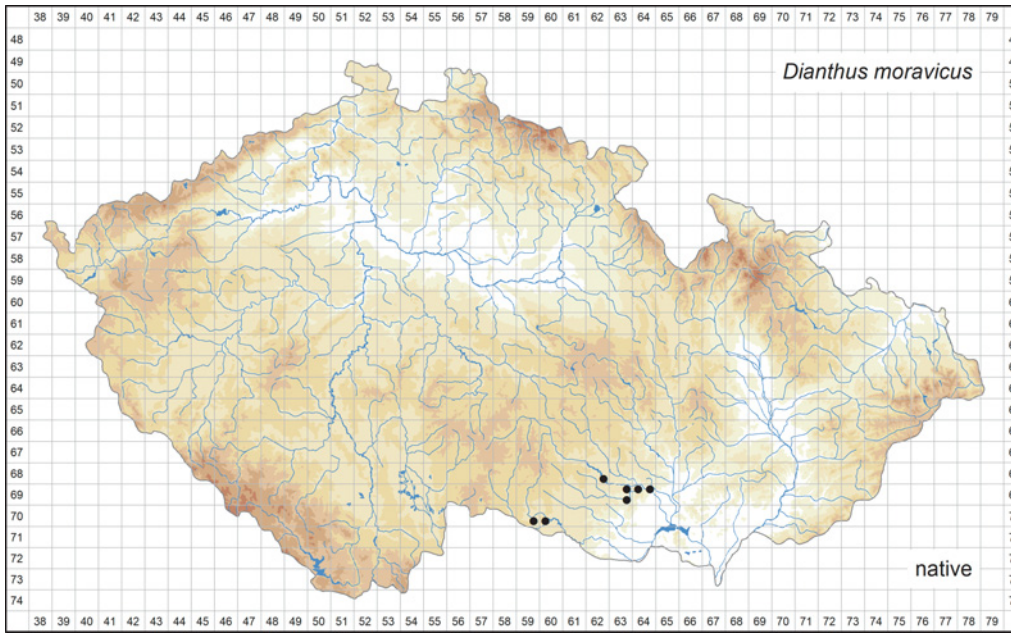

Fig. 26. Distribution of *Dianthus moravicus* in the Czech Republic (7 occupied quadrants). Prepared by Jindřich Chrtek Jr.

Dianthus superbus (Figs 27–29)

Dianthus superbus is a Eurasian species, distributed in the temperate zone from western France in the west to Korea and Japan in the east. In Europe, it is absent from its southern part as well as from the British Isles, most of Scandinavia and the meadow-steppe zone in Ukraine and the southern part of Russia and is rare in the Balkan Peninsula (Jalas & Suominen 1986, POWO 2024). *Dianthus superbus* is a polymorphic species. Several subspecies are recognized (Hardion et al. 2020), of which only subsp. *superbus* and subsp. *alpestris* have been recorded from the Czech Republic with certainty. Late flowering plants from open-canopy forests and forest edges were sometimes assigned to *D. superbus* subsp. *sylvestris*, described from this country. However, the morphological distinction is weak, and delimitation of this taxon is not supported by any molecular markers (Hardion et al. 2020); these plants are thus assigned to the typical subspecies here. They were previously classified as lower risk – data deficient (Grulich 2012).

Dianthus superbus subsp. *superbus* occurs in Europe except for its southern and north-western parts and the meadow-steppe zone in Ukraine and the southern part of Russia. Records from Asia may actually refer to other subspecies (Jalas & Suominen 1986). In the Czech Republic *D. superbus* subsp. *superbus* occurs in intermittently wet meadows, less often also in broad-leaved dry grasslands, open-canopy, mainly deciduous forests, forest fringes and shrub communities. Soils are usually loamy to clayey, basic to slightly acidic, and rich in mineral nutrients. In the past, *D. superbus* subsp. *superbus* was scattered throughout this country from lowlands to middle elevations, especially in

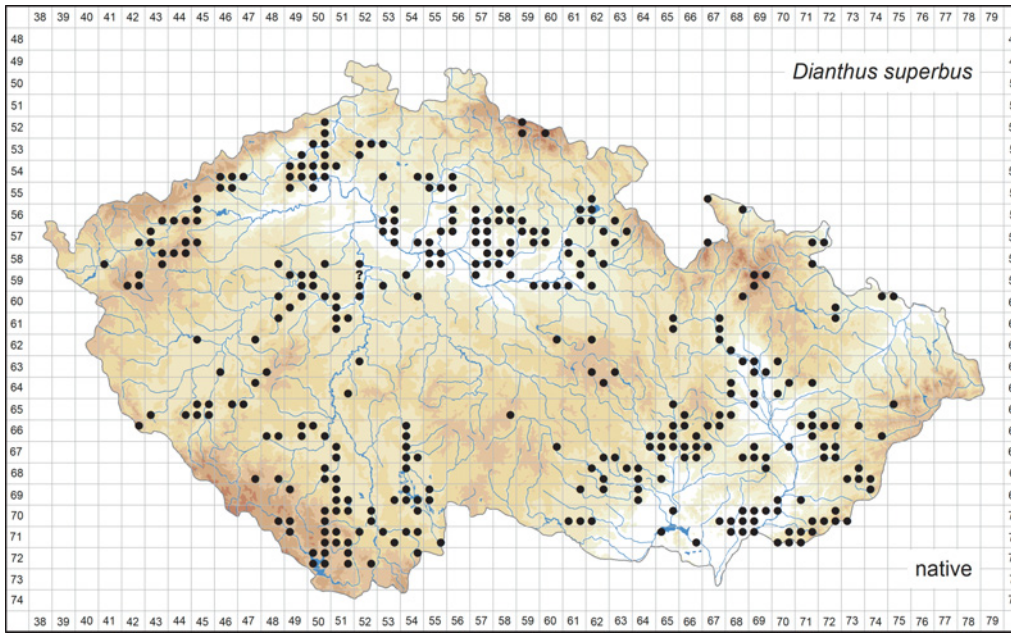

Fig. 27. Distribution of *Dianthus superbus* in the Czech Republic (340 occupied quadrants). Prepared by Jindřich Chrtek Jr.

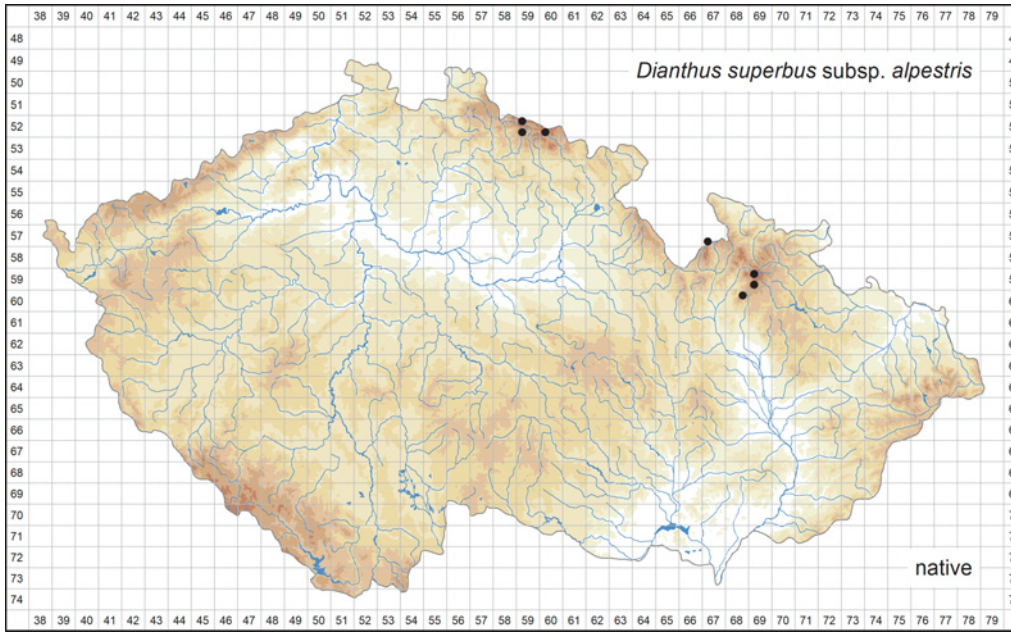

Fig. 28. Distribution of *Dianthus superbus* subsp. *alpestris* in the Czech Republic (7 occupied quadrants). Prepared by Jindřich Chrtek Jr.

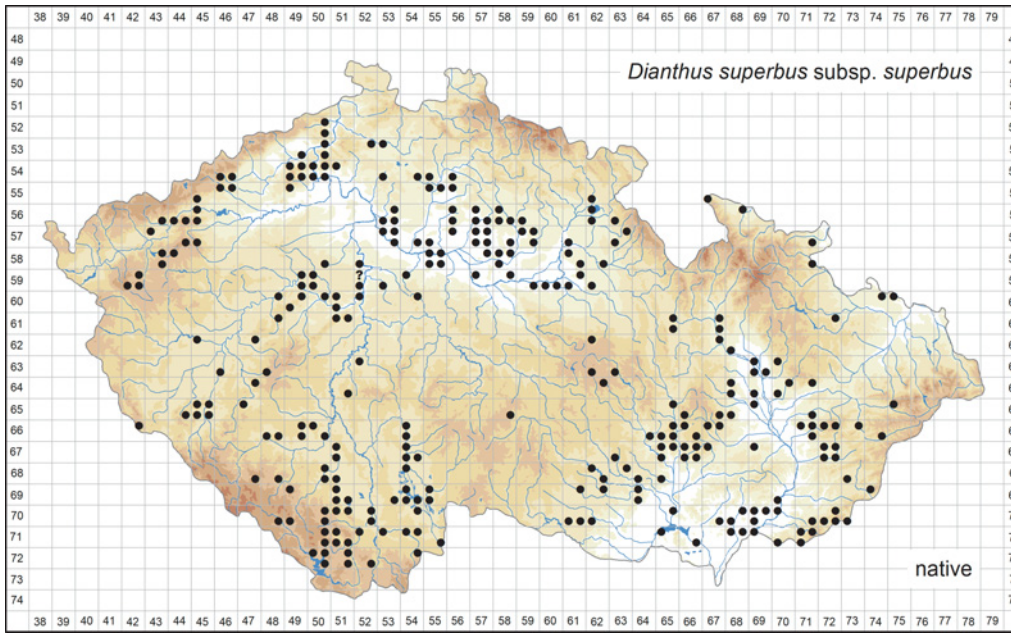

Fig. 29. Distribution of *Dianthus superbus* subsp. *superbus* in the Czech Republic (285 occupied quadrants). Prepared by Jindřich Chrtek Jr.

central-eastern, eastern and southern Bohemia and in some parts of Moravia (Fig. 29). It has declined markedly due to abandonment, drainage and eutrophication of wet meadows and due to closed canopy in forests. This subspecies is therefore classified as endangered in this country (Grulich 2012).

Dianthus superbus subsp. *alpestris* is distributed in high European mountains, namely in the Vosges Mts, the Alps, Sudetes mountains and the Carpathians (Jalas & Suominen 1986). In this country it occurs mainly in subalpine cliff vegetation, grasslands and tall-herb vegetation, often in glacial cirques on base-rich soils supplied with calcium. It is a rare plant in the Krkonoše Mts in north-eastern Bohemia and in the Hrubý Jeseník Mts and Králický Sněžník Mts in northern Moravia at elevations of 850–1,450 m (Fig. 28). Many populations known in the past have vanished (it is locally extinct in the Králický Sněžník Mts), mostly due to succession in subalpine grasslands. *Dianthus superbus* subsp. *alpestris* is classified as critically endangered (Grulich 2012).

Plants morphologically intermediate between *D. superbus* subsp. *alpestris* and *D. superbus* subsp. *superbus* were collected in the surroundings of the town of Solnice in eastern Bohemia.

Three distribution maps were prepared for *D. superbus*. The maps of each subspecies are based on examined herbarium specimens and only selected reliable literature and database records, and thus the map of *D. superbus* subsp. *superbus* is inevitably incomplete. The distribution map of the entire species (Fig. 27) derives from all the available literature and database records for it as well as all records accepted for the subspecies and includes also the morphologically intermediate plants (see above).

Dianthus sylvaticus (Fig. 30)

Dianthus sylvaticus is a member of a taxonomically complex group of *D. seguieri*. The group consists of three taxa, evaluated at either the species or subspecies level, at the latter as *D. seguieri* subsp. *seguieri* (south-western and central Alps), *D. seguieri* subsp. *gautieri* (eastern Pyrenees) and *D. seguieri* subsp. *glaber* (= *D. sylvaticus*; mountains and hilly landscapes of central-western Europe, north of the Alps). For practical reasons, we accept here *D. sylvaticus* at the species level, but its treatment as a subspecies may be more appropriate because the morphological differences between particular taxa are subtle (Fassou et al. 2022, POWO 2024). The disjunct distribution range of *D. sylvaticus* includes the Massif Central and its surroundings, south-eastern and eastern Germany, northwards to the vicinity of the town of Leipzig, and western part of Bohemia (Czech Republic), where it reaches its eastern limit of native distribution (Jalas & Suominen 1986). In the Czech Republic *D. sylvaticus* grows in open-canopy forests, forest fringes, shrub communities and mesic grasslands. It prefers loamy, loamy-sandy to clayey, moderately humid, acidic to slightly basic and usually calcium-free soils. It occurs discontinuously in the western part of Bohemia; the eastern limit runs roughly from the town of Mimoň in the north, via Prague to the vicinity of the town of Třeboň in the south. It is locally common in the north-eastern part of the Krušné hory Mts and in the serpentine area in the Slavkovský les hills, and scattered to rare in the westernmost Bohemia (surroundings of the town of Cheb), surroundings of the city of Plzeň, in the hilly areas west, south-west and south of Prague, and in the southern Bohemia; several localities are also in the České středohoří Mts and in the Ralská pahorkatina hills between the towns of

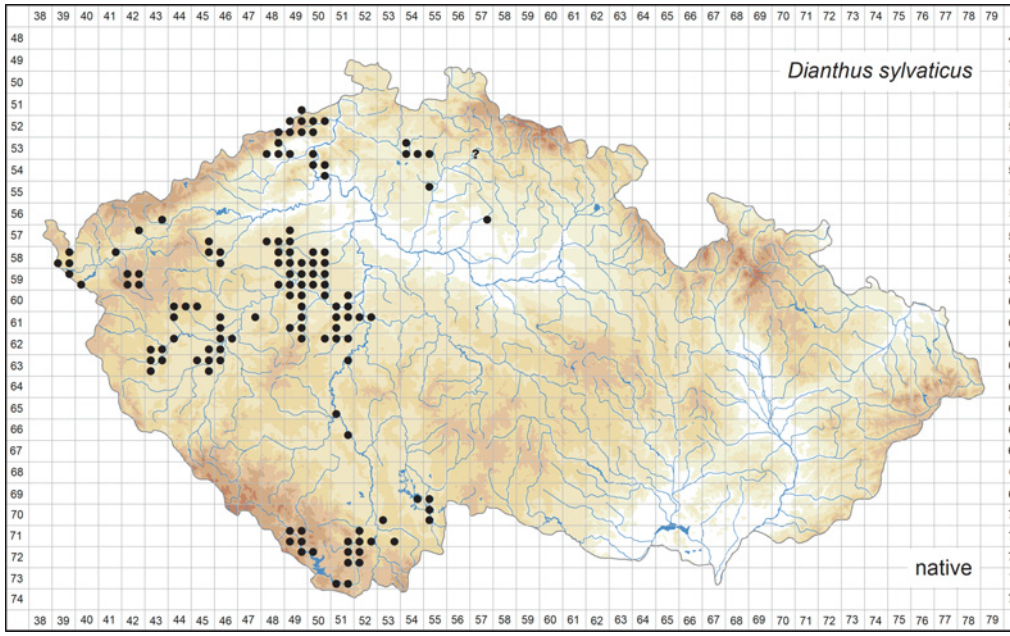

Fig. 30. Distribution of *Dianthus sylvaticus* in the Czech Republic (126 occupied quadrants). Prepared by Jindřich Chrtek Jr.

Česká Lípa and Mladá Boleslav. Populations of *D. sylvaticus* are threatened by abandonment of meadows and pastures and by afforestation, but also by overgrazing. *Dianthus sylvaticus* has declined in some areas and is therefore classified as vulnerable in this country (Grulich 2012).

Glaux maritima (Fig. 31)

Glaux maritima has a circumpolar distribution encompassing the coasts of western and northern Europe, eastern Asia, and western and eastern North America, as well as inland saline habitats in eastern Europe, Siberia, central Asia, northern China, Mongolia and North America. It also occurs scattered in inland saline habitats across western and central Europe, particularly in Germany, western Poland, the Czech Republic and Slovakia (Meusel et al. 1978). In the Czech Republic *G. maritima* grows in wet saline pastures in the past grazed mainly by geese and ducks, often in villages along ditches and streams and around fishponds, at ruderal trampled sites in settlements and around mineral springs. Soils are usually heavy, well-moistened in the spring but often becoming dry during the summer, basic, moderately rich in nutrients and saline. Most occurrences of *G. maritima* in the Czech Republic are situated in the warmest and driest parts of the country where arid climates combine with the presence of soluble salts (sulphates rather than chlorides) in the geological substrate and suitable geomorphology. The species reaches its elevational maximum at 449 m in the Soos National Nature Reserve near the town of Františkovy Lázně in western Bohemia, but all other occurrences are in lowlands and adjacent hilly areas below 250 m. In the past, *G. maritima* was locally common in

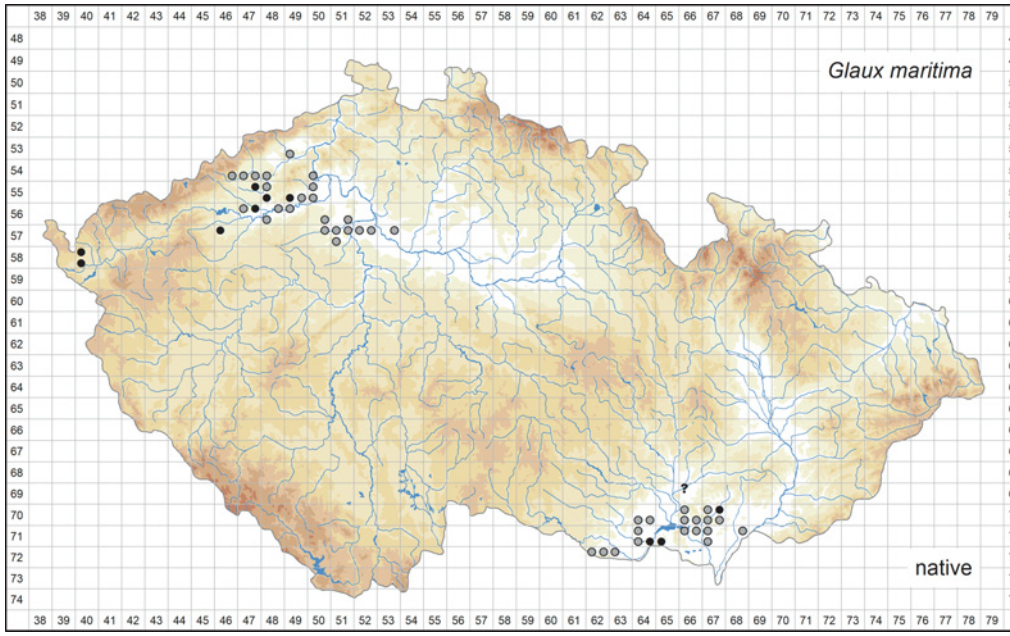

Fig. 31. Distribution of *Glaux maritima* in the Czech Republic: ● at least one record in 2000–2024 (10 quadrants), ● pre-2000 records only (41 quadrants). Prepared by Jiří Danihelka, Petr Hubatka & Pavel Dřevojan.

north-western and northern central Bohemia, as well as in southernmost Moravia in a triangle between the towns of Znojmo, Židlochovice and Hodonín. The occurrence near the town of Františkovy Lázně, where *G. maritima* occurs around mineral springs, is spatially separated from the other sites. A decline of *G. maritima* started as early as the late 19th century, with drainage, abandonment of pastures, and later the paving of public spaces being the main causes. Since the year 2000 the occurrence of *G. maritima* has been confirmed at about seven sites in Bohemia and at three sites in southern Moravia with most of the populations consisting of only small numbers of plants. The species is classified as critically threatened (Grulich 2012) due to its decline.

Inula britannica (Fig. 32)

Inula britannica is native to temperate regions of Eurasia. It occurs from north-eastern Spain in the west to the Lena river and Sakhalin in the east, extending north to southern Sweden, southern Finland and Karelia, and south to northern Greece, Anatolia, Iraq, northern Iran and Central Asia (Hultén & Fries 1986, Meusel & Jäger 1992, Santos-Vicente et al. 2019). In the Czech Republic *I. britannica* grows mainly in various types of mesic meadows and pastures, most frequently in the floodplains of lowland rivers and intermittently wet *Molinia* meadows, saline meadows, halophilous reed and sedge beds, and other types of wetlands and riverine herbaceous vegetation, and vegetation of wet, disturbed soils. It also occurs in perennial thermophilous ruderal communities and some other types of ruderal and semiruderal vegetation, often in settlements. Soils are usually heavy, well-moistened but may dry out in summer, usually basic and nutrient-rich, often

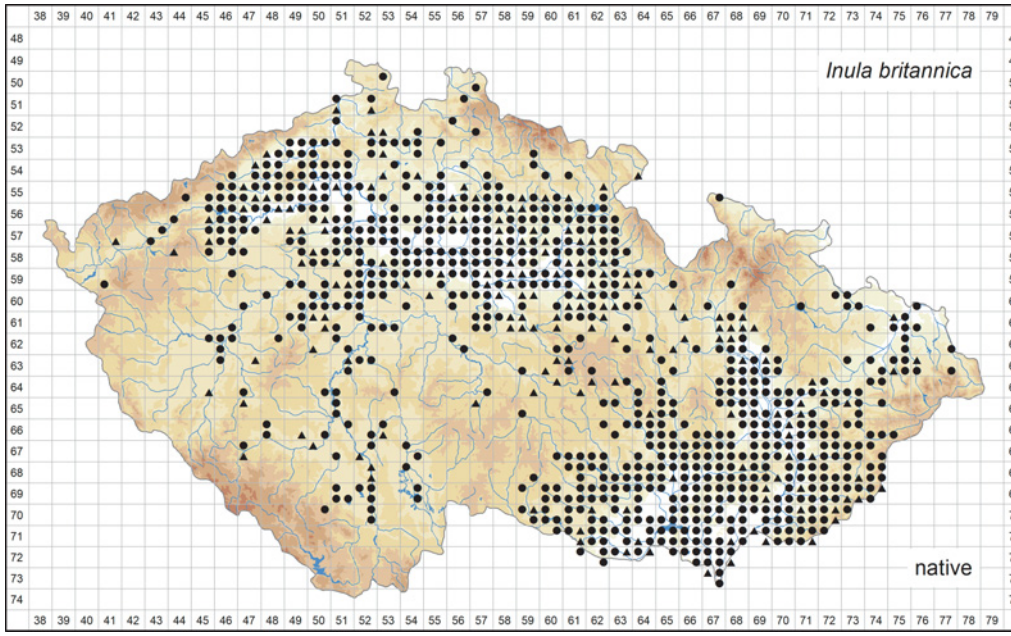

Fig. 32. Distribution of *Inula britannica* in the Czech Republic: ● occurrence documented by herbarium specimens (727 quadrants), ▲ occurrence based on other records (173 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

with a low content of soluble salts. *Inula britannica* is widespread in the Czech Republic. It is almost continuously distributed in the lowlands and hilly areas with warm to moderately warm climates. In contrast, it is almost absent from large parts of western, southwestern and southern Bohemia. At least some of the scattered records in landscapes with fishponds may be due to casual introductions. The same applies to records in and around railway stations, in villages, along roads and around farms at middle elevations. Most of the records are from elevations of up to 500 m, with a maximum of ~710 m on the shores of Medlovský fishpond near the village of Tři Studně in the Žďárské vrchy hills; however, this occurrence may be secondary. *Inula britannica* is reported to hybridize with *I. oculus-christi* (*I.* ×*magyarica*; Hrouda 2004) in the Czech Republic, but the corresponding specimen in the herbarium PR from Květnice hill near the town of Tišnov, southern Moravia, is most likely a hairy specimen of *I. britannica* collected from a dry habitat.

Inula conyzae (Fig. 33)

Inula conyzae is native to western, central and south-eastern Europe, as well as to Crimea, the Caucasus Mts and Transcaucasia. In Europe it is almost continuously distributed from northern Portugal and Great Britain to eastern Romania and Bulgaria; it occurs as far north as northern England and is known from Sardinia and northern Sicily in the south, possibly also from the Sierra Nevada Mts in southern Spain (Hultén & Fries 1986, Meusel & Jäger 1992). In the Czech Republic *I. conyzae* occurs in open-canopy forests, mainly thermophilous oak forests and limestone beech forests, on mobile calcareous screes, in dry grasslands, thermophilous forest fringe vegetation, tall mesic and xeric

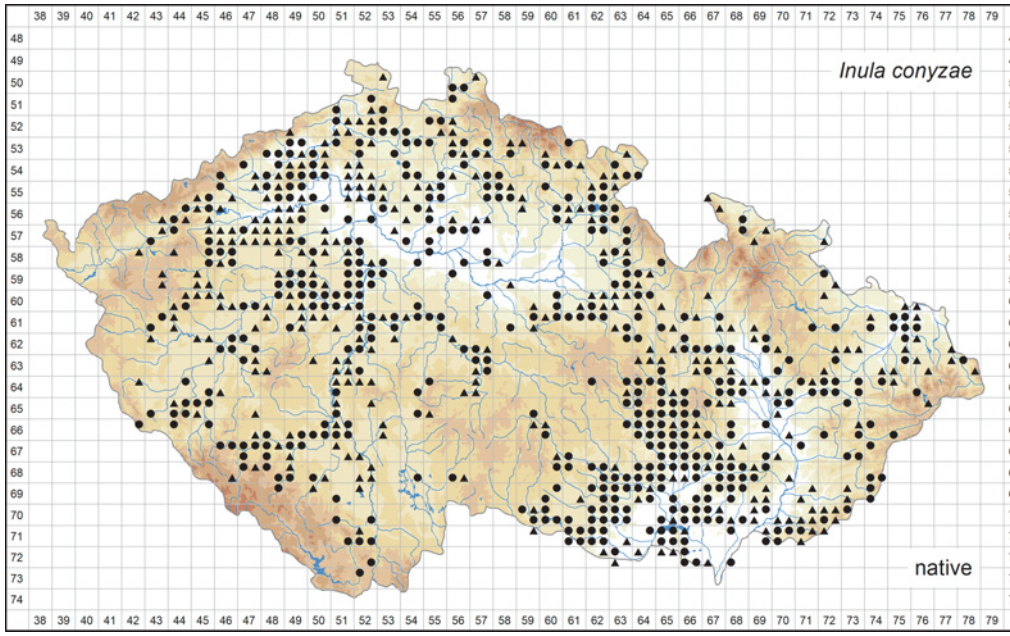

Fig. 33. Distribution of *Inula conyzae* in the Czech Republic: ● occurrence documented by herbarium specimens (462 quadrants), ▲ occurrence based on other records (324 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

scrub, as well as in thermophilous ruderal vegetation. The soils are shallow to moderately deep, fresh, slightly acidic to basic and relatively nutrient-poor. *Inula conyzae* is the most widespread species of the genus in the Czech Republic. It occurs mainly in hilly areas, while largely avoiding alluvial landscapes, deforested lowlands, and hilly landscapes with nutrient-poor and acidic soils covered by coniferous plantations, such as those in the Českomoravská vrchovina highlands. In such areas occurrences of *I. conyzae* are confined to abandoned limestone quarries, outcrops of relatively mineral-rich rocks along river valleys and castle hillsides. The occurrences on castle hillsides may be partly secondary, as this species was used as a medicinal plant (for delousing and other purposes) in the Middle Ages (Matthiolus 1562: f. 241 as *Conyza maior*). Most of the species' occurrences are at elevations below 600 m, with the maximum elevations reaching ~880 m at the castle ruin Kašperk, north of the town of Kašperské Hory in southern Bohemia, and ~820 m north of the village of Staré Hamry in the Moravskoslezské Beskydy Mts in north-eastern Moravia. *Inula conyzae* hybridizes with *I. oculus-christi* (*I.* ×*suaveolens*). This hybrid, which is easy to identify, has been recorded at a dozen sites in southern Moravia where both species co-occur (Fig. 44).

Inula ensifolia (Fig. 34)

Inula ensifolia is a Pontic-Pannonian species native mainly to south-eastern Europe, occurring almost continuously from northern Italy in the west to the Dniester river and Black Sea coast in Romania and Bulgaria, as well as Crimea in the east, extending sporadically eastward as far as the Volga river. Its northern distribution limit in central Europe runs

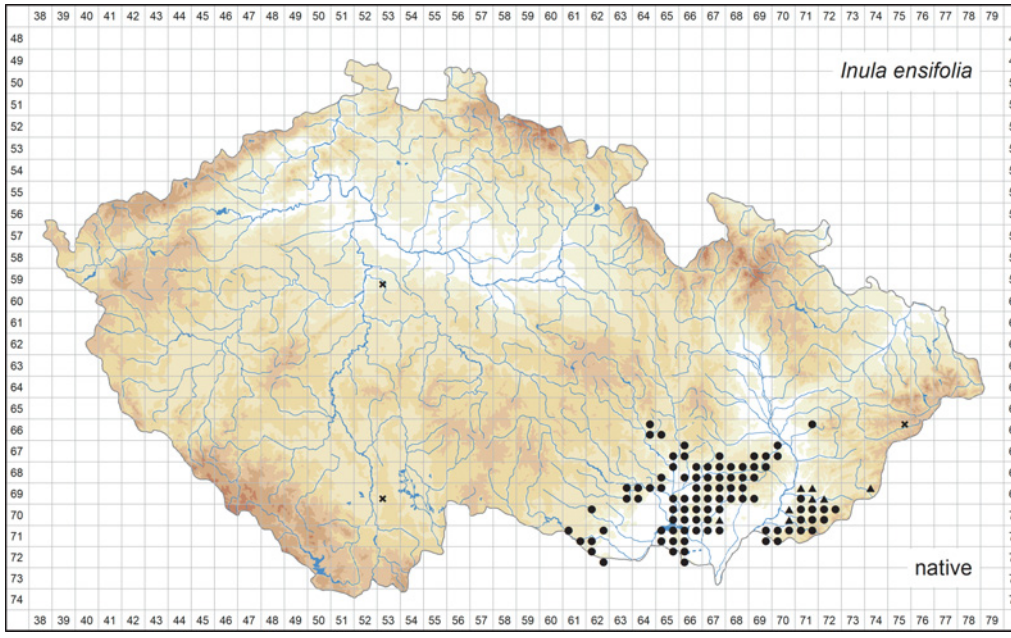

Fig. 34. Distribution of *Inula ensifolia* in the Czech Republic: ● native, occurrence documented by herbarium specimens (90 quadrants), ▲ native, occurrence based on other records (8 quadrants), × alien only (3 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

through Lower Austria, southern Moravia, Slovakia and south-eastern Poland, while its southern limit extends through northern Albania, North Macedonia and northern Greece. Isolated occurrences exist on the island of Gotland in the Baltic Sea. Outside Europe it occurs in northern Anatolia (Hultén & Fries 1986, Meusel & Jäger 1992). In the Czech Republic *I. ensifolia* grows on mobile calcareous screes, various types of dry grasslands, thermophilous forest fringe vegetation, some scrub communities, and open thermophilous oak and pine forests on basic substrates. The soils are dry to well moistened, mostly calcium-rich and relatively nutrient-poor. In this country *I. ensifolia* occurs in south-western, southern and south-eastern Moravia, towards the north reaching to Květnice hill north-west of the town of Tišnov. One or two outlying populations likely existed north-east of the town of Holešov in central Moravia. The occurrence north of the town of Velké Karlovice in the Javorníky Mts in eastern Moravia at an elevation of 620 m was first recorded in 1999 and is certainly secondary, as is the recent occurrence at the north-eastern outskirts of the city of České Budějovice in southern Bohemia. Most native occurrences of *I. ensifolia* are from elevations 200–450 m, with the highest recorded at ~540 m near the village Komňa in the Bílé Karpaty Mts. *Inula ensifolia* is classified as vulnerable (Grulich 2012), likely due to its limited distribution within the country. Still, many abundant populations are located in protected areas with appropriate management, and no considerable decline has been observed yet. *Inula ensifolia* hybridizes with *I. germanica* (*I.* ×*hybrida*; Fig. 40), *I. hirta* (*I.* ×*hausmannii*; Fig. 39) and *I. salicina* (*I.* ×*stricta*; Fig. 43), with the latter being a rather common *Inula* hybrid in southern Moravia.

Inula germanica (Fig. 35)

Inula germanica is a Pontic-Pannonian species with a range centred around the Black Sea, almost continuously occurring from southern Moravia, Lower Austria and the central part of the Balkan Peninsula in the west to the southern Ural Mts in the east, and extending southwards to central Greece, Crimea and the northern foothills of the Caucasus Mts. In Asia it occurs in Transcaucasia and sporadically in Anatolia and westernmost Kazakhstan. In central Europe isolated populations are found in Bohemia and in the Thuringian Forest, the Harz Mts and central Rhineland (the westernmost occurrence) in Germany; in addition, there is an isolated occurrence above the right bank of the Odra river near the village Bielinek in westernmost Poland (Hrouda 1972, Meusel & Jäger 1992). In the Czech Republic *I. germanica* grows in dry grasslands, primarily narrow-leaved subcontinental steppes and broad-leaved dry grasslands, thermophilous forest fringe vegetation, as well as in tall mesic and xeric scrub and low xeric scrub. It is rarely found also in open-canopy thermophilous oak forests and thermophilous ruderal vegetation. The soils are dry to well-moistened, usually basic and poor to moderately rich in nutrients. In this country *I. germanica* occurs in the areas with the warmest and driest climates, namely north-western and central Bohemia, as well as southern Moravia. In Bohemia occurrences of *I. germanica* are concentrated in the southern part of the České středohoří Mts, in the hilly landscapes along the Ohře river and along the Vltava river valley between the town of Veltrusy in the north and the southern outskirts of Prague in the south. There are some outposts, with uncertain status, in the Český kras karst area and in eastern central Bohemia. In southern Moravia *I. germanica* mainly occurs in the hilly landscapes toward the south, south-east and east of the city of Brno, as well as along the

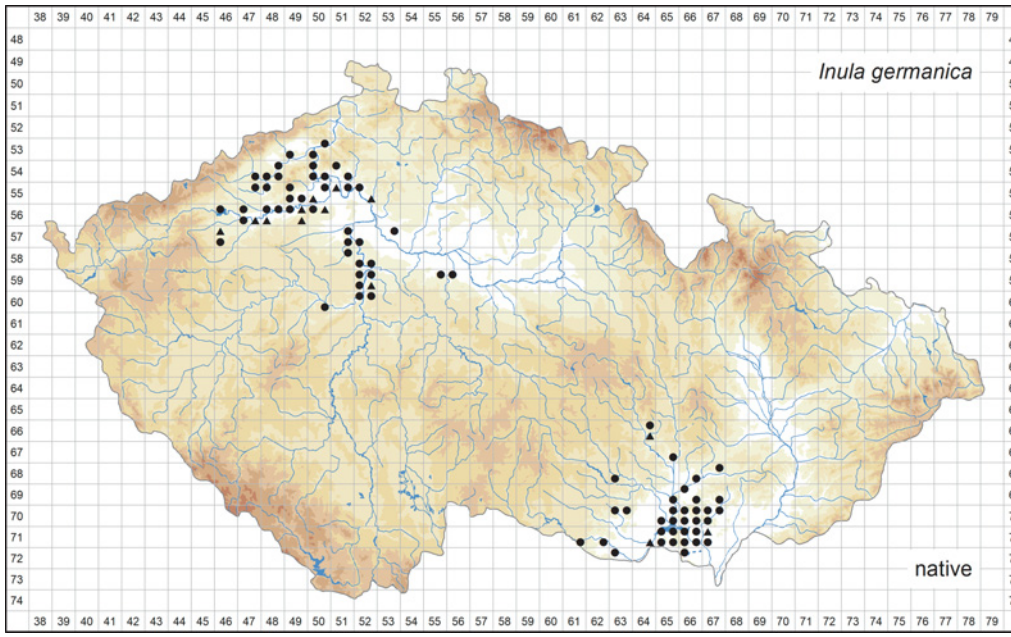

Fig. 35. Distribution of *Inula germanica* in the Czech Republic: ● occurrence documented by herbarium specimens (77 quadrants), ▲ occurrence based on other records (13 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

south-western margin of the Českomoravská vrchovina highlands near the town of Znojmo and north-west of it. A few isolated sites are found at the northern outskirts of Brno and near the town of Tišnov. Most occurrences are situated at elevations of 200–350 m, with the lowest at 164 m on sandy hummocks in the Dyje river floodplain north of the village of Bulhary in southern Moravia and the highest at ~440 m, north of the village of Dolní Zálezly in north-western Bohemia. *Inula germanica* is classified as endangered due to both its rarity and decline (Grulich 2012). It hybridizes with *I. ensifolia* (*I.* ×*hybrida*; Fig. 40) and *I. salicina* (*I.* ×*media*; Fig. 41).

Inula hirta (Fig. 36)

Inula hirta is a Euro-Siberian species. In Europe it is distributed from central France in the west to the southern Ural Mts in the east, southwards reaching the North Apennines in Italy and northern Greece in the Balkan Peninsula, and northwards central Germany and northern Poland. It is also found in the northern foothills of the Caucasus Mts. Particularly the northern part of its European range is very discontinuous. Its Asian range includes the temperate part of western Siberia, eastward reaching Tyumen province (Meusel & Jäger 1992). In the Czech Republic *I. hirta* grows in various types of dry grasslands, fringe vegetation of thermophilous forests, open canopy tall mesic and xeric scrub, low xeric scrub and open-canopy basiphilous thermophilous oak forests. The soils are usually dry to fresh, basic and relatively nutrient poor. In this country *I. hirta* is found at locally varying frequencies in the areas with warm and dry to moderately dry climates, i.e. in the hilly landscapes of north-western, central and eastern Bohemia, and central and southern

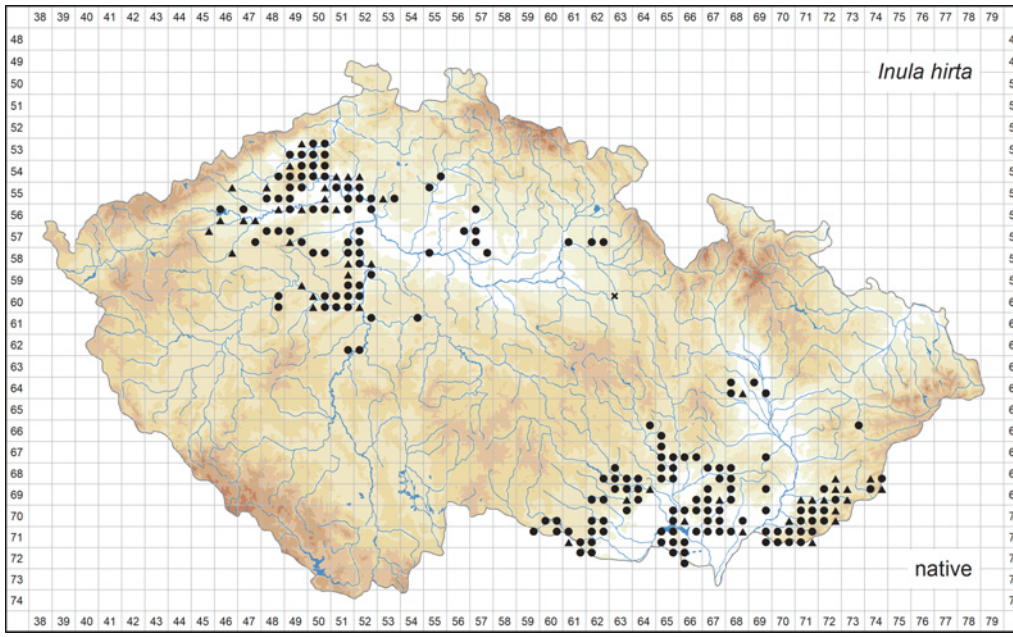

Fig. 36. Distribution of *Inula hirta* in the Czech Republic: ● native, occurrence documented by herbarium specimens (167 quadrants), ▲ native, occurrence based on other records (46 quadrants), × alien only (1 quadrant). Prepared by Jiří Danihelka & Hana Galušková.

Moravia. Most of the occurrences are situated at elevations of 200–550 m, with the lowest at ~175 m on the slopes above the Labe river south of the town of Libochovany in northern Bohemia and the highest at 630–640 m on Lipská hora hill in the České středohoří Mts in north-western Bohemia and east of the village of Nedašov in the Bílé Karpaty Mts in eastern Moravia. *Inula hirta* is classified as vulnerable (Grulich 2012). *Inula hirta* hybridizes with *I. ensifolia* (*I.* ×*hausmannii*; Fig. 39), and *I. salicina* (*I.* ×*rigida*; Fig. 42), with the latter being the most common *Inula* hybrid in the Czech Republic.

Inula oculus-christi (Fig. 37)

Inula oculus-christi is a Pontic-Pannonian species. In Europe it occurs in the Balkan Peninsula, Romania, Moldova and south-eastern Ukraine including Crimea, extending eastward as far as the Volga river in southern Russia and the northern foothills of the Caucasus Mts. In Asia it occurs from Anatolia in the west to north-western Iran in the east, as well as in Transcaucasia and the Caucasus Mts themselves. In central Europe isolated occurrences exist in the western part of the Pannonian basin in Hungary and Slovakia, north-westward extending to Lower Austria and southern Moravia (Hrouda 1974a, Meusel & Jäger 1992). In the Czech Republic *I. oculus-christi* grows in various types of dry grasslands, thermophilous forest fringe vegetation and on mobile calcareous screes. It occurs less frequently in low xeric scrub and openings of basiphilous thermophilous oak forests. The soils are usually dry, basic and nutrient-poor. In the Czech Republic *I. oculus-christi* is found only in southern Moravia along the south-eastern margin of the Českomoravská vrchovina highlands, mainly along narrow river valleys with rock outcrops, as

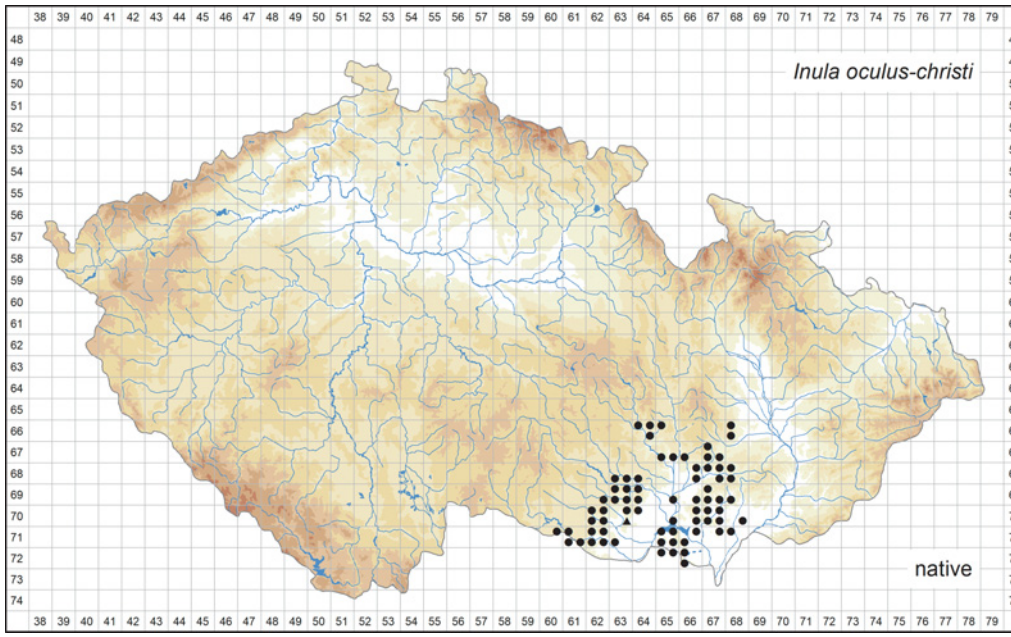

Fig. 37. Distribution of *Inula oculus-christi* in the Czech Republic: ● occurrence documented by herbarium specimens (70 quadrants), ▲ occurrence based on other records (1 quadrant). Prepared by Jiří Danihelka & Hana Galušková.

well as in the hilly landscapes south of the city of Brno and in the Pavlovské vrchy hills and their surroundings. The northernmost populations are situated near the town of Tišnov, north-west of Brno. Most occurrences are at elevations of 200–500 m, with the highest elevation on Děvín hill in southernmost Moravia at ~530 m. *Inula oculus-christi* is classified as vulnerable (Grulich 2012). It hybridizes with *I. conyzae* (*I.* ×*suaveolens*; Fig. 44).

Inula salicina (Fig. 38)

Inula salicina is a Eurasian temperate species. It occurs from the northern part of the Iberian Peninsula in the west to Japan in the east, extending as far north as 60°N in Siberia, with isolated occurrences reaching the Lena river. It is also found in the Caucasus Mts and Transcaucasia, extending south-east to northern Iran. In Europe this species extends northwards to northern France, northern Germany, southern Scandinavia and the Baltic countries, and southwards to central Italy, Corsica and northern Greece (Hultén & Fries 1986, Meusel & Jäger 1992). Four subspecies are often recognized (e.g. Meusel & Jäger 1992, Gubanov 1994). The typical subspecies is found over almost the entire range of the species, but some authors separate the populations found in China and Japan as subsp. *asiatica* (e.g. Meusel & Jäger 1992). Narrow-leaved plants from sandy habitats are often separated as subsp. *sabuletorum*, first described from southern Ukraine. This subspecies is reported to occur discontinuously in sandy habitats from the Pannonian basin in the west to Lake Balkhash in the east. The subsp. *aspera* is reported to occur in dry grasslands and steppes in the southern part of the species' range from central Italy in the west

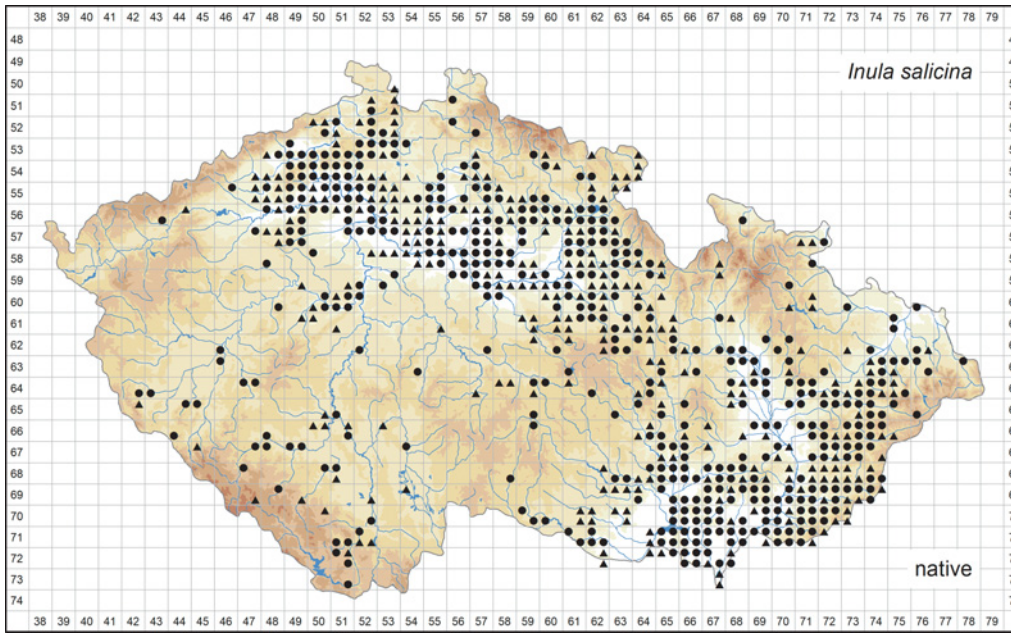

Fig. 38. Distribution of *Inula salicina* in the Czech Republic: ● occurrence documented by herbarium specimens (446 quadrants), ▲ occurrence based on other records (287 quadrants). Prepared by Jiří Danihelka & Hana Galušková.

to eastern Kazakhstan in the east, including the Caucasus Mts, Transcaucasia and northern Iran. However, the infraspecific taxonomy of *I. salicina* is disputed. Morphological characters given in floras and taxonomic studies for particular subspecies are sometimes even contradictory (cf. Hrouda 1974b, 2004, Ball & Tutin 1976, Gubanov 1994). Additionally, some authors (e.g. Gubanov 1994) noted the occurrence of "various transitory specimens", which results in identification difficulties. Hrouda (2004) assigned most populations found in the Czech Republic to subsp. *salicina*, while recording subsp. *aspera* at two sites in southern Moravia. However, broad-leaved specimens corresponding to the description given by the cited author rarely occur within the populations of *I. salicina* in various parts of this country and show no clear spatial pattern. In our opinion, they represent extreme cases of continuous variation and do not warrant taxonomic recognition. Consequently, we assign all populations of *I. salicina* occurring in this country to its typical subspecies. In the Czech Republic *I. salicina* grows mainly in intermittently wet meadows, broad-leaved dry grasslands, thermophilous forest fringe vegetation, limestone beech forests, peri-Alpidic basiphilous and subcontinental thermophilous oak forests. The soils are usually rather heavy, fresh, basic and moderately nutrient-rich. In the Czech Republic *I. salicina* occurs in the areas with warm to moderately warm climates, avoiding acidic soils. It is absent from the mountains and rare in large parts of the hilly landscapes in western and southern Bohemia. In these areas it is found only at locations where calcareous or other mineral-rich rocks occur or, possibly, also due to introductions. *Inula salicina* mainly occurs at elevations of 150–600 m, with a minimum elevation of ~150 m reached in the Dyje river floodplain south of the town of Lanžhot and maximum

elevations of 700–730 m reached at several sites in south-western Bohemia and eastern Moravia. *Inula salicina* subsp. *salicina* is classified as lower risk – near threatened (Grulich 2012). The distribution map includes all types of records; however, records not documented by a herbarium specimen may be erroneous due to frequent confusion with *I. britannica*. *Inula salicina* hybridizes with *I. ensifolia* (*I.* ×*stricta*; Fig. 43), *I. germanica* (*I.* ×*media*; Fig. 41) and *I. hirta* (*I.* ×*rigida*; Fig. 42).

Inula hybrids (Figs 39–44)

Inula hybrids have been given consistent attention in national and local floras since the late 19th century (e.g. Oborny 1886, Dostál et al. 1948–1950), including more recent accounts (e.g. Hrouda 2004). They were treated in detail by Beck (1891), who provided morphological descriptions, along with discussions on their morphological variation, including formal classifications, and information on their distributions. Hybrids between *Inula* species are quite common where two or more species co-occur. As most of the species involved are clonal long-living perennials, the hybrids are also perennials and may form large patches due to vegetative spread. However, so far only hybrids between the species with the same ploidy level have been documented in central Europe. Among the seven *Inula* species native to the Czech Republic, there are four diploids (*Inula ensifolia*, *I. germanica*, *I. hirta* and *I. salicina*), with 2n = 16. The remaining three are tetraploids (*I. britannica*, *I. conyzae* and *I. oculus-christi*), with 2n = 32 (Hrouda 2004). Within the diploids, hybrids have been found in the wild between *I. ensifolia* and *I. germanica* (*I.* ×*hybrida*), *I. ensifolia* and *I. hirta* (*I.* ×*hausmannii*), *I. ensifolia* and *I. salicina* (*I.* ×*stricta*), *I. germanica* and *I. salicina* (*I.* ×*media*) and *I. hirta* and *I. salicina* (*I.* ×*rigida*). Among the tetraploids, only the hybrid between *I. conyzae* and *I. oculus-christi* (*I.* ×*suaveolens*) has been documented with certainty. The hybrid between *I. britannica* and *I. oculus-christi*, reported by Hrouda (2004) from a single site, may exist but the only available herbarium specimen originally assigned to this parental combination is most likely the "pure" *I. britannica* collected in a dry habitat, namely an abandoned stone quarry. The reports about the hybrids between *I. hirta* and *I. oculus-christi*, as well as between *I. ensifolia* and *I. oculus-christi* (cf. Dostál et al. 1948–1950) are most likely erroneous. The hybrids are usually easily recognizable in the field when observed within their population contexts. The identification of herbarium specimens is more difficult due to the phenotypic plasticity and variation observed among both putative parents and hybrids themselves. Although hybrids are often described as intermediate, this does not apply to individual characters. In fact, hybrids often combine character states close to the states found in either parent. This was already noted by some 19th century authors, who sometimes recognized two nothospecies from one parental combination, or two or three varieties within a nothospecies. Each of these nothotaxa (in recent terminology) approached one of the parents. For instance, *I.* ×*stricta* nothovar. *neilrechii* was the name for plants resembling *I. ensifolia* in general habit, while *I.* ×*stricta* nothovar. *vera* referred to plants resembling *I. salicina* (Beck 1891). The same author recognized two nothospecies derived from the cross between *I. conyzae* and *I. oculus-christi*, namely *I.* ×*intermixta* and *I.* ×*suaveolens*, each combining character states of its parents in a different manner. This kind of variation may be interpreted as resulting from introgressive hybridization, but no study has explored this process in *Inula*. In our opinion, however, it is more likely the consequence of gene expression in interspecific hybrids.

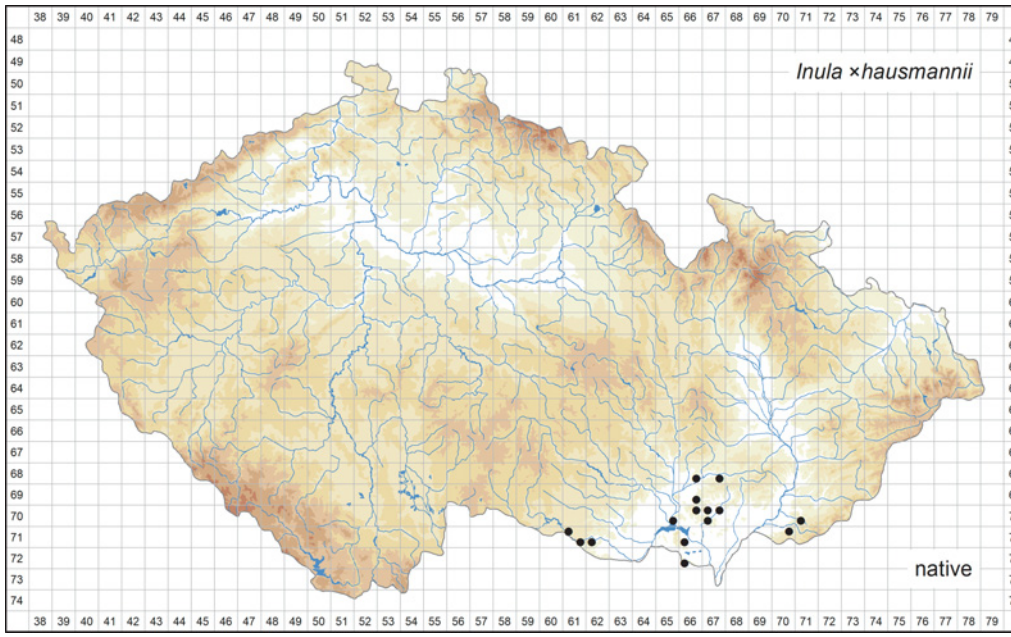

Fig. 39. Distribution of *Inula* ×*hausmannii* (*I. ensifolia* × *I. hirta*) in the Czech Republic (15 occupied quadrants). Prepared by Jiří Danihelka & Hana Galušková.

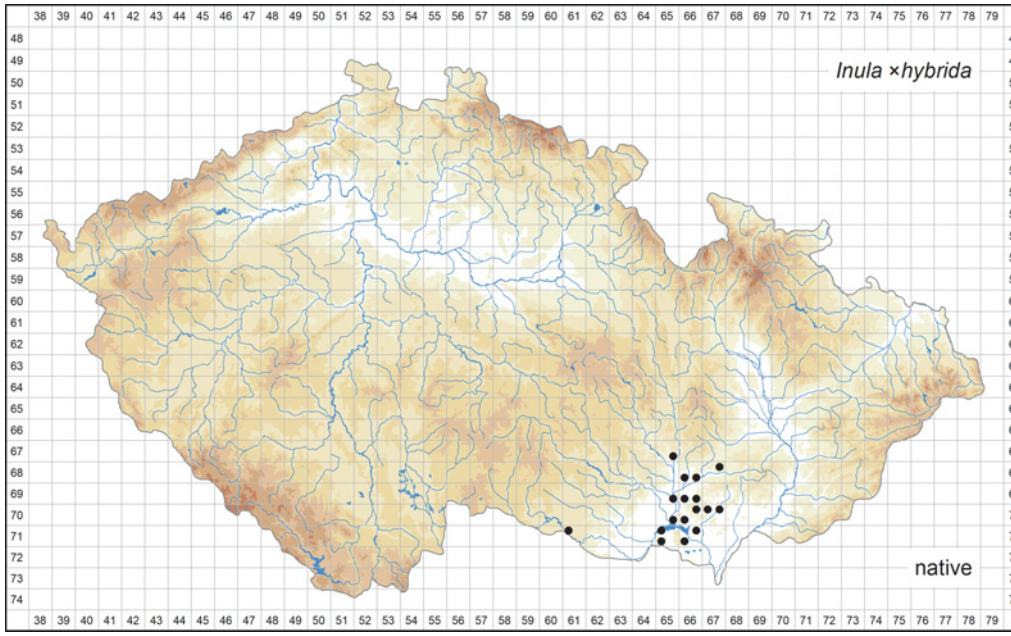

Fig. 40. Distribution of *Inula* ×*hybrida* (*I. ensifolia* × *I. germanica*) in the Czech Republic (17 occupied quadrants). Prepared by Jiří Danihelka & Hana Galušková.

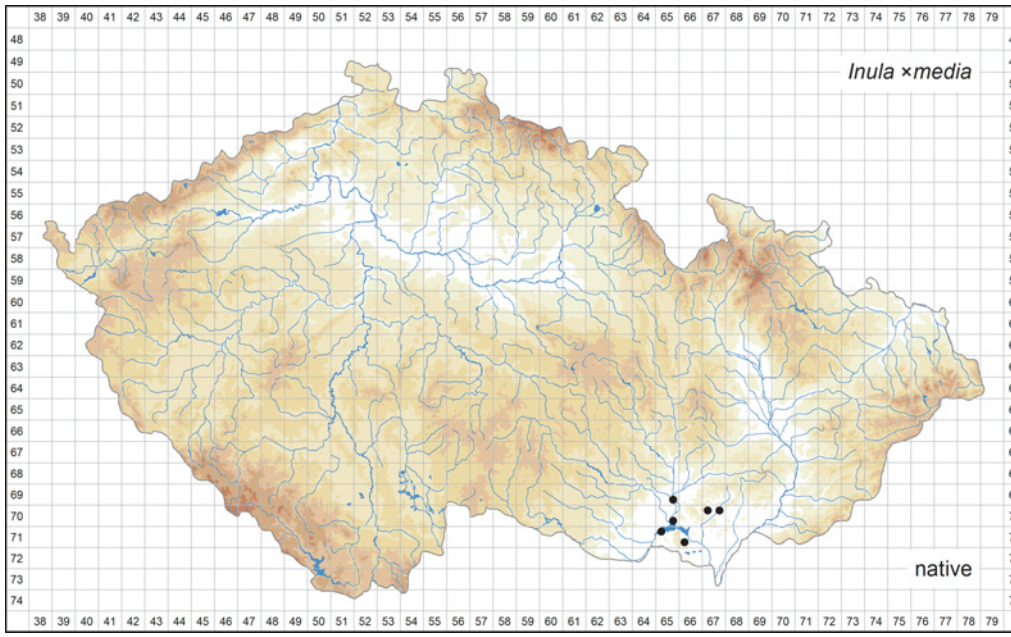

Fig. 41. Distribution of *Inula* ×*media* (*I. germanica* × *I. salicina*) in the Czech Republic (6 occupied quadrants). Prepared by Jiří Danihelka & Hana Galušková.

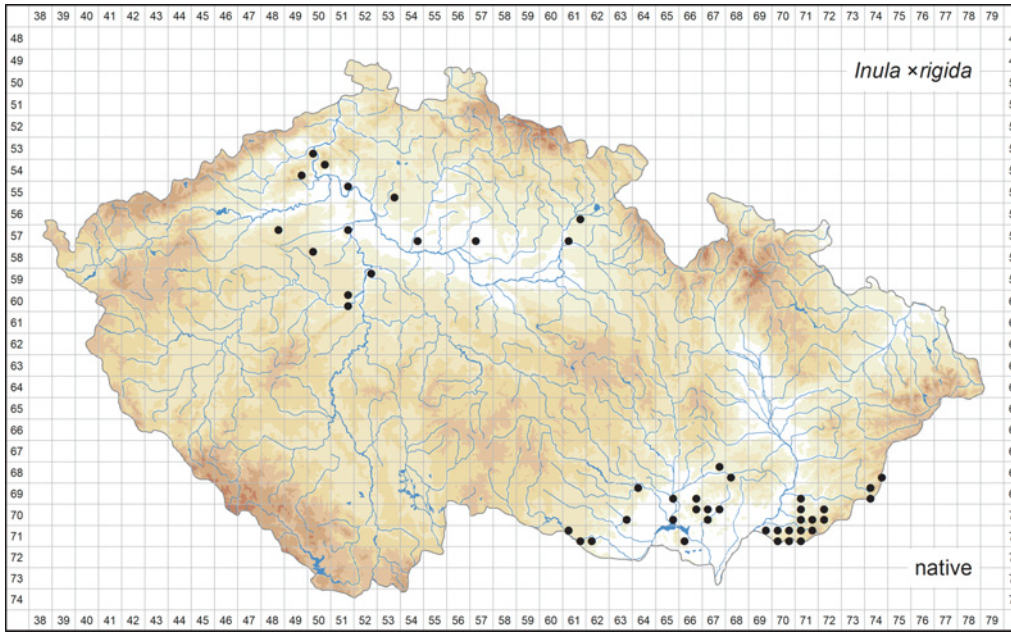

Fig. 42. Distribution of *Inula* ×*rigida* (*I. hirta* × *I. salicina*) in the Czech Republic (47 occupied quadrants). Prepared by Jiří Danihelka & Hana Galušková.

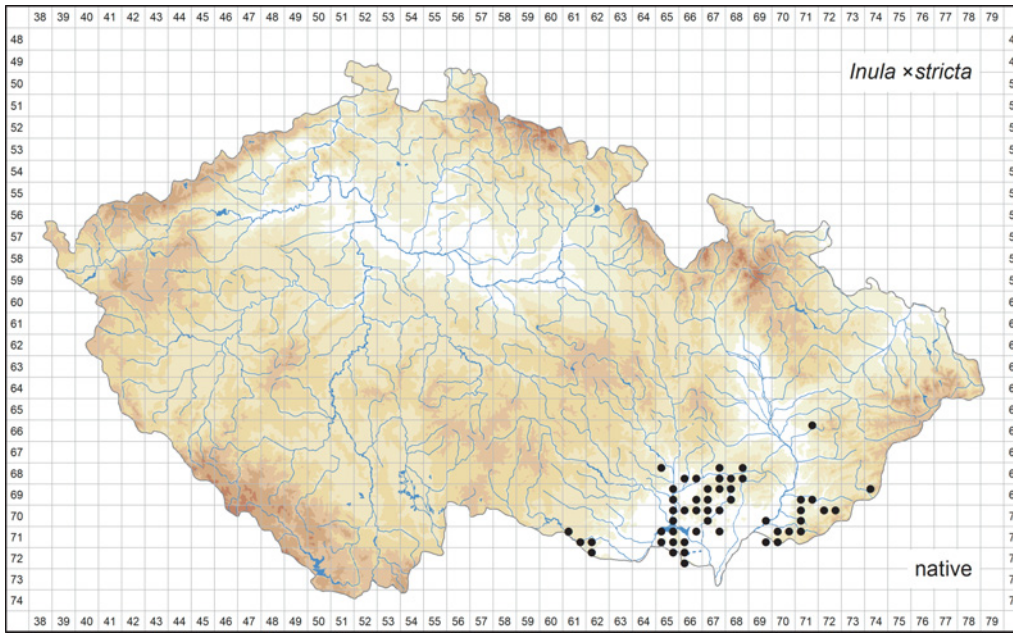

Fig. 43. Distribution of *Inula* ×*stricta* (*I. ensifolia* × *I. salicina*) in the Czech Republic (51 occupied quadrants). Prepared by Jiří Danihelka & Hana Galušková.

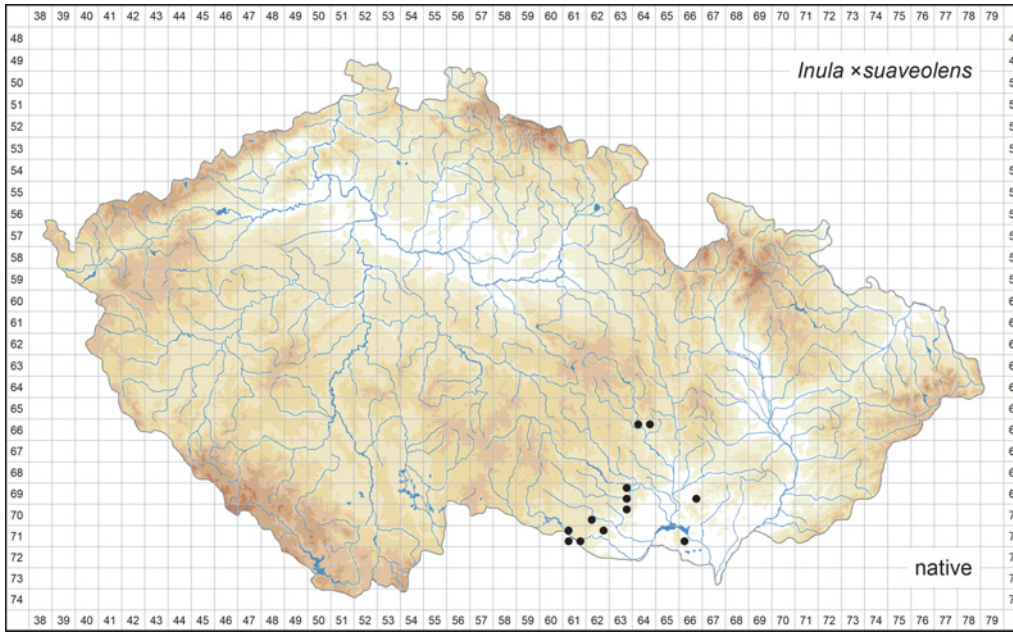

Fig. 44. Distribution of *Inula* ×*suaveolens* (*I. conyzae* × *I. oculus-christi*) in the Czech Republic (12 occupied quadrants). Prepared by Jiří Danihelka & Hana Galušková.

Here we provide distribution maps for six *Inula* hybrids. The hybrids are more frequent in southern Moravia because *I. ensifolia* and *I. oculus-christi*, involved in four hybrid combinations, are absent from Bohemia. *Inula* ×*hybrida* (*I. ensifolia* × *I. germanica*) has been recorded at about 19 sites in southern Moravia (Fig. 40). *Inula* ×*hausmannii* (*I. ensifolia* × *I. hirta*) has been recorded as being scattered across southern and south-eastern Moravia (Fig. 39). *Inula* ×*media* (*I. germanica* × *I. salicina*) has been recorded at about 6 sites, exclusively in southern Moravia (Fig. 41), although both parents also occur in Bohemia. *Inula* ×*rigida* (*I. hirta* × *I. salicina*) has been recorded in both Bohemia and Moravia (Fig. 42). It is the most widespread *Inula* hybrid in this country, being locally common in the Bílé Karpaty Mts in south-eastern Moravia. *Inula* ×*stricta* (*I. ensifolia* × *I. salicina*) has been recorded at numerous sites in southern and south-eastern Moravia (Fig. 43). *Inula* ×*suaveolens* (*I. conyzae* × *I. oculus-christi*) has been recorded at about 14 sites in southern Moravia (Fig. 44).

Juncus compressus (Fig. 45)

Juncus compressus is native to temperate Eurasia, extending eastward as far as the Korean Peninsula and Japan; however, the populations from eastern Siberia and the Russian Far East are sometimes separated as *J. gracillimus*. It has been introduced into North America, where it has become naturalized in Canada and the northern half of the USA (Meusel et al. 1965, Hultén & Fries 1986, POWO 2024). In the Czech Republic *J. compressus* occurs in halophilous reed and sedge beds and some other types of wetland vegetation, as well as in pastures and park grasslands, vegetation of wet disturbed soils,

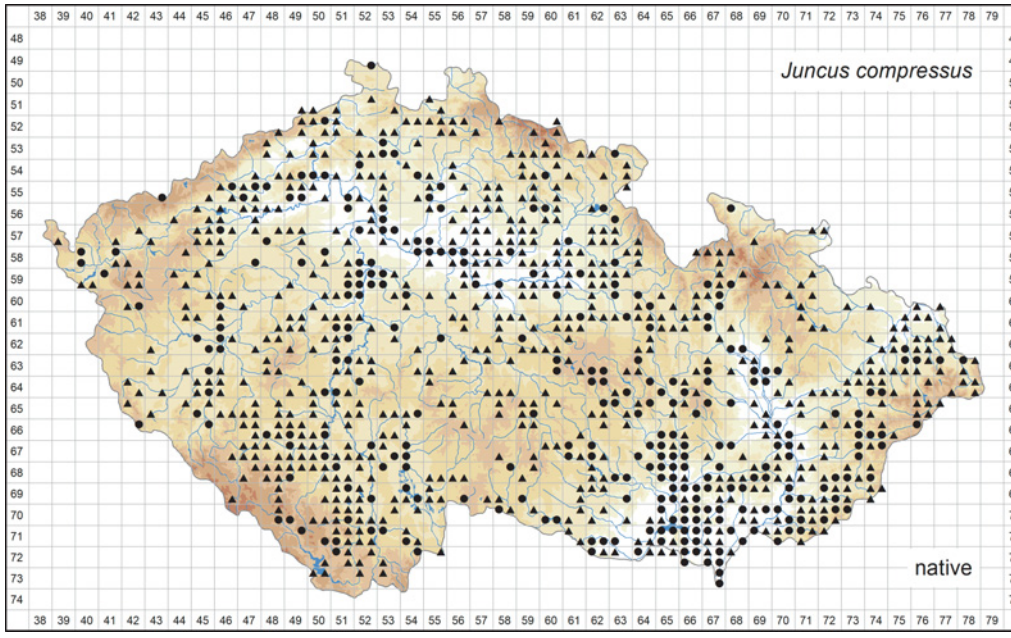

Fig. 45. Distribution of *Juncus compressus* in the Czech Republic: ● occurrence documented by herbarium specimens (285 quadrants), ▲ occurrence based on other records (677 quadrants). Prepared by Jiří Danihelka.

ruderal sites in villages as well as in inland saline meadows, and more recently also on road verges. The soils are well-moistened to wet, slightly acidic to slightly basic, usually moderately rich in nutrients, and sometimes with low salt content. On saline soils it co-occurs with *J. gerardii*, sometimes forming mixed stands. In the Czech Republic *J. compressus* is widespread and occurs with various frequencies from lowlands up to low mountains. While it is locally common, e.g. in eastern Bohemia, in fishpond landscapes of southern Bohemia and in southern in Moravia, it is relatively rare in the Českomoravská vrchovina highlands and elsewhere in areas with nutrient-poor, acidic soils. Some undocumented records of *J. compressus* in the mountains may be based on misidentified specimens of *J. tenuis*. Most of its occurrences are found at elevations up to ~600 m, with the maximum elevation reached at ~950 m on Mt Velká Javořina in the Bílé Karpaty Mts in south-eastern Moravia.

Juncus gerardii (Fig. 46)

Juncus gerardii is distributed along the coasts of Europe and the eastern coasts of North America, as well as at inland saline sites in Europe, western temperate Asia, Siberia and North America (Meusel et al. 1965, Hultén & Fries 1986). In the Czech Republic *J. gerardii* occurs in halophilous reed and sedge beds, vegetation of succulent halophytes, wet saline meadows and marshes, at mineral springs, and rarely in wetlands on arable land. The soils are usually heavy, well-moistened to wet, but may become dry later in the growing season, and are moderately rich in nutrients, calcium and soluble salts (mainly sulphates). In the Czech Republic *J. gerardii* was once the most widespread component of

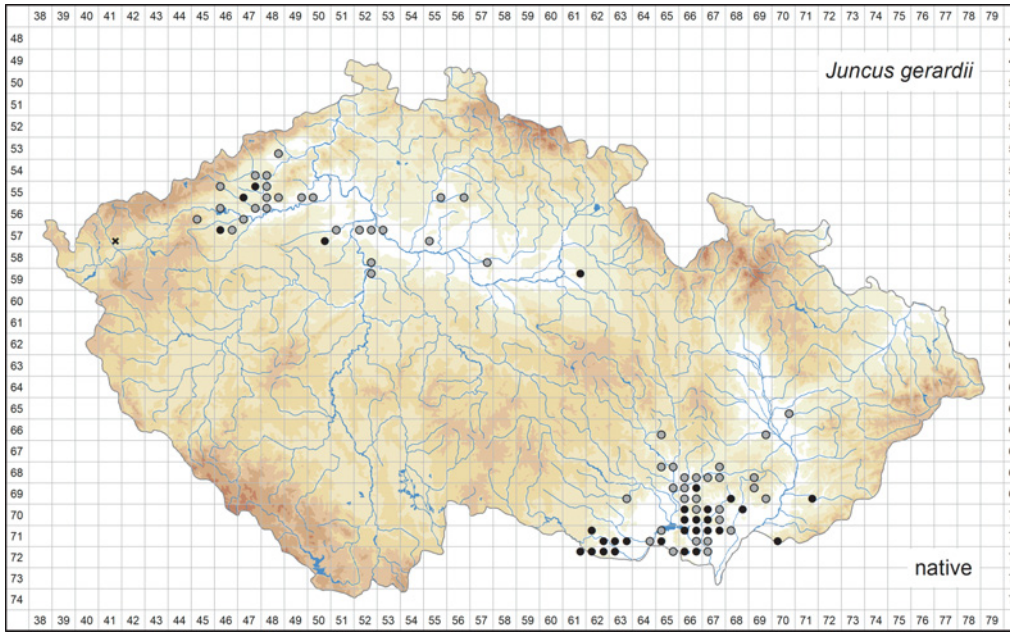

Fig. 46. Distribution of *Juncus gerardii* in the Czech Republic: ● native, at least one record in 2000–2024 (30 quadrants), ◍ native, pre-2000 records only (53 quadrants), × alien only (1 quadrant). Prepared by Jiří Danihelka & Petr Hubatka.

the country's halophilous flora, occurring in both north-western Bohemia and southern Moravia. There are also several isolated records from wetland habitats in eastern central and eastern Bohemia, as well as central and south-eastern Moravia, usually from wetlands on mineral-rich soils, such as fen meadows and wet places in abandoned loam and kaolin pits. These occurrences may be explained by the spread of seeds through migrating wetland birds. *Juncus gerardii* is often the last halophyte to survive at former halophytic sites after their drainage and reclamation. The seeds probably form a long-persistent seed bank; therefore, this species may reappear at restored wetlands after a long time. *Juncus gerardii* occurs in lowlands and adjacent hilly areas, usually at elevations below 250 m; it reaches its elevational maximum of 360 m south-east of the town of Radějov in the Bílé Karpaty Mts in south-eastern Moravia. *Juncus gerardii* is very similar to the frequently co-occurring *J. compressus*, causing confusion between the species. For instance, half of the specimens originally identified as *J. gerardii* from the Czech Republic in the herbarium BRNU were revised as *J. compressus*. For some sites with repeated records of *J. gerardii* no herbarium specimens were found; e.g. all herbarium specimens we have seen from the Soos National Nature Reserve in westernmost Bohemia were revised as *J. compressus*. Therefore, with a few exceptions, only records supported by a herbarium specimen are accepted in the map, which may underestimate both the distribution and local frequency of this species. *Juncus gerardii* has strongly declined due to destruction of saline habitats, mainly by drainage; therefore, it is classified as critically threatened (Grulich 2012).

Laser trilobum (Fig. 47)

Laser trilobum is distributed in central, south-eastern and eastern Europe, extending to south-western Asia (Caucasus, Anatolia, Syria, Lebanon and Iran). In central Europe the species is scattered in rather warm areas, towards the west reaching north-eastern France and central Germany. It occurs more abundantly in the northern part of the Balkan Peninsula, southern half of Ukraine and in warm areas of European Russia. It has also been introduced into Great Britain (Hendrych 1980, Hand 2011). *Laser trilobum* grows in open-canopy deciduous forests, particularly in sub-continental thermophilous oak forests, also in forest fringes and clearings, usually on base-rich substrates. It prefers dry loamy soils that are rather poor in nutrients. In the Czech Republic the species reaches the northern limit of its distribution. In this country a single population is known in southern Moravia, being situated in the protected area of Kukle and its closest surroundings between the villages of Boleradice, Kurdějov and Diváky, formerly referred to as "Divácký les". *Laser trilobum* occurs there in a thermophilous oak forest on loess, occasionally also in man-made habitats such as forest roadsides and plantations of *Robinia pseudoacacia*, at elevations ca 240–360 m. It is quite abundant at the site, yet it is classified as critically threatened due to its rarity (Grulich 2012).

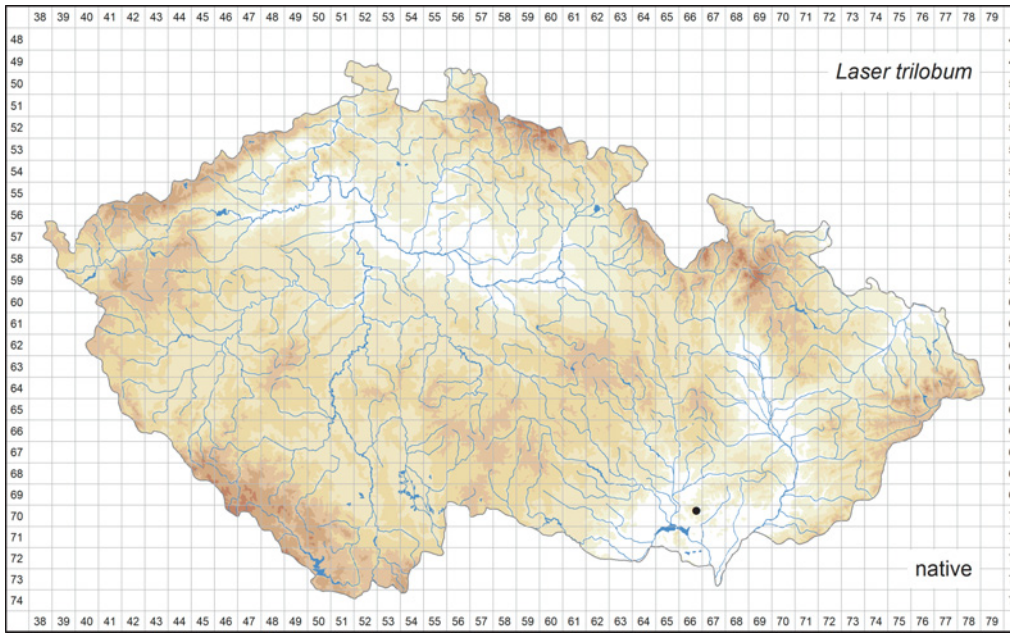

Fig. 47. Distribution of *Laser trilobum* in the Czech Republic (1 occupied quadrant). Prepared by Jan Prančl.

Linum austriacum (Fig. 48)

Linum austriacum is a member of the taxonomically difficult group *Linum perenne* agg., which includes several closely related taxa (Ockendon & Walters 1968); two of them, *L. austriacum* and *L. perenne*, are considered as native to the Czech Republic. Several subspecies of *L. austriacum* have been distinguished in various treatments of this group, with some of them later promoted to the species level (e.g. Ockendon & Walters 1968, Ockendon 1971, Raab-Straube 2018, GBIF 2024, POWO 2024). Taxonomy of this species and subordinate taxa is not yet satisfactorily resolved and, as a consequence, the distribution of these taxa is not precisely known. Moreover, *L. austriacum* subsp. *austriacum* may spread spontaneously or with humans and quickly colonize new regions. Its native distribution probably encompasses large parts of central, south-eastern and eastern Europe, reaching its north-western and western distributional limit in north-western Poland, the south-eastern part of the Czech Republic, and in Austria and Switzerland; towards the south-east and east its range extends as far as Kazakhstan, the Caucasus, Transcaucasia, Iran and Iraq (Svetlova 2010, Raab-Straube 2018, GBIF 2024, POWO 2024). However, the southern and eastern distributional limit of subsp. *austriacum* is rather unclear, as from these regions also some other subspecies of *L. austriacum* are reported, namely subsp. *collinum* and subsp. *tommassinii* (Raab-Straube 2018). In Denmark, Belgium, Luxembourg, France and Germany *L. austriacum* subsp. *austriacum* is reported as introduced, and its records from Italy and Morocco are recently considered erroneous (Verloove 2015, Raab-Straube 2018). In the Czech Republic *L. austriacum* is considered native only to southern Moravia where it grows in open dry grasslands, particularly on

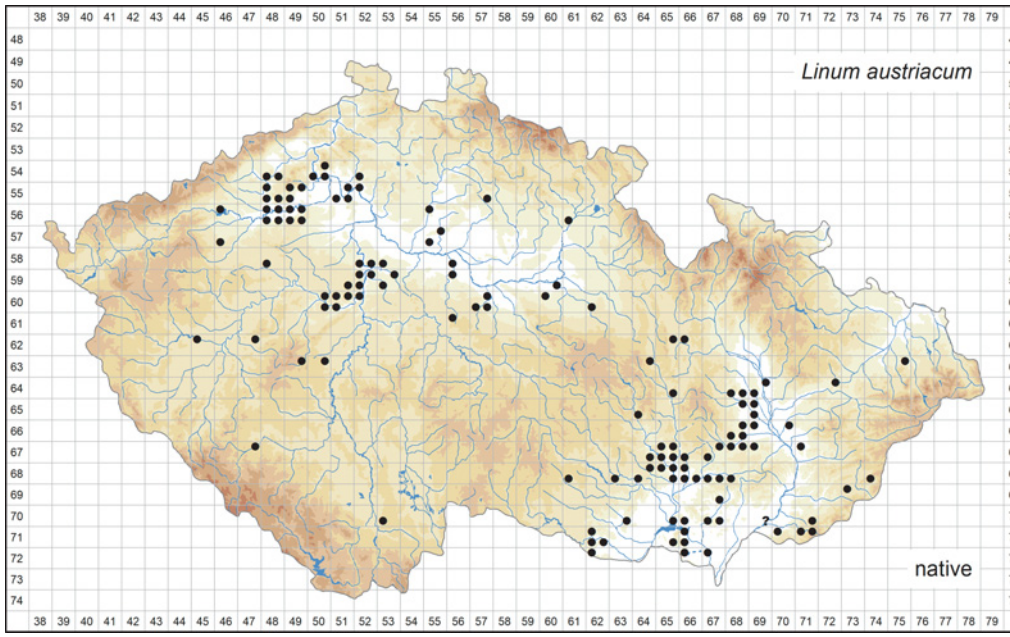

Fig. 48. Distribution of *Linum austriacum* in the Czech Republic (127 occupied quadrants). Prepared by Kateřina Šumberová.

southern and south-western slopes formed by loess, limestone and other calcareous bedrock. Soils are basic, rather rich in nutrients, sandy to loamy-sandy. Although many of the populations in Bohemia occur in natural or semi-natural habitats, including the most valuable steppic grasslands in nature reserves, there exist neither herbarium vouchers nor reliable literature records on *L. austriacum* from such sites dated before the end of the 19th century. As late as 1884 this species was found in a small population on Chožovský vrch hill near the town of Louny in the České středohoří Mts in north-western Bohemia, and since then many other occurrences have been documented not only in this area but also elsewhere in the warm parts of Bohemia. Given the conspicuous appearance of the species and a long tradition of botanical research in dry grasslands (such as those near Prague or in northern and north-western Bohemia), it is highly probable that all the populations found in Bohemia originate from either deliberate planting (see e.g. Martinovský 1960) or accidental introduction. Martinovský (1960) analysed in detail occurrences of the species in Bohemia and considers it an expansive steppic weed, particularly at sites grazed by cattle or sheep, subjected to grass burning or on abandoned arable fields. The species has been recently found also in various types of dry secondary habitats such as fallows, railway embankments, margins of dirt roads, stone quarries, sand pits, margins of *Robinia pseudoacacia* groves or waste places. Some of the isolated occurrences may be related not only to long-distance seed dispersal (e.g. with railway traffic) but also to recent escapes of *L. austriacum* from gardens, as it is frequently cultivated as an ornamental plant. Nowadays it is scattered to locally common mostly at elevations below ~400 m in north-western, northern and central Bohemia and southern, south-eastern and central Moravia, with isolated occurrences elsewhere. *Linum austriacum* is classified as

lower risk – near threatened in this country (Grulich 2012). Populations in natural and near-natural habitats in south-eastern Moravia demand more attention, as many of these sites are threatened by overall eutrophication and succession of competitive grasses and shrubs because of management cessation. Moreover, as we found during herbarium studies, plants collected in some of the populations in Bohemia (e.g. vicinity of Prague and in the České středohoří Mts) exhibit specific morphological features, e.g. robust growth and frequently occurring three-vein leaves (which should occur only rarely in this species) and they should be subjected to further study. Although *L. austriacum* is considered native in southern Moravia, the status of many of its occurrences in secondary habitats is unclear, as they might be either refugia for native populations from former semi-natural dry grasslands or have an origin in recent introductions. Therefore, the native and secondary occurrences are not distinguished on the map.

Linum catharticum (Fig. 49)

Linum catharticum is mainly a European species with its range extending from northern Scandinavia and Iceland in the north to Spain, Italy and Greece in the south, and from Portugal and Great Britain in the west to European Russia in the east. It is absent only from Sardinia, Sicily, Crete and Cyprus but reaches northern Africa in Morocco and Asia in Turkey and Transcaucasia; according to some sources it occurs also in the Caucasus, Iran, Iraq, Tajikistan, Pakistan and western Siberia (Raab-Straube 2018, GBIF 2024, POWO 2024). It has been introduced into Canada (but in Nova Scotia and Newfoundland it may be native), the eastern USA, Argentina, Chile, Australia and New Zealand (Morin 2016, GBIF 2024, POWO 2024). *Linum catharticum* is usually reported as an annual species, but in high mountains it can also occur in a biennial to perennial form. Based on the difference in life cycle and small morphological differences (short internodes, leaves concentrated at the stem base etc.), plants from the high mountains and far north are sometimes treated as *L. catharticum* subsp. *suecicum* (Futák 1982, Hrouda 1997, Raab-Straube 2018). However, taxonomic value of this subspecies is questionable, as similar plants occur also at lower elevations, usually in open habitats with limited competition of tall herbs, or the plants of both forms can co-occur. Therefore, we did not distinguish subspecies of *L. catharticum* in the map, which is in accordance with the majority of taxonomic treatments of this species (e.g. Ockendon & Walters 1968, Hultén & Fries 1986, Hrouda 1997, Svetlova 2010, Martínez Labarga & Muñoz Garmendia 2015, POWO 2024). *Linum catharticum* grows in open habitats with a rather broad range of moisture conditions and vegetation types, such as broad-leaved dry and semi-dry grasslands, mesophilous meadows and pastures, intermittently wet meadows, rather dry microhabitats in mires and fens, some types of floodplain meadows, wet sandy depressions, margins of forest and meadow dirt roads, abandoned sand pits, etc. At high elevations it prefers calcareous substrates, and in the mountains formed of acidic bedrocks it often expands along roads made of calcareous gravel. Soils are of various types, basic or acidic, usually with low to medium amounts of nutrients and sometimes organic (fen, peaty). As a competitively poor species, it requires regular disturbances such as mowing, temporary flooding, low-intensity grazing, occasional trampling or mining. *Linum catharticum* used to be scattered to rather common across this country, from the lowlands, where it is particularly common, to the mountains, with the elevational maxima at about 1,150 m in the Krkonoše

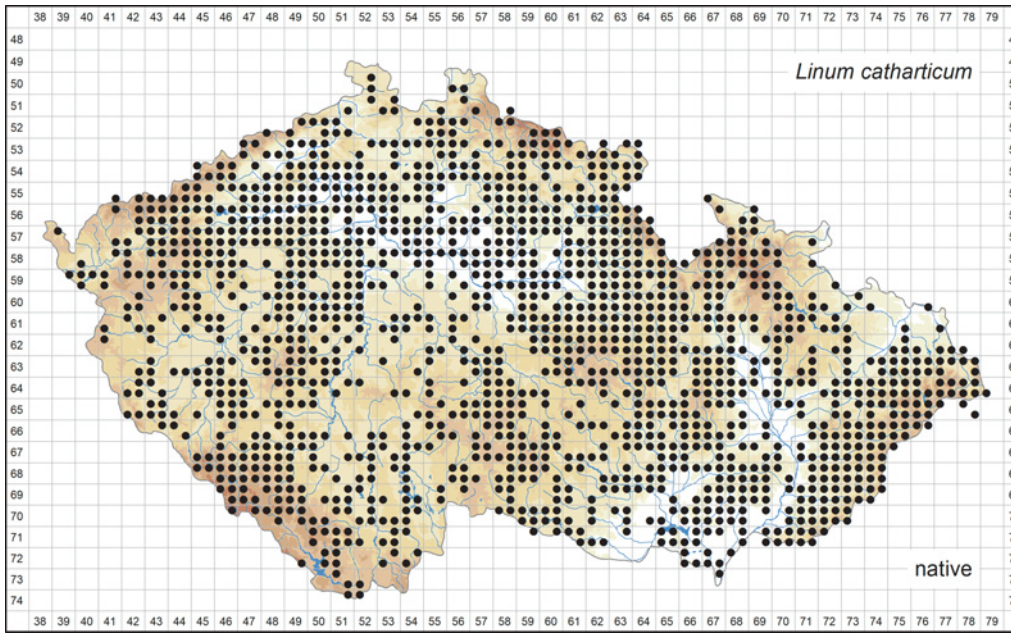

Fig. 49. Distribution of *Linum catharticum* in the Czech Republic (1,489 occupied quadrants). Prepared by Kateřina Šumberová.

Mts, 1,244 m in the Krušné hory Mts and 1,250 m in the Šumava and Hrubý Jeseník Mts. Most of the gaps on the map are probably due to under-recording rather than true absences. In the past it was probably absent only from areas with prevailing arable land and without suitable habitats, e.g. in some parts of southern Moravia. However, during the several past decades this species started to decline, similarly to many other short-lived and low-growing, competitively poor plants, which suffer under fast succession by tall herbs, grasses and shrubs as a consequence of eutrophication and management cessation (Klinkovská et al. 2024). On the other hand, it has spread in anthropogenic habitats into higher elevations and currently is not listed as threatened.

Linum flavum (Fig. 50)

Linum flavum is a member of the taxonomically difficult group of closely related taxa usually referred to as *L. flavum* agg. (Ockendon & Walters 1968). Most of them are accepted as separated species with ranges in south-eastern or eastern Europe (e.g. Raab-Straube 2018), but this taxonomic treatment is not supported by the results of recent molecular analyses and will require further study (Bolsheva et al. 2015). Within the species *L. flavum*, several subspecies are sometimes distinguished (e.g. Raab-Straube 2018, POWO 2024); most of them are probably local endemics, although the taxonomic value of some of them may be questionable. Only subsp. *flavum* occurs in the Czech Republic. It probably occurs throughout the overall range of the species (e.g. Meusel et al. 1978, POWO 2024) and includes most countries of central, south-eastern and eastern Europe, reaching its north-western limit in Germany, south-western limit in northern Italy,

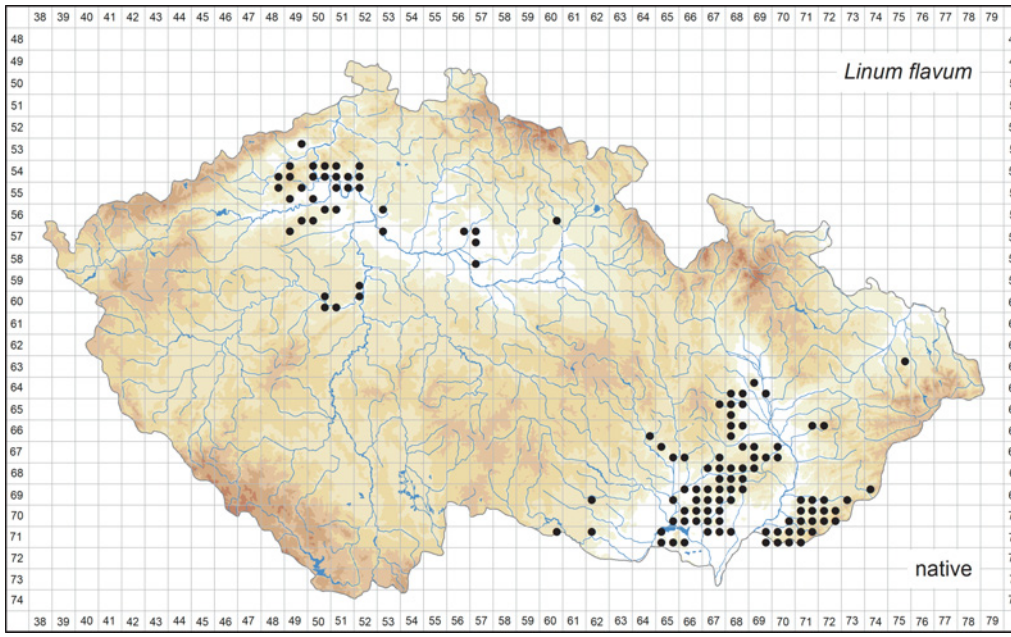

Fig. 50. Distribution of *Linum flavum* in the Czech Republic (123 occupied quadrants). Prepared by Kateřina Šumberová.

south-eastern limit in northern Turkey and north-eastern limit in European Russia. The Pannonian Basin together with the Balkan Peninsula represents a distribution centre of subsp. *flavum*, while the populations elsewhere are usually rare and threatened. In the Czech Republic *L. flavum* usually grows in broad-leaved, species-rich, semi-dry to dry grasslands and thermophilous forest and shrub fringes, particularly on steep northern and north-western slopes. It also rarely occurs in intermittently wet meadows. The soils are basic, rich in calcium, developed mainly over loess, marlstone, limestone or calcareous flysch. Unlike other steppe *Linum* species, *L. flavum* prefers well-preserved near-natural habitats without signs of ruderalization and only scarcely occurs elsewhere. Its distribution includes particularly the České středohoří Mts, the Český kras karst area and their close surroundings and several sites in eastern central and eastern Bohemia. Approximately several dozen localities have been known in southern, south-eastern and central Moravia, with some outposts also in south-western Moravia. A single past occurrence was also documented in northern Moravia. Most *L. flavum* sites were situated at the elevations of about 250–450 m. Many of the populations have been lost due to overall eutrophication, fast succession of competitive grasses and shrubs and abandonment of mowing and low-intensity grazing of steep, difficult-to-access slopes. Some recently recorded populations, not known in the past, most probably or demonstrably originated from deliberate planting (e.g. some of the populations in central Moravia). However, due to strong decline and habitat loss, the species is classified as endangered (Grulich 2012).

Linum hirsutum (Fig. 51)

Several infraspecific taxa on the level of subspecies or varieties are usually distinguished within *Linum hirsutum*, but their taxonomic treatment strongly differs among the authors (e.g. Ockendon & Walters 1968, Svetlova 2010, Raab-Straube 2018, POWO 2024). Some of these taxa are probably local endemics in the eastern Mediterranean area (e.g. Yılmaz & Kaynak 2006); however, the whole group needs further taxonomic study. The typical subspecies probably occurs throughout the overall range of the species and includes eastern-central, eastern and south-eastern Europe, with almost continuous distribution in the Pannonian Basin, the Balkan Peninsula, southern Ukraine, Moldova and southern parts of European Russia. The north-western distribution limit of the species runs through the south-eastern part of the Czech Republic and eastern Slovakia; there is also a small, isolated area comprising occurrences at several localities in southern Poland (GBIF 2024). Another subspecies, *L. hirsutum* subsp. *glabrescens*, is mentioned for some central-European and Balkan countries, including the Czech Republic, Slovakia, Hungary, Serbia and Bulgaria, but its taxonomic value is unclear (Futák 1982, Hrouda 1997). Some herbarium vouchers with glabrous plants collected in this country were originally assigned to subsp. *glabrescens*, but we consider these plants as part of the variation of subsp. *hirsutum* and follow the concept in the recent Czech floras (Hrouda 1997, 2019). The record of *L. hirsutum* from Italy (Raab-Straube 2018) is probably based on a misidentification of another species (Conti et al. 2005). In the Czech Republic *L. hirsutum* occurs in open, dry to semi-dry calcareous grasslands or thermophilous forest margins developed mainly on loess or rocky (limestone, marlstone, calcareous flysch)

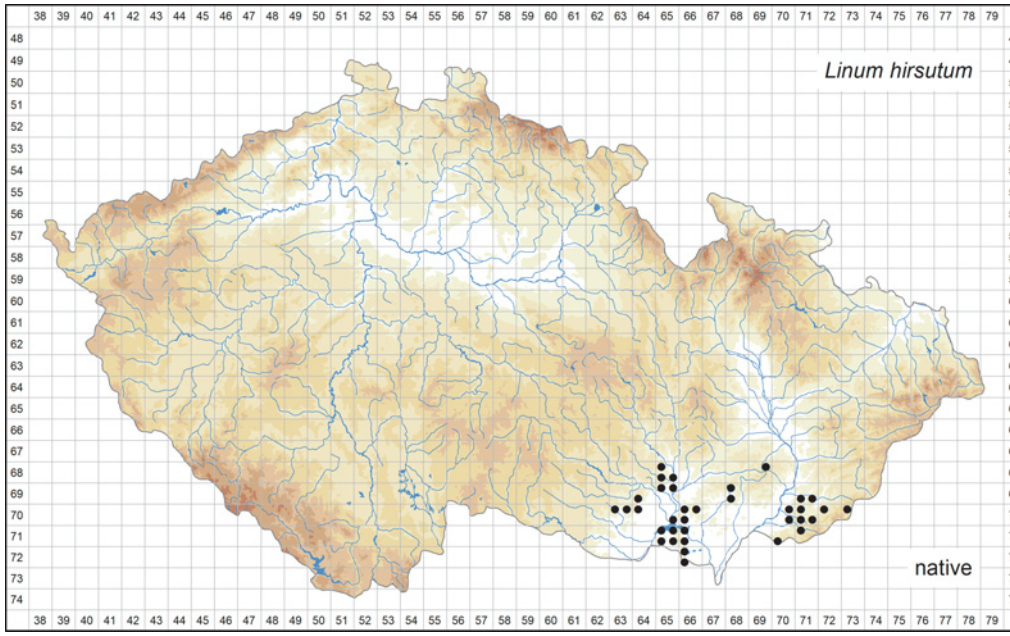

Fig. 51. Distribution of *Linum hirsutum* in the Czech Republic (35 occupied quadrants). Prepared by Kateřina Šumberová.

slopes, sometimes also in secondary habitats such as old fallows, orchards, stone quarries and sand pits. The habitats are dependent on regular (grazing, mowing) or occasional disturbances (periodic mining or ploughing); abandonment usually leads to succession of shrubs or competitive grasses and subsequent loss of *L. hirsutum* populations. In this country the species' definite native occurrence have only been recorded in southern and south-eastern Moravia, with northern distribution limits as far as the city of Brno and the town of Uherské Hradiště, respectively. Its northern outposts are situated near the city of Brno and the town of Kroměříž and western outposts (two sites, one of them already vanished) near the town of Miroslav. Earlier records of *L. hirsutum* from these sites do not exist and therefore origin of all these populations from either deliberate planting or unintentional introduction is probable. The elevations of all the sites range between ca 200 and 400 m. The species is classified as endangered in this country (Grulich 2012).

Linum perenne (Fig. 52)

Linum perenne is, besides *L. austriacum*, the other member of the taxonomically difficult group of taxa usually referred to as *L. perenne* agg. (Ockendon & Walters 1968, Ockendon 1971) that is native to the Czech Republic. *Linum perenne* has an extensive but disjunct distribution that includes large parts of central and eastern Europe as well as central, eastern and northern Asia; it has been introduced into North America (Hultén & Fries 1986, Liu & Zhou 2008, Svetlova 2010, Morin 2016, POWO 2024). Several subspecies of *L. perenne* have been distinguished, but some of them were later raised to the species level (e.g. Ockendon & Walters 1968, Ockendon 1971, Raab-Straube 2018, GBIF 2024, POWO 2024). Only the typical subspecies occurs in central Europe. According to some authors, its native range includes only Germany, Austria, Slovakia, Hungary, Romania and Ukraine (Ockendon 1971, Futák 1982, Hrouda 1997; but see Raab-Straube 2018 for different view); a single population in Poland, not confirmed recently, was probably of anthropogenic origin (Wilkoń-Michalska & Bohr 1960, Nienartowicz et al. 2014). However, many authors do not distinguish any subspecies within *L. perenne* and explicitly refer to the broad distribution described above (e.g. Liu & Zhou 2008, Svetlova 2010, Morin 2016, POWO 2024). Hence, the general distribution of *L. perenne* subsp. *perenne* is obscured particularly in eastern parts of its range. Moreover, Ockendon (1971) pointed out plants morphologically intermediate between *L. perenne* subsp. *perenne* and *L. austriacum* subsp. *austriacum* in Romania and Russia, although the possibility of hybridization is very limited according to his experiments. The group obviously needs further study, utilizing molecular approaches (recent studies in *Linum* considered the *L. perenne* group only marginally, e.g. Talebi et al. 2015, Valdés-Florido et al. 2023, or they did not bring unequivocal results, e.g. Vromans 2006). In the Czech Republic *L. perenne* subsp. *perenne* grew in semi-dry to dry grasslands on neutral to slightly basic, usually sandy soils, sometimes rather skeletal or with an admixture of peaty sediment. There were probably two sites with native populations in this country in the past: a dry meadow in fens at the town of Všetaty in northern-central Bohemia and sandy places between the town of Poděbrady and the village of Libice nad Cidlinou in eastern-central Bohemia. These records are documented by herbarium specimens that represent morphologically typical plants. Both populations disappeared more than a century ago, with the last reliable record from the town of Všetaty dating to 1902 (the year 1908, given by Hrouda

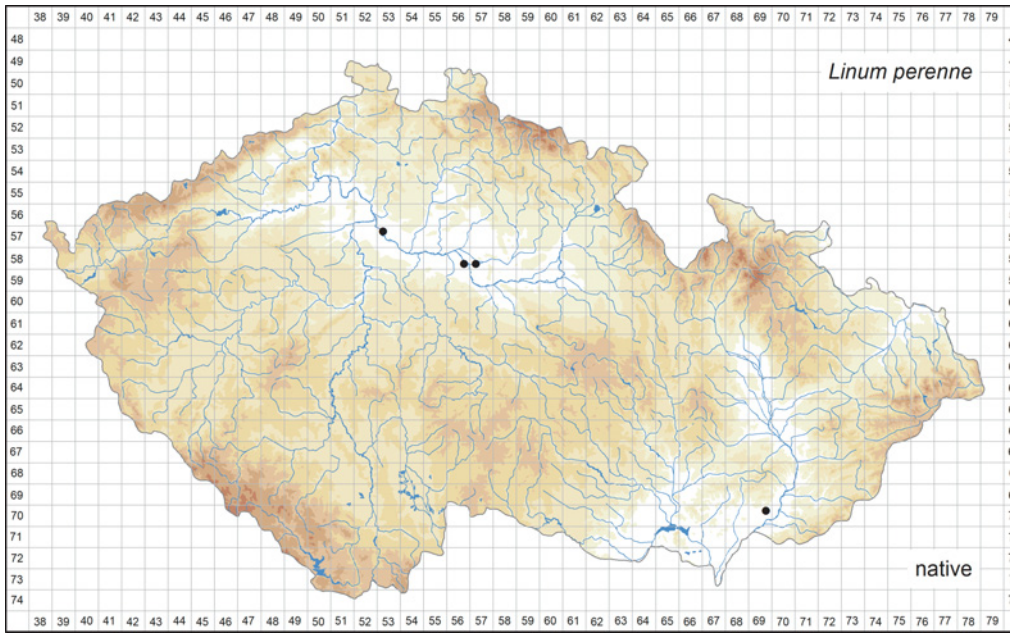

Fig. 52. Distribution of *Linum perenne* in the Czech Republic (4 occupied quadrants). Prepared by Kateřina Šumberová.

1997, is unclear, as two dates are written on the relevant herbarium label, the first one being 1879). It is not excluded that intensive plant sampling for herbaria at the Všetaty site contributed to the species' extinction there, as noted by Faustus on the label of one of the herbarium specimens. Although earlier literature records from elsewhere are usually considered to represent confusion with *L. austriacum*, rare occurrence of other populations in this country cannot be excluded. Two early-19th-century specimens and a single specimen from 1900, all of them originally identified as *L. austriacum*, originated according to their labels from the Dúbrava forest near the town of Bzenec in southern Moravia; they are clearly *L. perenne*, but the reliability of the two earlier records is questionable. No extant native population is known in the Czech Republic and therefore the species is classified as nationally extinct (Grulich 2012). Recent, usually temporary occurrences of *L. perenne*, are plants escaped from cultivation, as this species has been a popular garden perennial in the past decade. However, it is likely that these plants belong to garden cultivars and are genetically distinct from the original *L. perenne* subsp. *perenne* populations (Tork et al. 2022).

Linum tenuifolium (Fig. 53)

Linum tenuifolium is mainly a European species. Its range extends from Spain (particularly in the Pyrenees), France, Belgium and central Germany in the west and north-west to Ukraine, Moldova and the south-western part of European Russia in the north-east. Towards the south and south-east, the distribution includes the Pannonian Basin, the Alps, the Apennine and Balkan Peninsulas, the Caucasus and Transcaucasia, and it

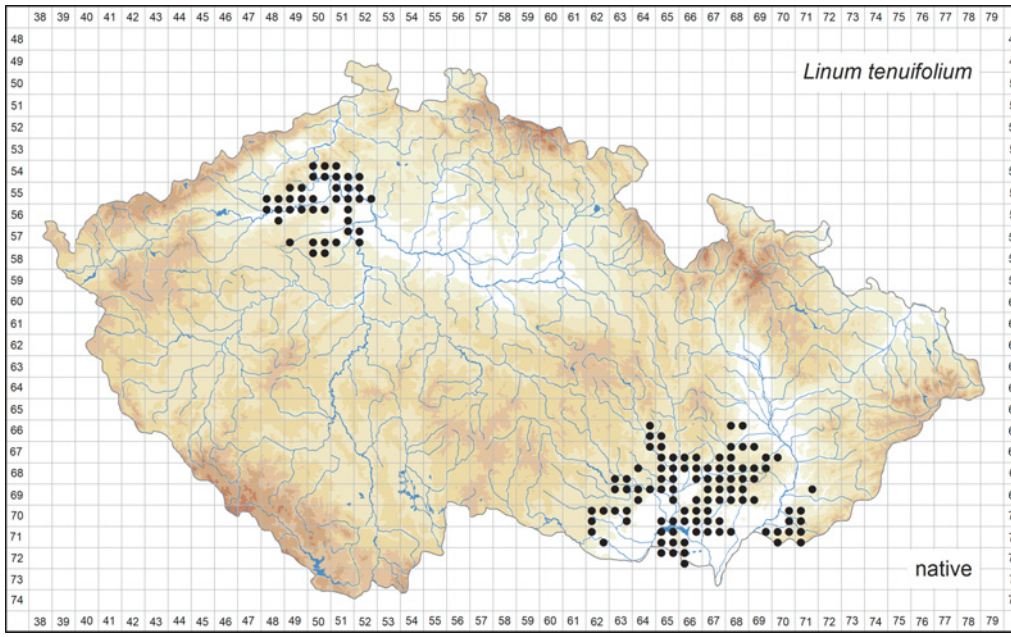

Fig. 53. Distribution of *Linum tenuifolium* in the Czech Republic (138 occupied quadrants). Prepared by Kateřina Šumberová.

reaches its eastern and south-eastern limits in Turkey, Syria, Lebanon and Iran (Ockendon & Walters 1968, Svetlova 2010, Raab-Straube 2018, GBIF 2024, POWO 2024). In the Czech Republic *L. tenuifolium* grows in open, dry grasslands developed over calcareous bedrock such as loess, limestone, marlstone or calcareous flysch. It often occurs at the same sites as *L. flavum*, where it, however, preferentially occupies habitats exposed to full sun and with very low soil moisture, e.g. south- and south-west-facing slopes. *Linum tenuifolium* also colonizes anthropogenic habitats such as old fallows, stone quarries and sand pits. It is able to grow on shallow as well as deep soils. In this country this species has two distinct distribution areas: north-western and northern central Bohemia and south-western, southern, south-eastern and central Moravia. The occurrences are at elevations of about 200–450 m. Although some populations of *L. tenuifolium* are large, the species has generally declined recently due to fast encroachment of dry grasslands by more competitive herbs and scrub. It is classified as vulnerable (Grulich 2012).

Linum usitatissimum (Fig. 54)

Linum usitatissimum is an anecophyte (a synanthropic plant with an unknown native range) cultivated since antiquity as a fibre and oil crop and recently utilised for an even broader variety of purposes (Shahada et al. 2024). The genetically closely related *L. bienne*, which is morphologically very similar and often considered a potential wild ancestor of *L. usitatissimum*, is native to western and southern Europe, northern Africa and south-western Asia (Martínez Labarga & Muńoz Garmendia 2015, Raab-Straube

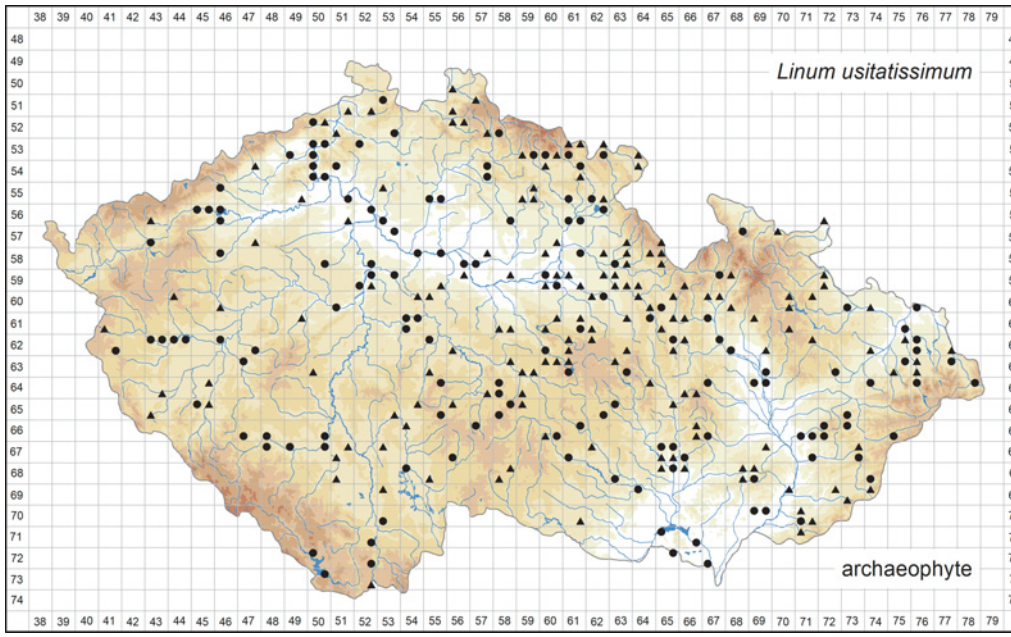

Fig. 54. Distribution of *Linum usitatissimum* in the Czech Republic: ● occurrence documented by herbarium specimens (144 quadrants), ▲ occurrence based on other records (157 quadrants). Prepared by Kateřina Šumberová.

2018, Valdés-Florido et al. 2023, POWO 2024). Due to frequent cultivation in many parts of the world with temperate and Mediterranean climates, *L. usitatissimum* is listed as alien in large parts of Europe and Asia, Africa, North, Central and South America and Tasmania (Raab-Straube 2018, POWO 2024). In the Czech Republic *L. usitatissimum* was widely cultivated for fibre in the past, particularly in cold hilly areas and highlands. Harvested flax plants were traditionally processed for textiles locally in the areas of their cultivation. Escapes of the plants, either from cultivations or during flax processing, were probably common but rather scarcely documented. Most of the records of escaped plants are from more recent decades, after the formerly common flax cultivation nearly disappeared from this country. Rare cultivation, still occurring in the Czech landscape, is usually used for edible oil and other food production (e.g. müsli, various seed mixtures or types of bread). Another source of seeds is seed mixtures used for feeding wild birds and sometimes also dry flax plants used for ornament as part of dry floral weaving. Escaped plants can be found in a broad range of habitats such as arable fields (as a weed in other crops), fallows, road verges, various urban habitats, sand pits, exposed margins of fishponds and river beds, dump grounds and game-feeding grounds. Escaped plants have been documented from lowlands up to the highlands across the country. The map is certainly incomplete, as many botanists do not note escaped crops in the field. On the other hand, frequency varies among the regions, with rare occurrence in warm lowlands. Confusion with *L. austriacum* is likely in some records from seminatural habitats, undocumented with herbarium specimen. *Linum usitatissimum* is classified as a casual archaeophyte (Pyšek et al. 2022).

Mahonia aquifolium (Fig. 55)

Mahonia aquifolium is native to the western part of North America, being distributed from British Columbia in the north to California in the south (Whittemore 1997). The species has been cultivated for a long time as an ornamental shrub, and hybridization with the related species *M. repens* and *M. pinnata* has been applied in the breeding of cultivars. It is likely that current invasive populations contain a genetic admixture of these taxa, although this has not yet been confirmed with certainty (Ross et al. 2008). *Mahonia aquifolium* is naturalized in large parts of North America (in areas adjacent to the native range as well as in the east of the continent), most of Europe, Australia and probably elsewhere (Whittemore 1997, Raab-Straube 2015, Kodela & Morley 2018). It was introduced to Europe as an ornamental plant in 1822; the first spontaneous occurrence outside gardens was observed in 1860 (Kowarik 1992). Now it is considered invasive in Germany and Belgium (Auge & Brandl 1997, Verloove 2020). It spreads on sites by root suckers, and over longer distances by birds that disperse its berries. In the Czech Republic *M. aquifolium* grows mainly in urban deciduous forests and shrub communities (including species-poor ones such as plantations of *Robinia pseudoacacia*), on urban and industrial waste land, in railway yards, along roads and railway tracks. The species is not restricted to particular soil conditions, occurring over a wide range of pH and nutrient content (including strongly eutrophic habitats), often growing in shallow soils or even on rock outcrops. In this country *M. aquifolium* has been cultivated since 1842 (Pejchal et al. 2021) and was first recorded as escaped in 1910 on Bohdalec hill in Prague. The species for a long time spread only slowly and randomly, but in recent decades its expansion has

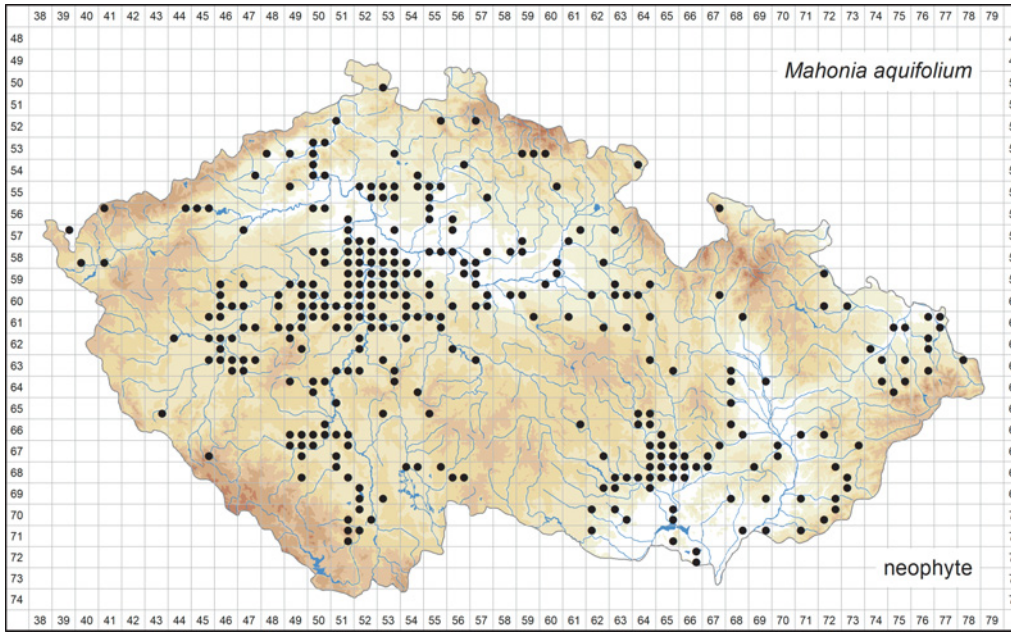

Fig. 55. Distribution of *Mahonia aquifolium* in the Czech Republic (323 occupied quadrants). Prepared by Jan Prančl.

accelerated, perhaps as a result of mild winters. It is now widespread mainly in large cities and their surroundings. Elsewhere it occurs largely around settlements and garden allotments. It grows particularly in the lowlands and at middle elevations, reaching its elevational maximum at 830 m near the settlement of Gerlův Dvůr in the Šumava Mts. *Mahonia aquifolium* is classified as a naturalized neophyte in this country (Pyšek et al. 2022). The distribution map includes only clear cases of escapes. Because the species is rarely recorded due to its occurrence in uninteresting habitats, the distribution map is inevitably incomplete.

Malaxis monophyllos (Fig. 56)

Malaxis monophyllos has a disjunct range in Eurasia and North America. In Europe it is mainly found in its central part, extending northwards to the northernmost part of the Gulf of Bothnia, westwards and southwards to the western Alps, and eastwards to the central part of European Russia. Isolated occurrences are in the Eastern Carpathians in Romania and in the southern Ural Mts. In Asia it is distributed in southern Siberia, southern and eastern China, the southern Russian Far East and Japan. In North America it extends from Alaska and British Columbia in the west to Newfoundland and the northeastern USA in the east (Baumann & Künkele 1982, Hultén & Fries 1986, Catling & Magrath 2002). In the Czech Republic *M. monophyllos* occurs in small forest meadows and grasslands, on grassy forest road verges, in forest clearings colonized by birch and spruce, open-canopy pine and beech forests, abandoned limestone quarries and around lime kilns. It is a calciphilous species that prefers fresh to wet basic soils that are often shallow and skeletal, but it has also been recorded on acidic soils. In this country

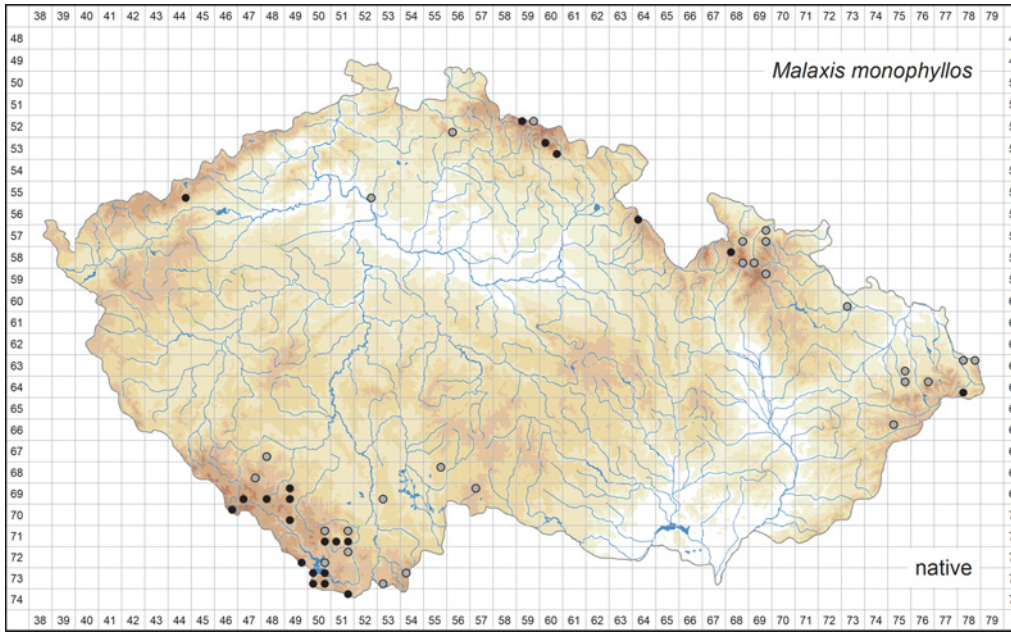

Fig. 56. Distribution of *Malaxis monophyllos* in the Czech Republic: ● at least one record in 2000–2024 (22 quadrants), ● pre-2000 records only (27 quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

M. monophyllos is rare, almost entirely restricted to mountains. It is most frequent in the south-eastern part of the Šumava Mts with a few sites in their foothills and the adjacent Novohradské hory Mts. Other isolated patches of populations are in the Krkonoše Mts, Hrubý Jeseník Mts and the Moravskoslezské Beskydy Mts and their foothills. In the 2010s, single population were discovered in both the Krušné hory and Orlické hory Mts. A few additional isolated occurrences have been recorded in the past at lower elevations in northern and southern Bohemia but these were only temporary and vanished long ago. Most of the extant populations consist of small numbers of individuals. However, new occurrences have been discovered during recent decades, mainly along forest roads hardened with limestone gravel. *Malaxis monophyllos* is classified as critically threatened in this country (Grulich 2012).

Mercurialis annua (Fig. 57)

Mercurialis annua is apparently native to the western Mediterranean area, but currently it is widespread in the entire Mediterranean area (including its African and Asian parts) as well as western and central Europe northwards to the British Isles and southern Scandinavia, and it also occurs along the coasts of the Black Sea. It has been introduced into New Zealand and the Americas (Meusel et al. 1978, Gillespie 2016). In the Czech Republic *M. annua* grows in various ruderal habitats in towns and villages such as pavement joints, roadsides, disturbed patches in ruderal grasslands, soil heaps, rubble sites, railway stations, yards of agricultural and industrial facilities, village squares and as a weed in gardens and flower beds in public spaces; outside human settlements it is most frequent as a weed in

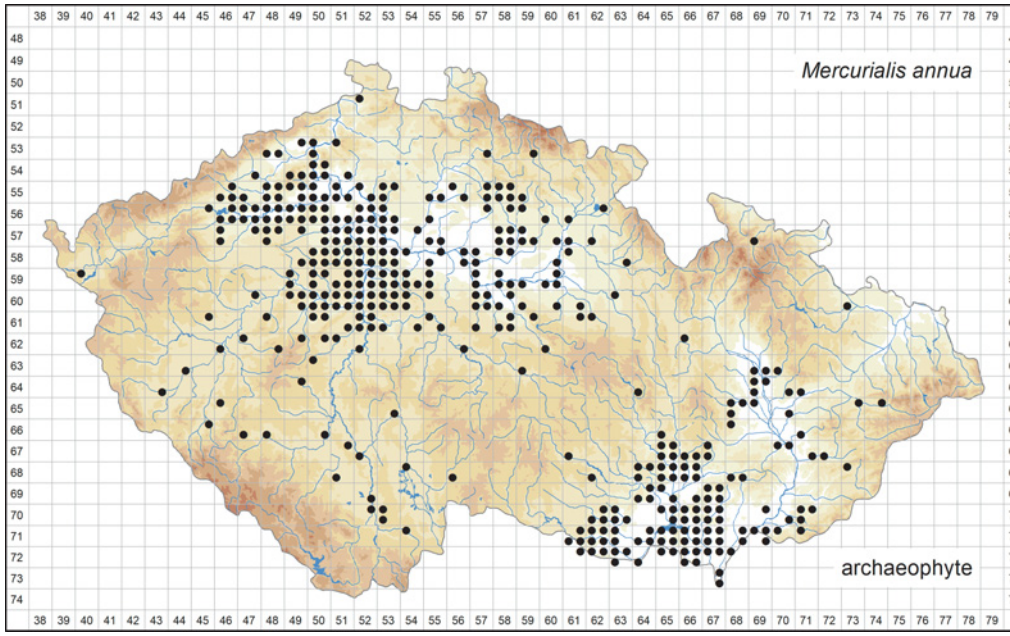

Fig. 57. Distribution of *Mercurialis annua* in the Czech Republic (393 occupied quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

root crop and vegetable fields, on fallow land, along dirt roads, on railway embankments and screes at bases of rocks. It prefers loamy to loamy-sandy permeable soils. In this country *M. annua* is mainly found in dry, warm lowlands and adjacent hilly areas in north-western and central Bohemia and south-western and southern Moravia. It is particularly frequent in cities and towns, e.g. Prague, Brno, Znojmo and Olomouc. Elsewhere it is occasionally introduced to middle elevations, but these occurrences are mostly just temporary. It is absent from the mountains along the country's borders, from large parts of the Českomoravská vrchovina highlands as well as northern and eastern Moravia and Silesia. Most of the stable occurrences are found at elevations of up to 400 m. However, records of introduced plants exist from elevations above 500 m, e.g. from the towns of Strašice and Příbram in central Bohemia, and Vrchlabí in north-eastern Bohemia. *Mercurialis annua* is classified as a naturalized archaeophyte in this country (Pyšek et al. 2022).

Mercurialis ovata (Fig. 58)

Mercurialis ovata is distributed in southern Europe in Italy and the Balkan Peninsula, extending northwards to Switzerland, Germany, the Czech Republic and Poland, and eastwards to Anatolia and the area around the Black Sea (Meusel et al. 1978). In the Czech Republic it grows in open-canopy thermophilous oak and oak-hornbeam forests, scrub along dirt roads and between vineyards and on scree forest slopes. The soils are often stony, permeable, basic to neutral, rich in humus and nutrients. *Mercurialis ovata* is a thermophilous species, in this country confined to two areas. Most of its sites are in the warm parts of south-western and southern Moravia, namely in the surroundings of the

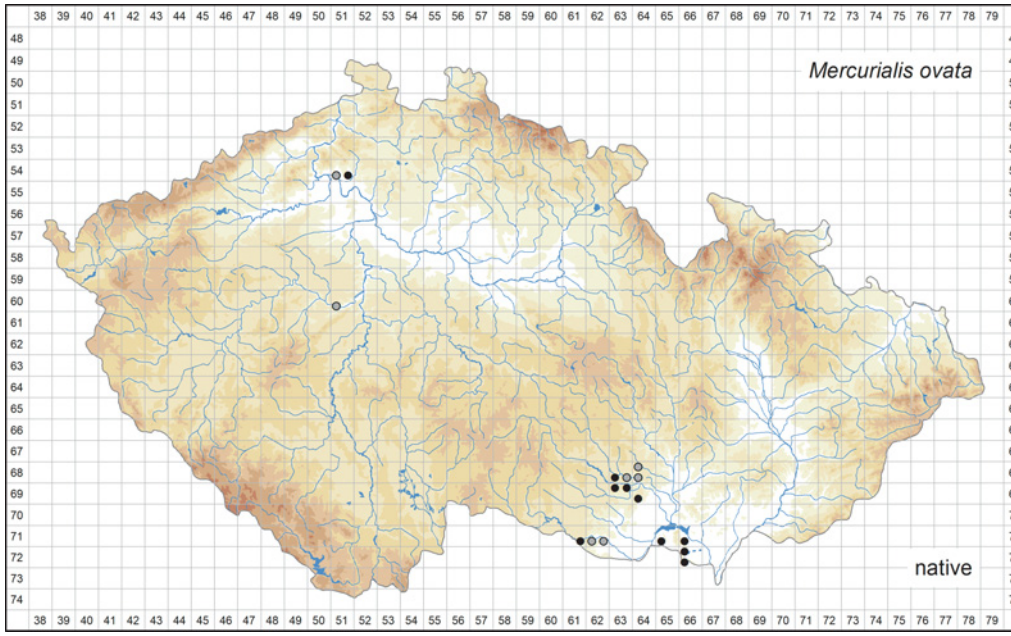

Fig. 58. Distribution of *Mercurialis ovata* in the Czech Republic: ● at least one record in 2000–2024 (10 quadrants), ● pre-2000 records only (7 quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

towns of Znojmo and Moravský Krumlov, in the Dunajovické vrchy hills and on the hills east and south-east of the town of Mikulov and south-west of the town of Valtice. In Bohemia this species has been recorded at two sites only; an extant population is on Skalky hill above the village of Encovany near the town of Litoměřice in northern Bohemia, whereas there is only an old record from the town of Karlštejn in the Český kras karst area in central Bohemia. The Bohemian populations are situated at the north-western limit of this species' range. At some of its sites, where it co-occurs with *M. perennis*, hybrids may be present (Kubát 1992), but we were not able to identify them in herbaria with certainty. *Mercurialis ovata* is classified as endangered due to its rarity (Grulich 2012).

Mercurialis perennis (Fig. 59)

Mercurialis perennis is a European species with its range extending northwards to southern Scandinavia and eastwards to the central part of European Russia; it is absent from the driest parts of the Mediterranean area and the large north-eastern and south-eastern parts of European Russia. An isolated outpost is in northernmost Algeria (Meusel et al. 1978). In the Czech Republic *M. perennis* is frequent in deciduous and mixed forests but also survives in secondary spruce plantations in areas of previous primary deciduous forests, where it grows mainly on humid, acidic to slightly basic soils that are rich in humus and nutrients. It is widespread in the mountains and at middle elevations throughout the country. In contrast, it is rare in or absent mainly from lowlands and deforested areas with prevailing arable land.

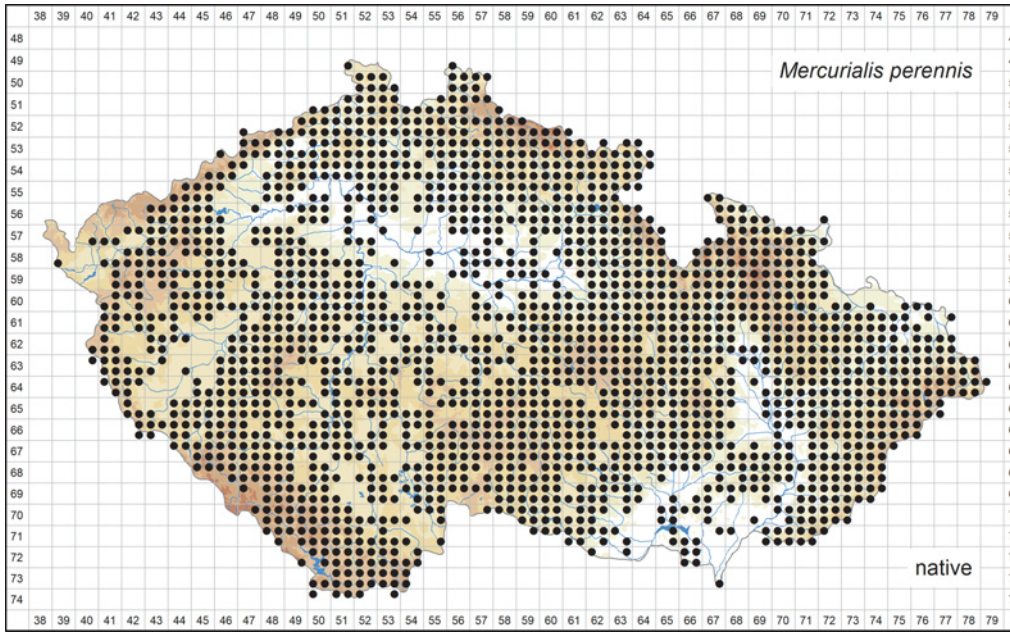

Fig. 59. Distribution of *Mercurialis perennis* in the Czech Republic (1,897 occupied quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

Nassella tenuissima (Fig. 60)

Nassella tenuissima is native to Argentina and Chile (Verloove 2005, Řepka et al. 2021) but according to Barkworth (2007) also native to the south-western USA and Mexico. In Argentina it occurs in pastures and scrub savannah (Řepka et al. 2021). It is a grass of high ornamental value, cultivated in various parts of the world with suitable climates. Escaped plants have been recorded in California and Colombia in the Americas, as well as in various countries of Europe, South Africa, south-eastern Australia and New Zealand (POWO 2024). In Europe *N. tenuissima* has been recorded in the British Isles, Spain, France, Germany, the Czech Republic, Austria, Switzerland and Italy (POWO 2024). It is at least locally established in southern France (Verloove 2005) and probably also elsewhere in southern Europe. In the Czech Republic *N. tenuissima* has been cultivated since the 1990s (Řepka et al. 2021). Nowadays it is a fashionable ornamental plant frequently planted in public spaces in cities and towns, as well as in private gardens. The first record of escaped plants in this country dates to 2016, when this species was collected in Prague's Vinohrady district. Escaped plants are usually found near cultivated specimens, most frequently in pavement joints, along walls and at places covered by gravel. As of September 2024, 22 records are available in the database, but these may represent only a small portion of actual escapes. *Nassella tenuissima* is classified as a casual neophyte (Pyšek et al. 2022).

Ononis arvensis (Fig. 61)

Ononis arvensis is a Eurasian species occurring in areas with temperate continental climates. In Europe the species' range is situated in the eastern part of the continent, extending

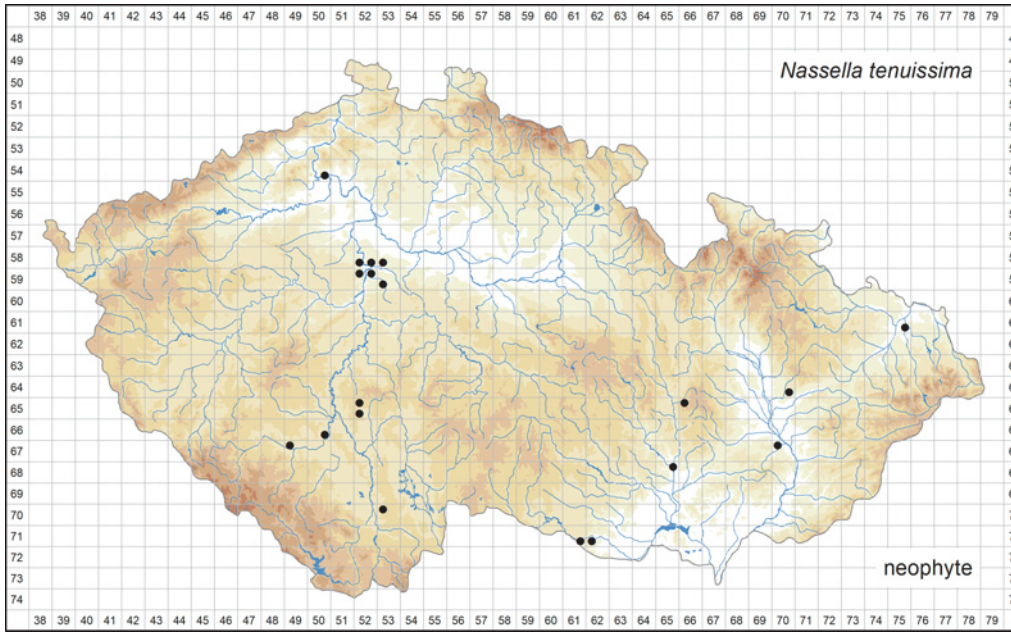

Fig. 60. Distribution of *Nassella tenuissima* in the Czech Republic: ● at least one record in 2000–2024 (19 quadrants), ● pre-2000 records only (0 quadrants). Prepared by Jiří Danihelka.

westwards to the southern half of Norway and to Denmark, eastern Germany, Austria and northern Italy. At the western boundary of the range, many sites are considered secondary. In Asia it is distributed mainly in temperate regions, eastwards extending perhaps as far as Mongolia, Kashmir and western China, also occurring in northernmost Anatolia and the Caucasus (Meusel et al. 1965, Hultén & Fries 1986, POWO 2024). It is often classified as a subspecies of *O. spinosa* under the name *O. spinosa* subsp. *hircina*. In the Czech Republic *O. arvensis* grows in pastures, mesic meadows, on grassy slopes, in forest fringes, occasionally on intermittently wet meadows that dry out during summer, often also in secondary habitats such as road verges, dirt roads, railways, railway stations and fallow land, at elevations of ~150–780 m. It is a light-demanding species preferring rather dry to moderately damp, neutral to basic, rather nutrient-poor soils. In this country the species grows at the western limit of its native distribution. It occurs continuously in the hilly area between the towns of Nový Jičín and Třinec in north-eastern Moravia and adjacent Silesia, while being rare elsewhere. Due to the frequent occurrence in man-made habitats, it is difficult to estimate the extent of its native range in this country. However, the species is likely to be indigenous also in the vicinity of the town of Opava in Silesia, at the northern edge of the city of Olomouc in central Moravia, and perhaps even in eastern Bohemia. The sites elsewhere in Bohemia are certainly secondary, but at some of them the species can persist for long periods, as is the case on the eastern outskirts of Prague (from 1873 until today) and at the railway station in the city of České Budějovice in southern Bohemia (since 1947 until present). *Ononis arvensis* has declined due to abandonment or intensive use of pastures and meadows. It is classified as vulnerable (Grulich 2012).

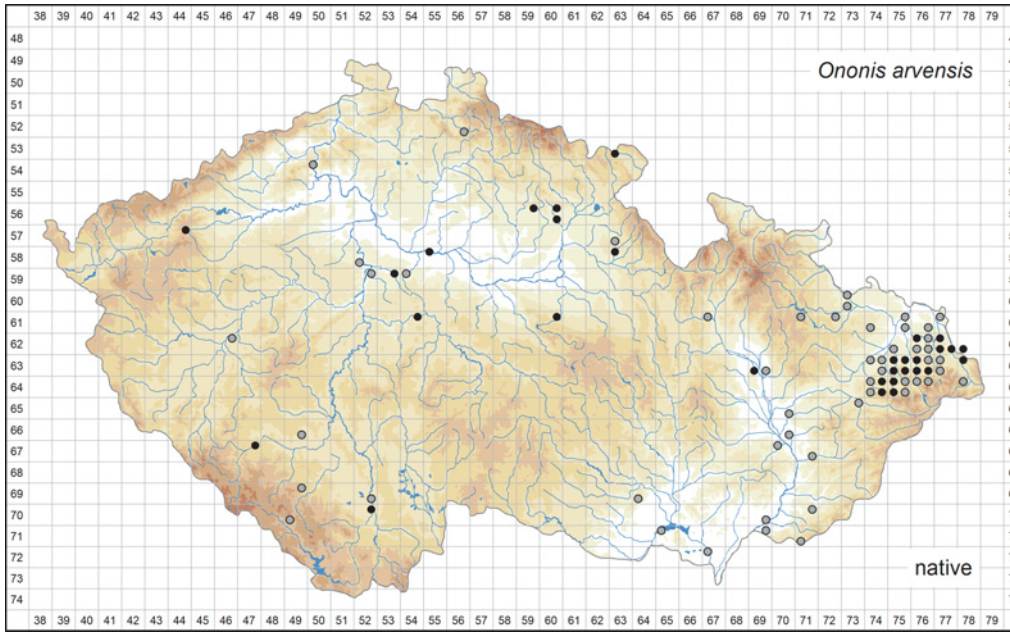

Fig. 61. Distribution of *Ononis arvensis* in the Czech Republic: ● at least one record in 2000–2024 (30 quadrants), ● pre-2000 records only (51 quadrants). Prepared by Jan Prančl.

Ononis repens (Fig. 62)

Ononis repens is distributed mainly in the western half of Europe. Towards the east, its distribution extends to southern Sweden and the Baltic countries, Poland, the Czech Republic and Austria; through the mountains of the Balkan Peninsula it reaches Bulgaria and northern Greece, with rare occurrences reported from Romania, southern Ukraine and Turkey. It is reported to have been introduced into Finland, the north-eastern USA and New Zealand. Two subspecies are distinguished, of which the typical subspecies occurs throughout most of the species' range, while subsp. *australis* grows in the Iberian Peninsula and northern Morocco (Meusel et al. 1965, Hultén & Fries 1986, NZPCN 2024, POWO 2024). *Ononis repens* is often classified at the subspecies level under the names *O. spinosa* subsp. *procurrens* or *O. spinosa* subsp. *maritima*; under this concept, *O. repens* subsp. *australis* is named *O. spinosa* subsp. *australis*. In the Czech Republic *O. repens* grows on stony, grassy slopes, in pastures, rather dry meadows, fallows, often also on road verges, dirt roads and railway embankments. It is a light-demanding species preferring rather dry, neutral to mineral-rich, nutrient-poor, rather shallow soils. In this country this species reaches the eastern limit of its distribution. It is more or less continuously distributed in moderately warm parts of south-western Bohemia. From there it extends to other areas through the valleys of the major rivers: through the successive valleys of the Berounka, Vltava and Labe rivers it penetrates to central and northern Bohemia up to the border with Germany; rarer occurrences are known in the middle course of the Vltava river at the border of southern and central Bohemia and in the valley of the Ohře river in north-western Bohemia. It has been introduced to a few sites elsewhere, in

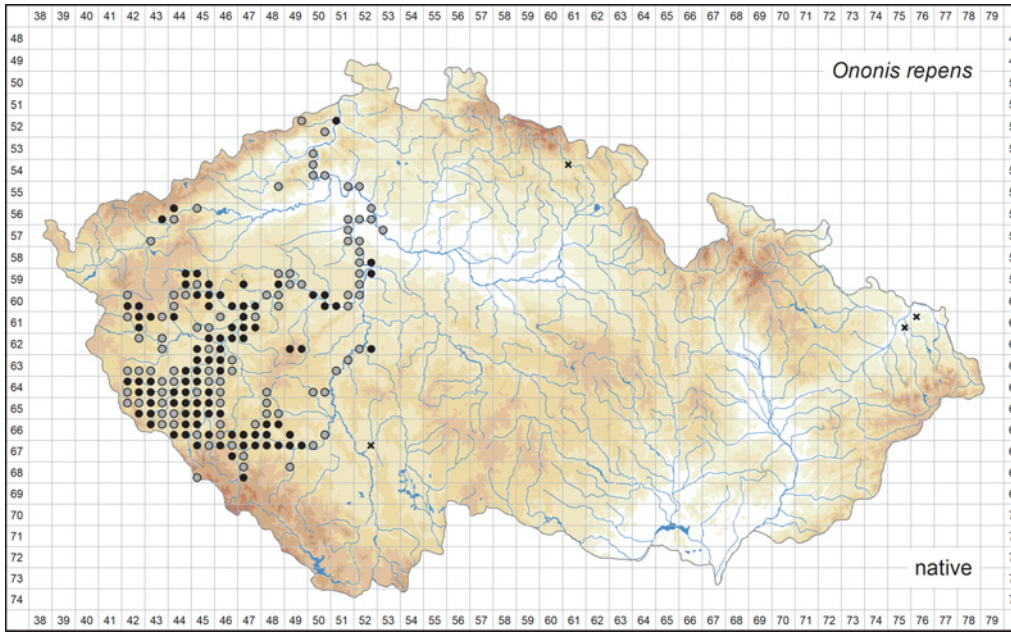

Fig. 62. Distribution of *Ononis repens* in the Czech Republic: ● native, at least one record in 2000–2024 (91 quadrants), native, ◍ pre-2000 records only (93 quadrants), × alien only (4 quadrants). Prepared by Jan Prančl.

most cases with rail traffic. The elevational maximum recorded is 780 m near the village of Rejštejn in the foothills of the Šumava Mts. *Ononis repens* has declined due to the eutrophication of landscape, abandonment or intensive use of pastures and meadows and also the urbanization of the riverside areas in the large river valleys in Bohemia. It is therefore classified as vulnerable (Grulich 2012).

Ononis spinosa (Fig. 63)

Ononis spinosa is a highly polymorphic species with an unresolved taxonomy. According to various concepts, one to eight subspecies are distinguished, some of which are often separated as distinct species (including *O. arvensis* and *O. repens*, see above). In its broadest circumscription, it is distributed in most of Europe except Iceland and north-eastern parts of Scandinavia, in northern Africa and in south-western and central Asia, eastwards to western China. In the narrowest sense it includes a single subspecies (corresponding to subsp. *spinosa*) occurring mainly in western and central Europe, westwards reaching Great Britain and western France, eastwards extending into southern Sweden, Poland, western Ukraine and the mountains of the Balkan Peninsula, perhaps also into Belarus, Romania and Moldova. It is reported to have been introduced into Finland, the USA, Australia and New Zealand (Meusel et al. 1965, Hultén & Fries 1986, POWO 2024). In the narrow circumscription adopted here (distinguishing *O. arvensis* and *O. repens* as separate species), only subsp. *spinosa* occurs in the Czech Republic. It grows in various types of semi-dry grasslands and meadows, on pastures, shrubby slopes, intermittently wet meadows that dry out during summer, often also on road verges, dirt roads, at railway

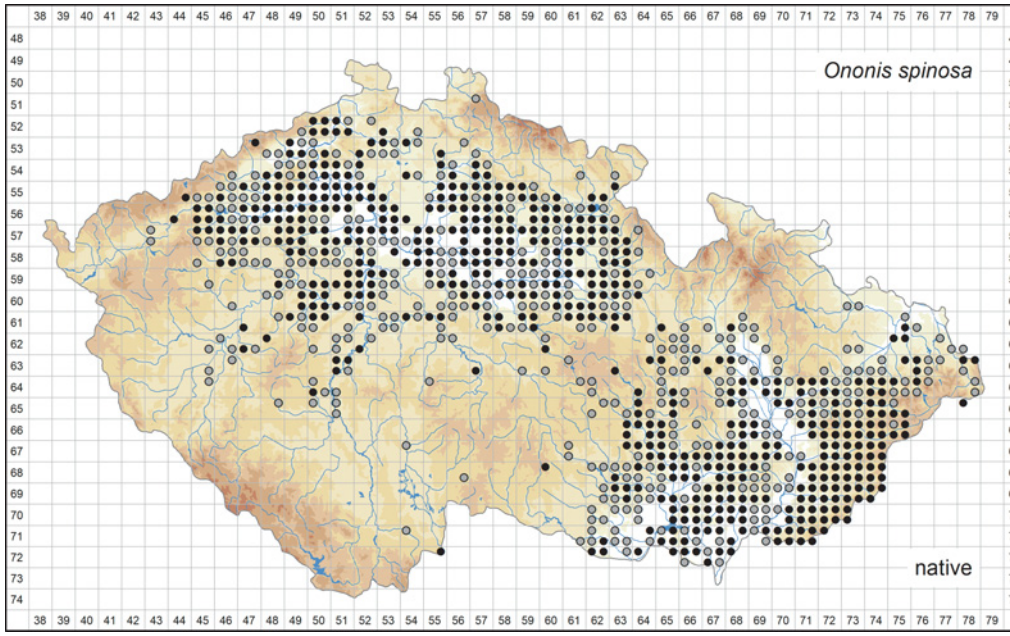

Fig. 63. Distribution of *Ononis spinosa* in the Czech Republic: ● at least one record in 2000–2024 (546 quadrants), ● pre-2000 records only (353 quadrants). Prepared by Jan Prančl.

stations and on railway embankments. Soils are rather deep and heavy, neutral to mineral-rich, nutrient-poor to moderately rich in nutrients, sometimes also slightly saline. *Ononis spinosa* is distributed throughout the warm parts of Bohemia and Moravia, while it is significantly rarer in colder areas where it is usually confined to basic bedrock. It usually ascends to the elevation of ~650 m; the elevational maxima have been recorded as 1,080 m on Mt Malý Smrk in the Moravskoslezské Beskydy Mts and 870 m on Mt Vlčí hora in the Krušné hory Mts, but these occurrences are rather secondary. It is absent from or very rare in southern, westernmost and northernmost Bohemia, the central part of the Českomoravská vrchovina highlands and north-western Moravia, being usually only rarely introduced into these areas. Although it is still rather common in some areas, it has undoubtedly declined due to either abandonment or intensive use and eutrophication of grasslands, particularly in the peripheral areas of its range.

Ononis ×*pseudohircina* (Fig. 64)

Ononis ×*pseudohircina* is a hybrid of *O. arvensis* and *O. spinosa*. According to this definition, it is reported only from Transylvania, from where it was described (Schur 1866, Soó 1966), and from the Czech Republic (Kirschner & Štěpánek 1995). However, in western Europe this name is sometimes, probably erroneously, attributed to the hybrid *O. repens* × *O. spinosa* (Kloda et al. 2008, Bock 2011). In the Czech Republic *O. spinosa* grows in all areas where *O. arvensis* occurs; although most individuals in these areas are clearly assignable to one or the other species, some individuals show more or less continuous morphological transition between the two taxa. This could be the result of hybrid-

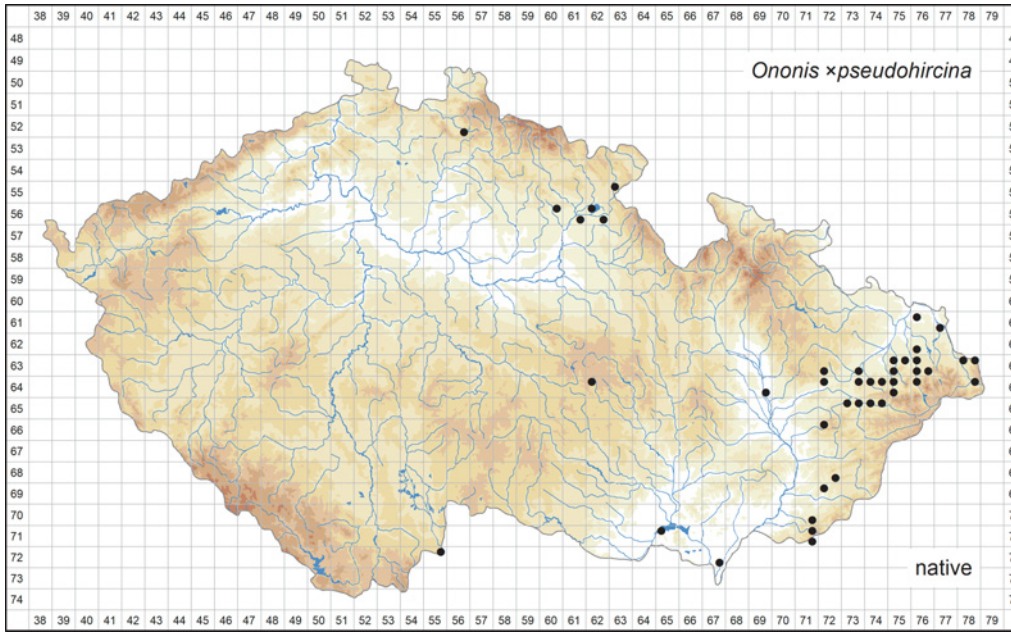

Fig. 64. Distribution of *Ononis* ×*pseudohircina* in the Czech Republic (42 occupied quadrants). Prepared by Jan Prančl.

ization or perhaps even backcrossing and introgression between these two diploid species. However, gene flow between them has not yet been confirmed by contemporary genetic methods and determining the true identity of such plants is a matter for further study. For practical reasons, only plants clearly sharing characters of both species are referred to here as hybrids. *Ononis* ×*pseudohircina* has similar ecological requirements as *O. arvensis*. It occurs mainly in the continuous range of *O. arvensis* in north-eastern Moravia and adjacent Silesia, while it is much rarer in the southern parts of Moravia and eastern Bohemia. Plants with the characters of *O.* ×*pseudohircina* also occur occasionally from introduction outside the native range of *O. arvensis*, namely in the towns of Jablonec nad Nisou in northern Bohemia, České Velenice in southern Bohemia and Nové Město na Moravě in the Českomoravská vrchovina highlands.

Pseudorchis albida (Fig. 65)

Pseudorchis albida is an amphi-atlantic species with a disjunct arctic-montane distribution in Europe, north-western Asia and north-eastern North America. Two to three subspecies are distinguished. The typical subspecies occurs mainly in the British Isles, Denmark, north-western Scandinavia and the northern European Russia; isolated southern outpost are mainly in mountains of central and southern Europe including the Pyrenees, Alps, Apennines, Dinarids, Sudetes and Carpathians. Near the northern Ural Mts it marginally penetrates into Asia. The second infraspecific taxon, subsp. *straminea*, occurs in north-western Scandinavia, the Faroe Islands, Iceland, coastal areas of southern Greenland, Newfoundland and Quebec (Meusel et al. 1965, Hultén & Fries 1986, Sheviak

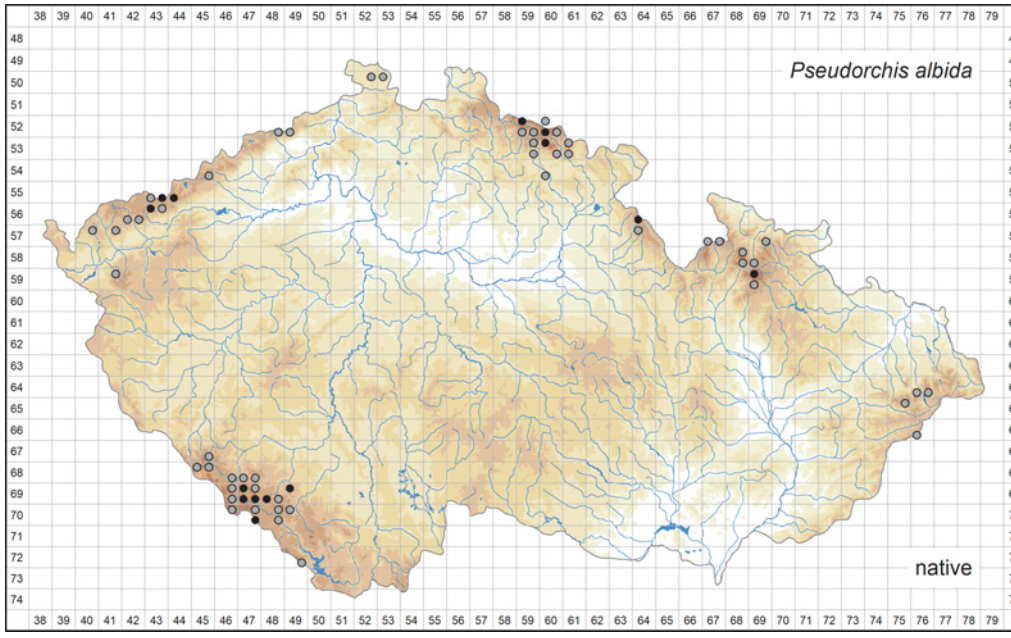

Fig. 65. Distribution of *Pseudorchis albida* in the Czech Republic: ● at least one record in 2000–2024 (14 quadrants), ● pre-2000 records only (50 quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

2002b). Another, subsp. *tricuspis*, has been distinguished in the Alps, Carpathians and Scandinavia (Klein 2000) but is not widely accepted. In the Czech Republic *P. albida* grows in montane and subalpine meadows and grasslands on shallow, loamy or peaty, skeletal, fresh, acidic soils. It is a rare species restricted to the high mountains along this country's borders, mainly the Šumava, Krušné hory, Krkonoše, Orlické hory, Králický Sněžník, Hrubý Jeseník and Moravskoslezské Beskydy Mts. Many of its populations have vanished due to acidification and changes in the management of mountain meadows. *Pseudorchis albida* is therefore classified as endangered (Grulich 2012).

Pyracantha coccinea (Fig. 66)

Pyracantha coccinea is native to the Mediterranean area in Europe, particularly Italy and the Balkan Peninsula, and to south-western Asia. The northern limit of its native range in Europe extends from Spain and France to Italy. In the Balkan Peninsula, the species occurs in Croatia, Montenegro, Albania, Greece, North Macedonia, Turkey and Bulgaria. An isolated occurrence is found in Crimea (Kurtto et al. 2013). In Europe *P. coccinea* has been cultivated since around 1600, and in the Czech Republic since 1785, when it was planted in the Lány manor garden in central Bohemia (Pejchal et al. 2021). Based on herbarium specimens, it was first recorded as escaped in the town of Příbram in central Bohemia in 1957. Only four additional records of escaped plants exist from the period 1970–2000. Since 2001, a total of 55 occurrences of escaped plants have been recorded, with their numbers increasing rapidly in recent years. This species is used in landscape design and is chiefly valued as a drought-tolerant shrub planted as hedges and groups of

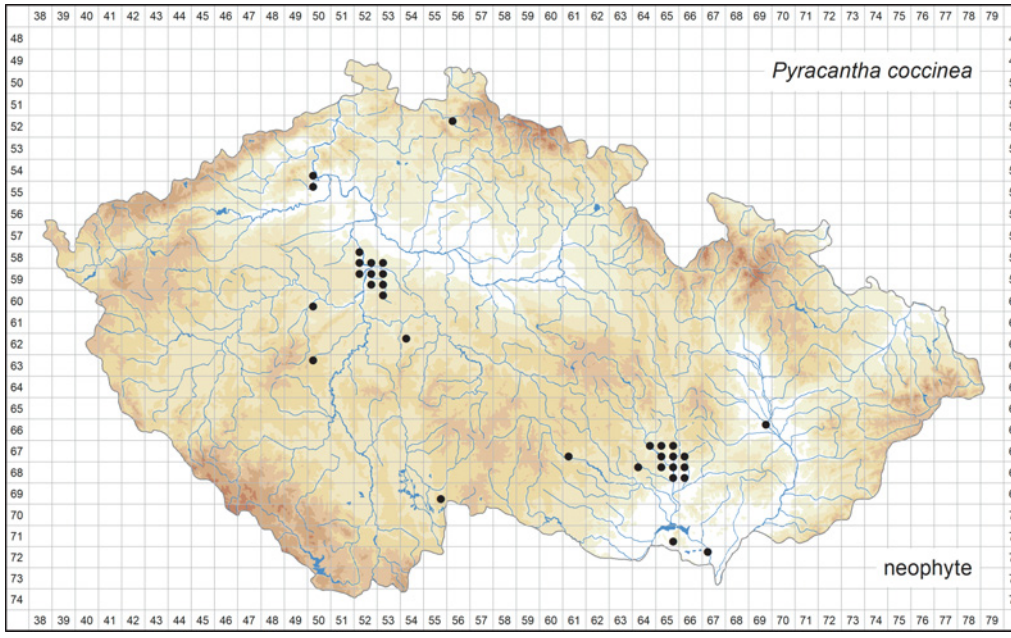

Fig. 66. Distribution of *Pyracantha coccinea* in the Czech Republic (33 occupied quadrants). Prepared by Jiří Velebil.

shrubs in both public parks and private gardens. It spontaneously spreads in the surroundings of cultivated plants, mainly through bird dispersal. Escaped plants occur mostly in various types of scrub and at ruderal sites, less frequently in grasslands, rocky slopes and forest fringes. Most of the recent records are from cities and towns, chiefly Prague and Brno. *Pyracantha coccinea* is classified as a naturalized neophyte (Pyšek et al. 2022). Only records explicitly referring to escaped plants were included in the map.

Rosa canina agg. (Figs 67–69)

Rosa canina agg. comprises several dozen taxa at species and infraspecific levels, previously circumscribed rather narrowly (Klášterský 1968). The current approach is broader (Kurtto et al. 2004) and includes 15 taxa previously recognized at species level. The taxonomy of the group is still unresolved and connected with nomenclatural chaos, with different species concepts among central-European authors (e.g. Větvička 1995, Király 2009, Henker 2017). *Rosa canina* agg. has a European range, with rare occurrences in the subcontinental eastern part of Europe. They are absent from the central part of the Iberian Peninsula, central and eastern Scandinavia, and the north-eastern part of European Russia (Kurtto et al. 2004). In the Czech Republic *R. canina* agg., as circumscribed here, comprises two species, namely *R. canina* and *R. dumalis* (Větvička & Kirschner 2019). Their distribution is almost continuous from the lowlands to low mountains. They are common up to elevations of about 600 m, reaching their elevational maximum at 1,185 m near the settlement of Březník in the Šumava Mts. These plants are very tolerant regarding soil depth, soil type and bedrock. They are common on dry slopes, in abandoned

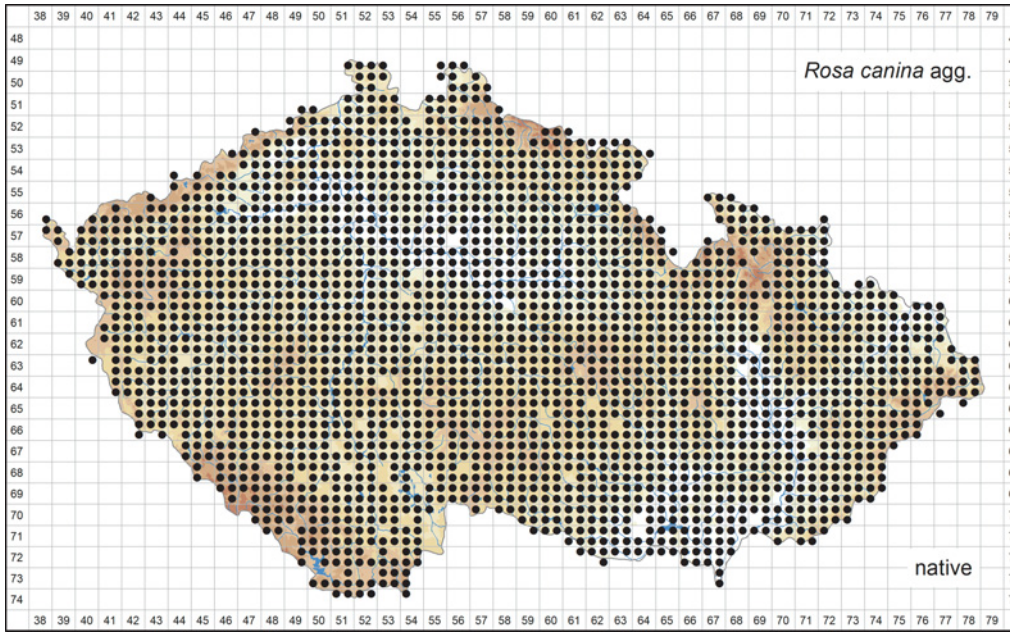

Fig. 67. Distribution of *Rosa canina* agg. in the Czech Republic (2,299 occupied quadrants). Prepared by Radomír Řepka & Petr Maděra.

meadows, along roads and in rocky steppes in warm hilly areas, while they are rather scarce on dry sands, in lowland floodplain forests and on river banks. *Rosa canina* agg. is also shade-tolerant, occurring in oak forests and *Robinia* woods. In recent decades, these roses have spread across abandoned sites and formed long-term successional stages. In dry grasslands and rocky steppes they successfully compete with rarer roses such as *R. agrestis*, *R. elliptica*, *R. micrantha* and *R. rubiginosa*. Their expansion may be a reaction to a combination of cessation of management, eutrophication and climate change. Herbarium and other records of *R. canina* with its two subspecies and *R. dumalis* with its four subspecies (see Větvička & Kirschner 2019) have all been included in the map (Fig. 67).

Rosa canina is a European species distributed from the British Isles in the west to south-western Russia in the east. It is absent from the western part of France and the central part of the Iberian Peninsula. There are few records from Belarus and Ukraine, similar to the European part of Russia, where the occurrence of the species gradually diminishes until it reaches the edge of its range (Kurtto et al. 2004). In the Czech Republic *R. canina* grows in a broad range of habitats including abandoned meadows and pastures, in fallows, in the undergrowth of various types of open-canopy deciduous forests and their fringes, and along roads and railways. It is common to scattered in rather dry and warm areas up to elevations of about 600 m, becoming progressively rarer towards high elevations and reaching its elevation maxima at about 1,100 m in the Šumava and Jizerské hory Mts (Fig. 68). The map was compiled based on examined herbarium specimens only. Identification of more than 10,000 specimens revealed that *R. canina* is less frequent than *R. dumalis* in this country. However, some of the gaps in the map at low elevations are due to a lack of data, but the species probably occurs there too. Two subspecies, subsp. *canina* and subsp. *corymbifera*, are sometimes distinguished (e.g. Větvička & Kirschner 2019). However, there is a continuous morphological transition between these subspecies that does not allow their clear separation.

Rosa dumalis is a species with a European distribution range, extending from the British Isles in the west to western Ukraine in the east. It is almost absent from Ireland, the Iberian Peninsula, France, parts of Denmark and north-western Germany, while it is common in central Europe, the Baltic countries, towards the north reaching Sweden and Finland. In southern, south-eastern, north-eastern and eastern Europe, possibly even on the Balkan Peninsula, it has only scattered occurrence, mostly in the mountains (Kurtto et al. 2004). In the Czech Republic *R. dumalis* tolerates various degrees of soil humidity. It is found in relatively wet habitats like river banks, fishpond dams and embankments along streams and rivers, but is most abundant in dry habitats such as forest fringes, grasslands along dirt roads and railways and abandoned agricultural land. It occurs from lowlands (although rarely) up to submontane areas, being most frequent in hilly landscapes and scattered in wetter high elevations, reaching its elevational maximum at 1,150 m near the settlement of Bučina in the Šumava Mts (Fig. 69). The map is based on examined herbarium specimens only. Four subspecies are distinguished within *R. dumalis* in the Czech Republic (Větvička & Kirschner 2019), namely subsp. *dumalis*, subsp. *coriifolia*, subsp. *subcanina* and subsp. *subcollina*. Their identification (especially in herbarium specimens) is not always reliable. Therefore, we do not provide separate maps for these subspecies.

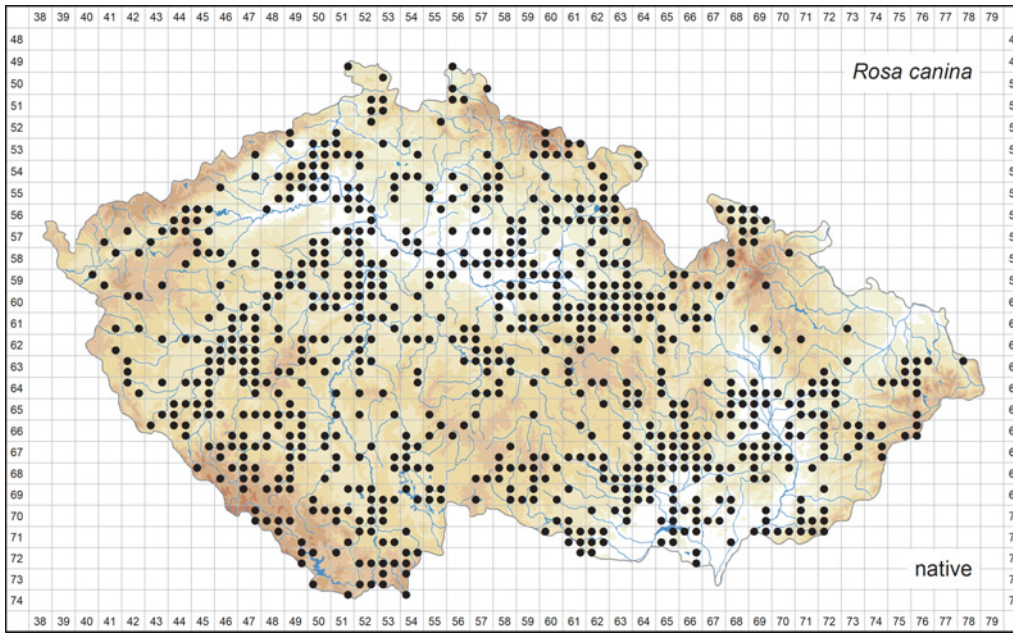

Fig. 68. Distribution of *Rosa canina* in the Czech Republic (800 occupied quadrants). Prepared by Radomír Řepka & Petr Maděra.

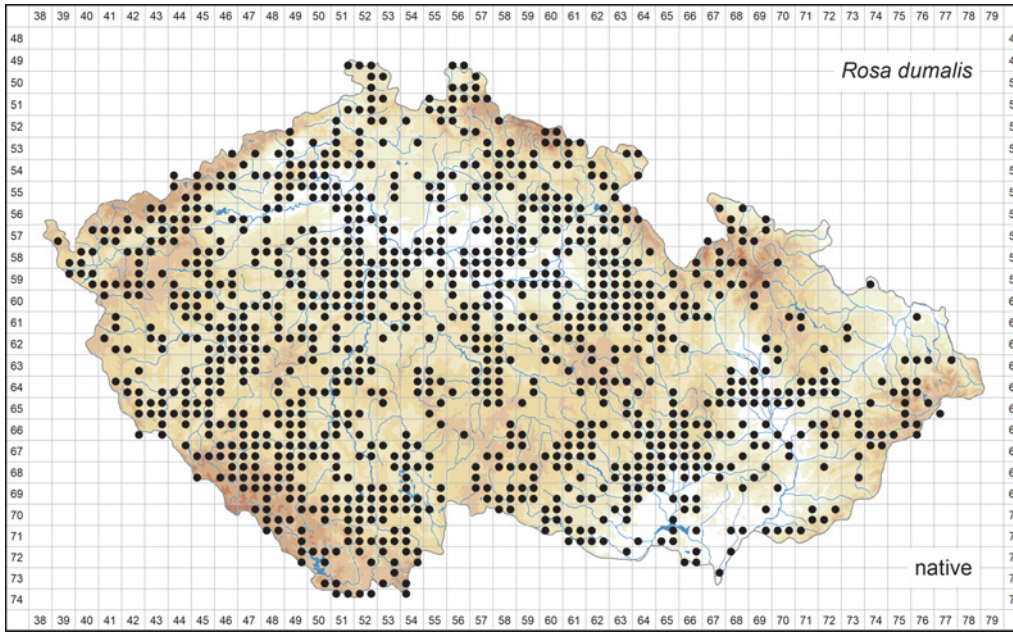

Fig. 69. Distribution of *Rosa dumalis* in the Czech Republic (1,099 occupied quadrants). Prepared by Radomír Řepka & Petr Maděra.

Rosa multiflora (Fig. 70)

Rosa multiflora is native to eastern Asia, including China, Japan, and Korea (Gu & Robertson 2003). It is also known as "Japanese rose" or polyantha roses, which are garden cultivars derived from hybrids of *R. multiflora*. It is grown as an ornamental plant and also used as a rootstock for some ornamental rose cultivars (Větvička 1995). It was introduced into Europe and North America before 1811 and today is regarded as an invasive species in the western, eastern and southern parts of North America (Lewis et al. 2014). In Europe *R. multiflora* has become established mainly in its western parts. It has become naturalized in the British Isles, France, Germany, Denmark and the southern part of Scandinavia, it is also recorded in Poland and Austria (GBIF 2024). In the Czech Republic *R. multiflora* has been cultivated since 1911 (Pejchal et al. 2021). It has escaped at about 45 sites, in both relatively warm and rather cold areas but mostly in the vicinity of the cities of Prague, Brno and Ostrava, where it is often planted as an ornamental shrub. The first record of an escaped plant dates to 1951, when it was found near the town of Slatiňany in eastern Bohemia. Most of the records come from elevations below 400 m. The species is classified as a casual neophyte (Pyšek et al. 2022).

Rosa pendulina (Fig. 71)

Rosa pendulina is a European endemic distributed in mountain areas in western, central, southern and south-eastern Europe. It grows in the Pyrenees, the Alps, the mountains of the Apennine Peninsula, mountains of the Bohemian massif, the Carpathians and the mountains of the Balkan Peninsula (Kurtto et al. 2004). The northern limit of the species

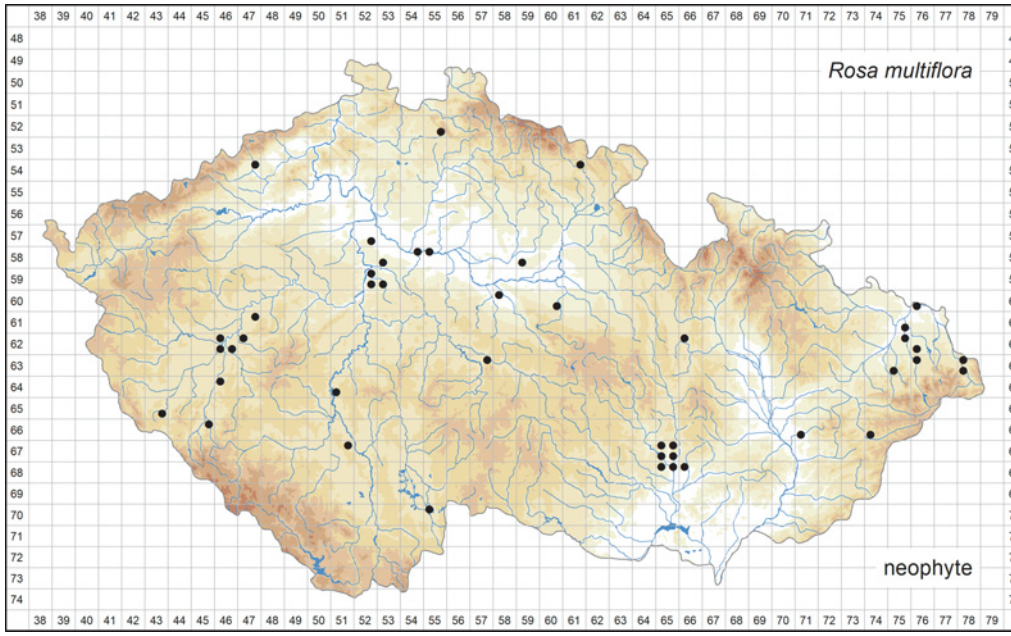

Fig. 70. Distribution of *Rosa multiflora* in the Czech Republic (43 occupied quadrants). Prepared by Radomír Řepka & Petr Maděra.

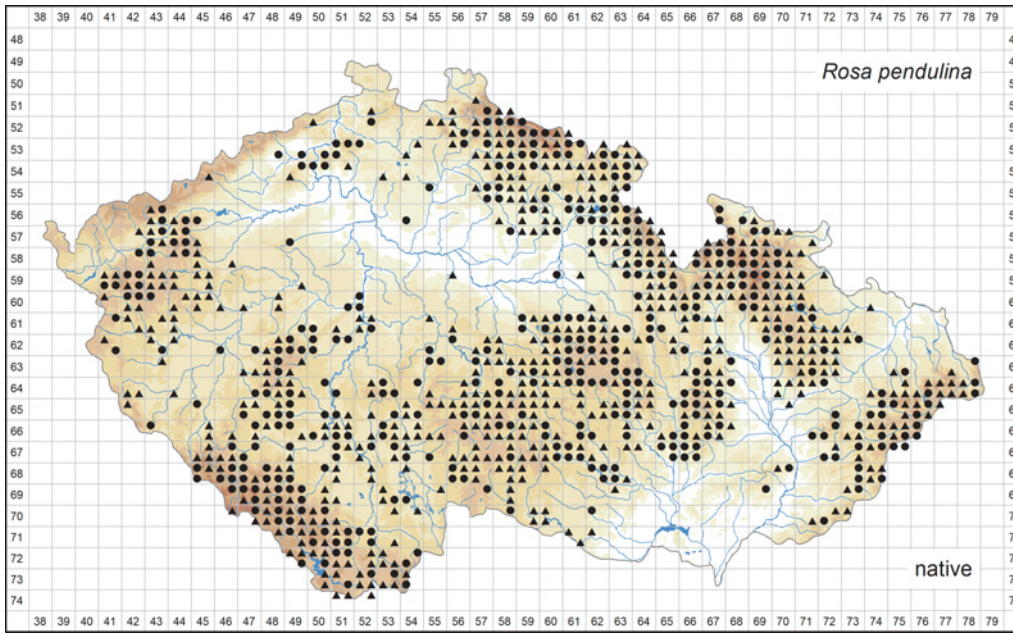

Fig. 71. Distribution of *Rosa pendulina* in the Czech Republic: ● occurrence documented by herbarium specimens (392 quadrants), ▲ occurrence based on other records (544 quadrants). Prepared by Radomír Řepka & Petr Maděra.

range runs through southern Poland and the northern part of the Czech Republic. The most common habitats of *R. pendulina* in the Czech Republic are rocky slopes, screes, stream banks, mixed and spruce forests, and avalanche tracks in glacial cirques, on various bedrock. The species has scattered occurrence from foothills to the subalpine belt, mainly in the peripheral mountain ranges and in the Českomoravská vrchovina highlands, but it is almost absent from the Krušné hory Mts. Numerous sites are found also in the Slavkovský les and Brdy hills, Drahanská vrchovina highlands and the Nízký Jeseník Mts. At some places, *R. pendulina* descends to low elevations, mainly along deep river valleys. It is rare in or absent from large parts of this country, particularly lowlands and warm hilly regions without suitable habitats. It reaches its elevational maxima at 1,370–1,390 m on Mt Králický Sněžník, in the Kotelní jámy glacial cirque in the Krkonoše Mts and in the Velká kotlina glacial cirque in the Hrubý Jeseník Mts. Its elevational minima are at 210–220 m, located at the village of Hluchov near the town of Prostějov, at the town of Přerov and at the town of Kravaře in northern Moravia.

Rosa rugosa (Fig. 72)

Rosa rugosa is native to Japan, Korea, China, the Russian Far East, the Sakhalin Island and the Kuril Islands (Gu & Robertson 2003). In Europe it is planted as an ornamental species and escapes mainly in its Atlantic and sub-Atlantic parts, e.g. in the British Isles, Germany, Poland, the Baltic countries and along the coast of the Scandinavian countries, rarely also in Ukraine, Belarus and the north-western part of European Russia (Kurtto et

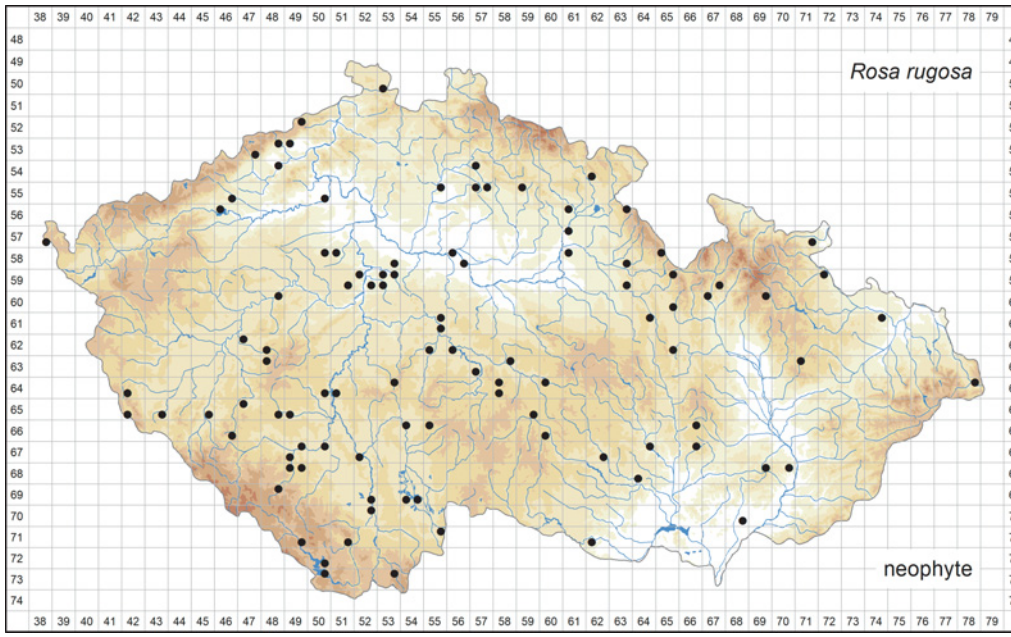

Fig. 72. Distribution of *Rosa rugosa* in the Czech Republic (100 occupied quadrants). Prepared by Radomír Řepka & Petr Maděra.

al. 2004). In addition, *R. rugosa* is widely naturalised in both the Pacific and Atlantic parts of North America, while its occurrence in Alaska and on the Aleutian Islands is probably native (Lewis et al. 2014). In the Czech Republic *R. rugosa* has been cultivated since 1886 (Pejchal et al. 2021). It escapes from cultivation to road verges and abandoned places near villages and towns; however, it is rarer than in other European countries. The first record of an escaped plant near the town of Rýmařov in northern Moravia dates back to 1903. Since then, it has been recorded scattered throughout the country up to middle elevations in the Krkonoše, Šumava and Krušné hory Mts. The species reaches its elevational maximum at about 750 m in the vicinity of the village of Záhvozdí in the Šumava Mts. The map was compiled solely based on the plants obviously escaped from cultivation. *Rosa rugosa* is classified as a casual neophyte (Pyšek et al. 2022).

Rubus

In this series of maps, only species of the subgenus *Rubus* are presented. Maps of members of other native subgenera (*R. chamaemorus*, *R. idaeus* and *R. saxatilis*) and selected members of the subgen. *Rubus* have already been published (Kaplan et al. 2018a). In sect. *Rubus* and subsect. *Hyemales*, members of three series are presented here: ser. *Rhamnifolii* (*R. gracilis*), ser. *Micantes* (*R. tabanimontanus*) and all species of ser. *Hystrix* (*R. apricus*, *R. bavaricus*, *R. brdensis*, *R. koehleri* and *R. schleicheri*). In sect. *Corylifolii* and subsect. *Sepincola*, members of three series are mapped here: ser. *Sepincola* (*R. franconicus*), ser. *Subcanescentes* (*R. mollis*) and ser. *Subradulae* (*R. fabrimontanus*). All these species are endemic to Europe (Kurtto et al. 2010) and are tetraploid except for

R. fabrimontanus, which is pentaploid (Krahulcová & Holub 1996, 1997, 1998). The distribution maps of the species are based solely on examined herbarium specimens, field records of the authors and other botanists with good knowledge of the genus.

Rubus apricus (Fig. 73)

Rubus apricus occurs mainly in central Germany, the Czech Republic and the southern half of Poland. To the west, it extends into Belgium and Luxembourg, to the east, marginally into the westernmost parts of Ukraine and eastern Slovakia. To the south, it extends into northern Austria (Kurtto et al. 2010), while it has been recorded at a single site in south-western Hungary (Király 2015). The Czech Republic is situated at the southern edge of its distribution. In this country, *R. apricus* is found mainly at semi-shaded and sunny places, in clearings, forest margins, along roads and rarely in mixed and coniferous forests and tree plantations. Its preferred soils are loamy, loamy-sandy and stony, humid to rather dry, slightly acidic to acidic and usually rich in humus. In the Czech Republic, *R. apricus* is distributed unevenly. It occurs mainly in south-western Bohemia and the adjacent southern half of central Bohemia, where it is scattered to common. In central and northern Moravia, as well as in Silesia, it is frequent only locally. In contrast, it is almost absent from north-western Bohemia, the Českomoravská vrchovina highlands and the southernmost and easternmost parts of Moravia. In other parts of the country, *R. apricus* has only been recorded in isolated localities. Most of its sites are situated at elevations of 300–600 m, with its elevational maximum at 850 m near the town of Vimperk in the Šumava Mts.

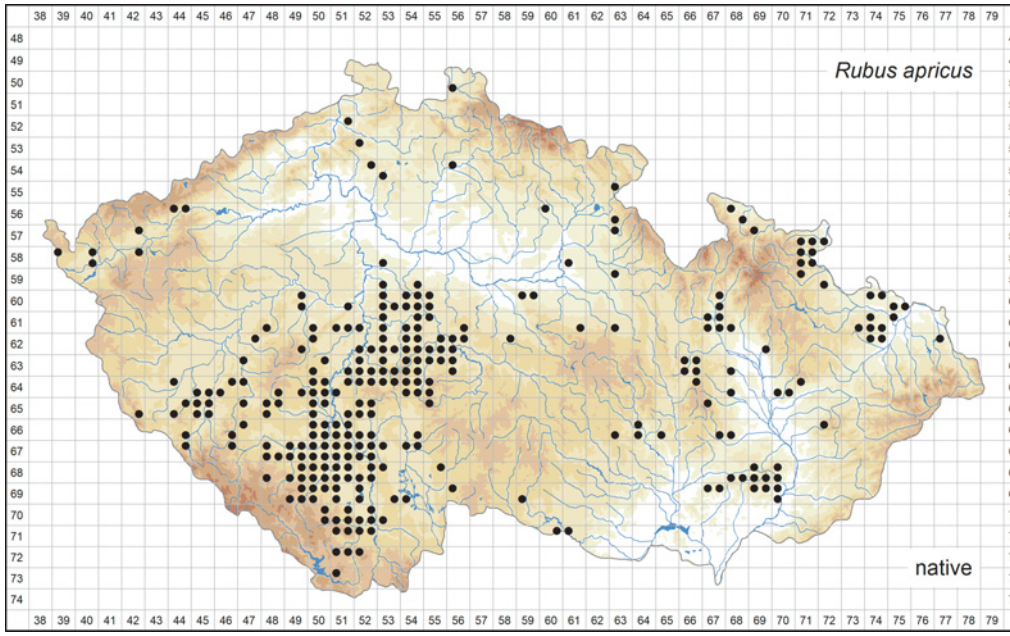

Fig. 73. Distribution of *Rubus apricus* in the Czech Republic (282 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

Rubus bavaricus (Fig. 74)

The main distribution of *Rubus bavaricus* is situated in Bavaria, the adjacent south-western part of Bohemia and marginally in the north-western part of Austria. In addition to this continuous distribution, there are a few isolated occurrences in eastern Germany, central Bohemia and the southern half of Poland (Kurtto et al. 2010, Pagitz 2013). Localities in the Czech Republic are at the north-eastern limit of its distribution. *Rubus bavaricus* grows mainly in forest communities, along roads, in ditches, and forest clearings. It prefers mineral-rich, deep, loamy or loamy-sandy, rather dry, slightly acidic, humus-rich soils. *Rubus bavaricus* occurs in two areas in the Czech Republic. The larger area covers the northern edge of the Šumava Mts, the southern half of the Český les hills, and the adjacent foothills up to the western edge of the city of Plzeň in western Bohemia. The other area is located in central Bohemia at the south-eastern edge of Prague. In addition, it has been recorded here and there in southern, central and western Bohemia. *Rubus bavaricus* occurs at elevations of about 300–700 m, with its elevational maximum at 950 m near the village of Hamry in the Šumava Mts.

Rubus brdensis (Fig. 75)

Until recently, *Rubus brdensis* was considered endemic to the Czech Republic (Holub 1995, Kurtto et al. 2010). In 2020 a small shrub was found in a clearing at the edge of the village of Bayerisch Eisenstein in Bavaria close to the border with Bohemia (Lepší & Lepší 2021). This species was described from the settlement of Sklená Huť near the town of Rokycany in western Bohemia (Holub 1991). It grows in deciduous, mixed and coniferous forests and tree plantations, where it favours semi-shaded places in clearings and

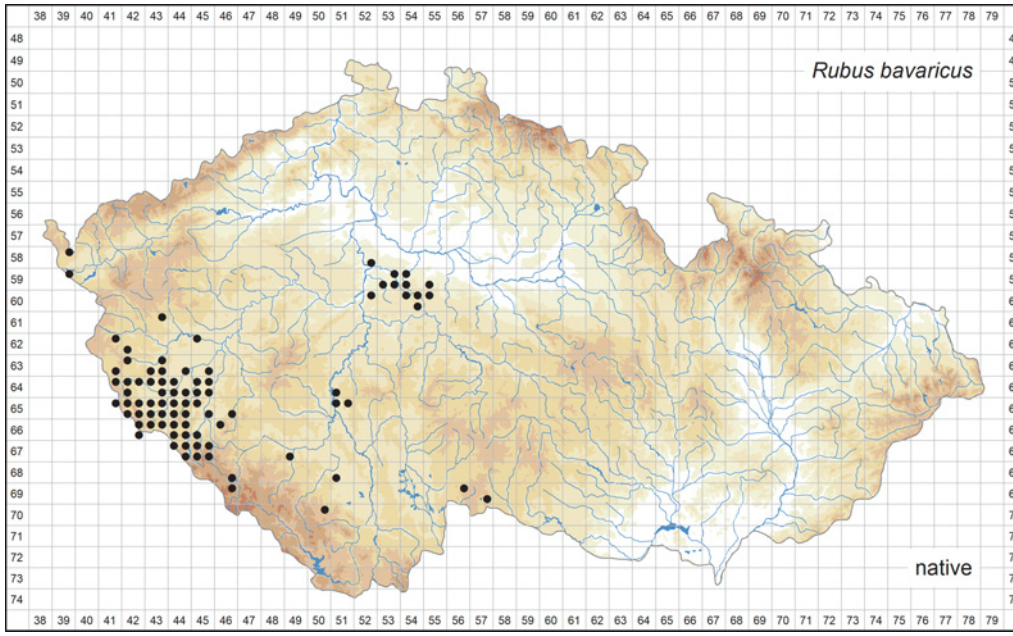

Fig. 74. Distribution of *Rubus bavaricus* in the Czech Republic (82 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

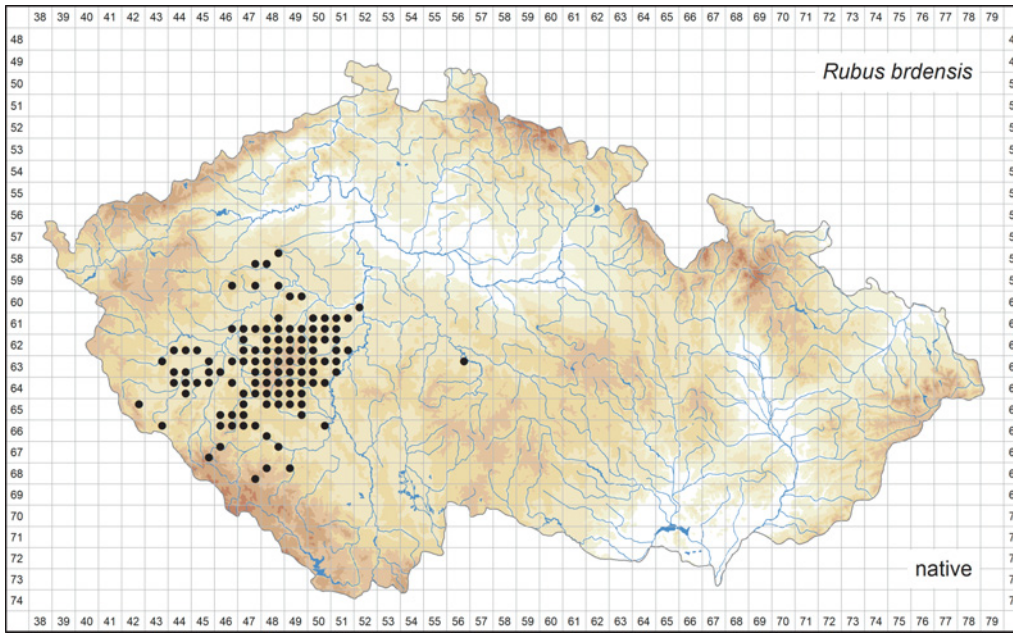

Fig. 75. Distribution of *Rubus brdensis* in the Czech Republic (110 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

forest margins. It prefers rather deep, loamy to loamy-sandy, humid to intermittently wet, non-calcareous soils that are usually rich in humus. The occurrence of *R. brdensis* in the Czech Republic is confined to central and south-western Bohemia. It is scattered to locally common in the Brdy hills and their foothills, extending south-west to the lower parts of the Šumava Mts and the Český les hills and northwards to the western part of central Bohemia. Most of the sites are situated at elevations of 400–700 m, with the elevational maximum at 990 m on Mt Javorná in the Šumava Mts. This species is classified as lower risk – near threatened in this country (Grulich 2012).

Rubus fabrimontanus (Fig. 76)

Rubus fabrimontanus is a Central European species with rare occurrence in northern Europe, including Norway, Denmark and probably southern Sweden. It has a continuous distribution in eastern and northern Germany, south-western, southern, and central Poland, and the Czech Republic (Kurtto et al. 2010). The occurrences in the Czech Republic are at the southern limit of its distribution. In this country *R. fabrimontanus* grows in forests, shaded scrub, along forest paths and roads, in forest fringes, and sometimes also in forest clearings and openings, particularly in mixed or coniferous forests and tree plantations. It thrives on moderately wet to semi-dry, acidic to slightly acidic soils, which are weakly to moderately rich in mineral nutrients and usually rich in humus. This species is scattered or locally common in the northern half of Bohemia, whereas it is rare in southern and south-eastern Bohemia, and in Moravia and Silesia. Most of the sites are situated at elevations of 200–600 m, with the elevational maximum at 885 m near the village of Srní in the Šumava Mts.

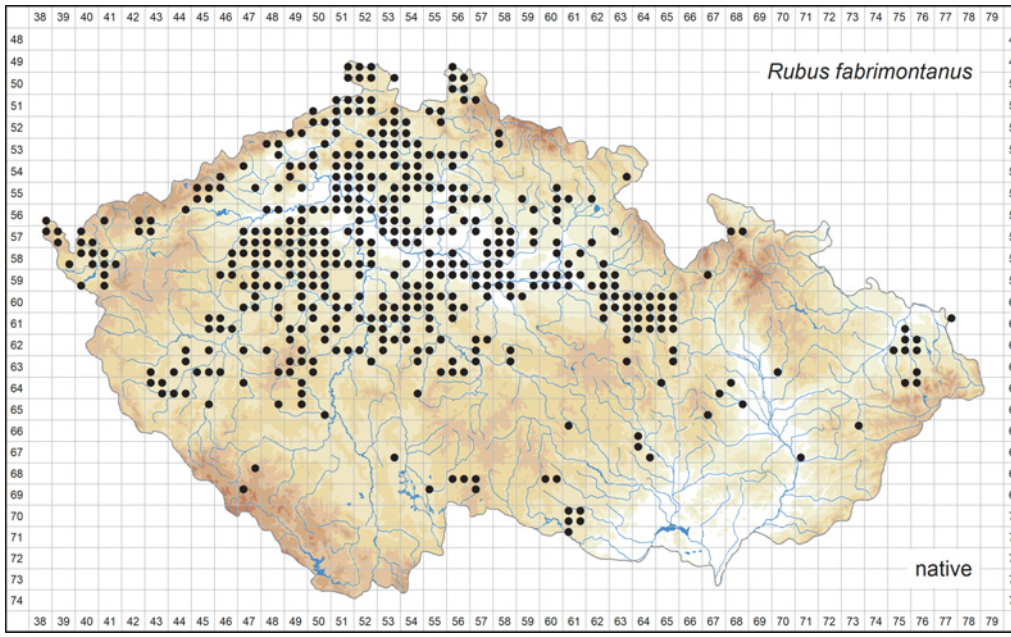

Fig. 76. Distribution of *Rubus fabrimontanus* in the Czech Republic (465 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

Rubus franconicus (Fig. 77)

Rubus franconicus is mainly distributed in the Czech Republic and adjacent eastern Germany, marginally extending into neighbouring northern Austria, south-western Poland and western to central Slovakia (Kurtto et al. 2010). Recently, it has also been found in eastern Austria (Carinthia and Burgenland), western Hungary and north-eastern Slovenia (Király & Hohla 2021). In the Czech Republic *R. franconicus* grows in semi-ruderal to ruderal places such as road ditches, ruderal scrub, forest fringes, sometimes also in forest clearings, often in or near settlements. It is found on loamy, slightly acidic to alkaline, often calcareous, and somewhat eutrophic and slightly humic soils. *Rubus franconicus* occurs mainly in Bohemia, where it is locally common (absent or rare only in the mountains and woodland areas), but the number of localities decreases eastwards. It is almost absent from Moravia, with only five localities recorded, all in its southern part. Most of the sites are situated at elevations of 200–500 m, with the elevational maximum at 870 m near the settlement of Idina Pila in the Šumava Mts.

Rubus gracilis (Fig. 78)

Rubus gracilis is widespread in central Europe, with its range in some areas extending into the adjacent parts of eastern and western Europe. It has been recorded in Luxembourg, Germany, the Czech Republic and Poland, rarely in south-eastern Austria and the adjacent part of Slovenia, with the eastern part of the range extending into western and central Slovakia, western Ukraine and Belarus (Kurtto et al. 2010). This species was described from the settlement of Hluboš near the town of Příbram in central Bohemia

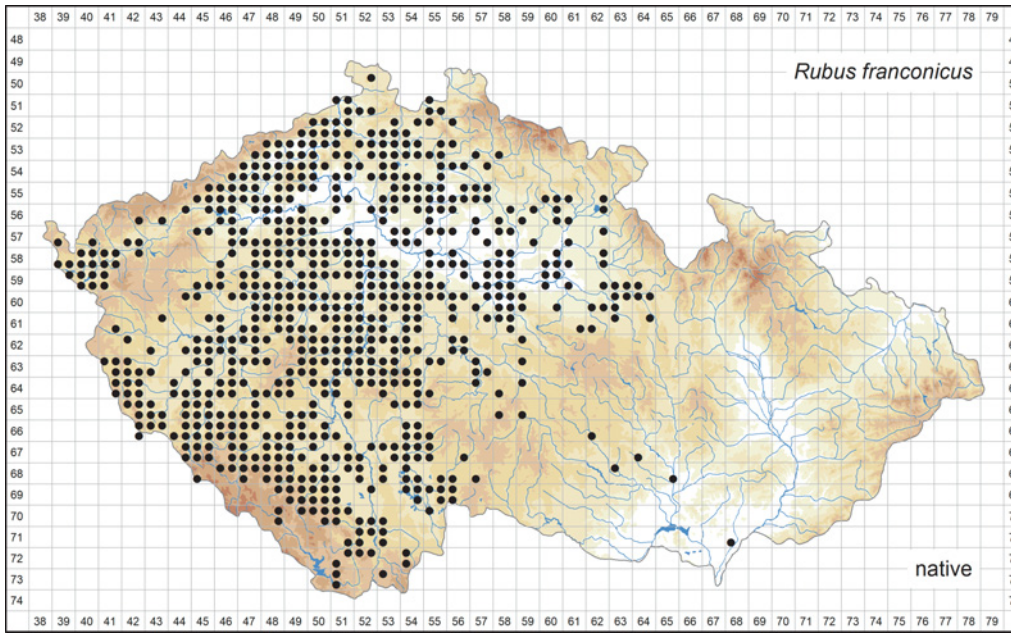

Fig. 77. Distribution of *Rubus franconicus* in the Czech Republic (714 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

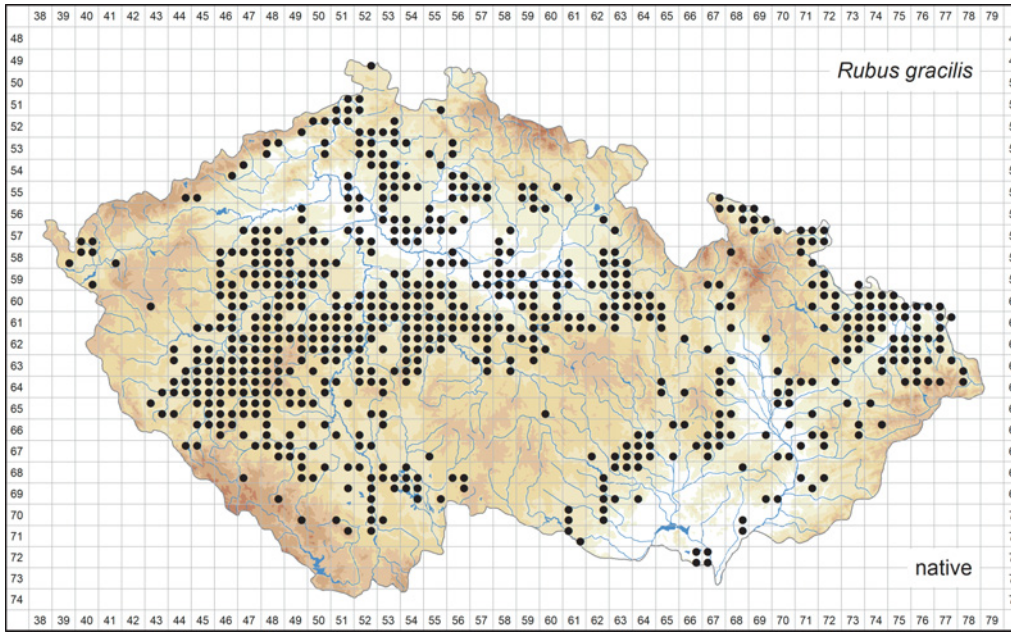

Fig. 78. Distribution of *Rubus gracilis* in the Czech Republic (680 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

(Presl & Presl 1822). The southern limit of the species' continuous range runs through the Czech Republic. In this country, *Rubus gracilis* occurs in forest fringes, open-canopy (often pine) forests, clearings, openings, thickets and on pond dams. It grows mainly on moderately rich, loamy to sandy soils, which are fresh to rather dry, slightly acidic to neutral, developed over siliceous substrates. *Rubus gracilis* is distributed throughout the country, with most records concentrated in moderately warm areas. It avoids shaded woodland areas at high elevations as well as deforested and dry areas. It is found mainly at elevations of about 200–500 m, with the elevational maximum at 820 m near the town of Vimperk in the Šumava Mts.

Rubus koehleri (Fig. 79)

The distribution of *Rubus koehleri* extends from the eastern half of Germany (stretching from Bavaria in the south to Hamburg, Schleswig-Holstein and Mecklenburg-Western Pomerania in the north) through the Czech Republic to south-western and south-eastern Poland (Kurtto et al. 2010). A single population was recorded in north-western Austria (ZOBODAT 2024). The occurrences in the Czech Republic are situated at the southern limit of its distribution. In this country *R. koehleri* grows in forest clearings and openings, thickets, and fringes of coniferous and mixed open-canopy forests and tree plantations at rather shaded to almost open places. It prefers moderately humid to slightly dry sandy to loamy soils, which are slightly acidic to acidic. In the Czech Republic *R. koehleri* is scattered to locally common, mainly in the northern half of Bohemia and, marginally, in north-western Silesia. Southwards and south-eastwards the number of records decreases.

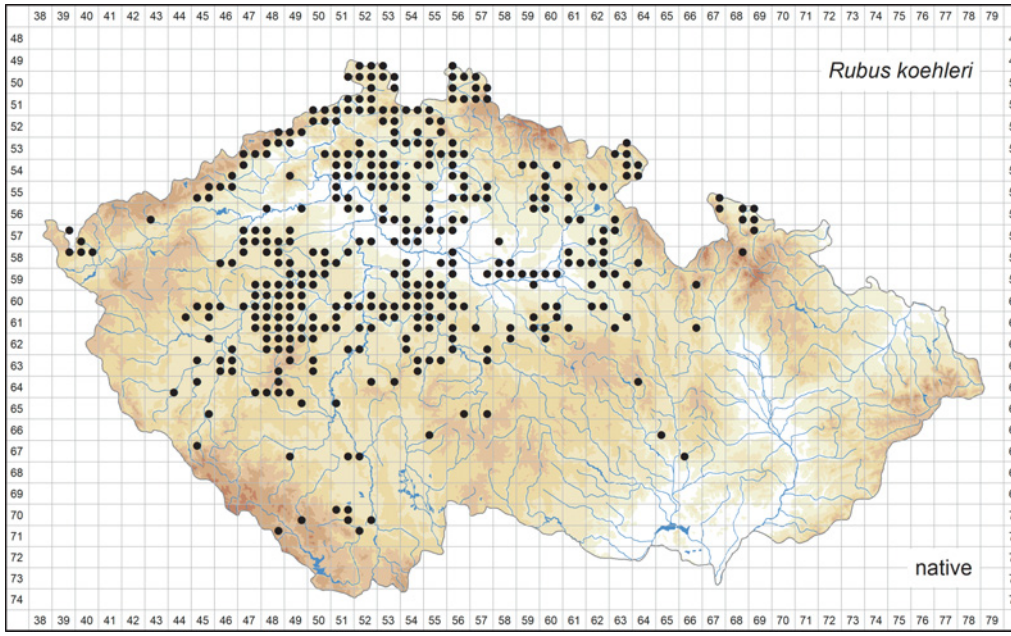

Fig. 79. Distribution of *Rubus koehleri* in the Czech Republic (373 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

It is almost absent from Moravia and the Českomoravská vrchovina highlands, and in Bohemia probably also from the Český les and Slavkovský les hills and their foothills. Most of the sites are situated at elevations of 200–500 m, with the elevational maximum at 940 m near the settlement of Dolní Sněžná in the Šumava Mts.

Rubus mollis (Fig. 80)

The main distribution of *Rubus mollis* is in the Czech Republic and from central to southern Germany. It rarely extends into Austria, southern Poland, and Slovakia (Kurtto et al. 2010). The localities in the Czech Republic represent the northern limit of its distribution. The species was described from the settlement of Tučapy near the town of Tábor in southern Bohemia (Presl & Presl 1822). In the Czech Republic *R. mollis* mainly grows in non-forest communities, especially in road and path ditches and their edges, other semi-ruderal to ruderal places, dry grasslands, pastures and thickets, ruderal scrub and forest fringes, often in or near settlements. It grows on loamy, loamy-sandy to sandy, stony, slightly dry, acidic, neutral to slightly alkaline and slightly humic soils. In the Czech Republic *R. mollis* is mainly found in warm and moderately warm parts of Bohemia, where it is locally common, but it is rare in or absent from agricultural landscapes due to lack of suitable habitats, and also is rare at or absent from middle and high elevations (particularly obvious in the Českomoravská vrchovina highlands). In Moravia it occurs only in its western part, and in Silesia it is very rare. Most of the sites are situated at elevations of 200–500 m, with the elevational maximum at 960 m on Mt Javorník in the Šumava Mts.

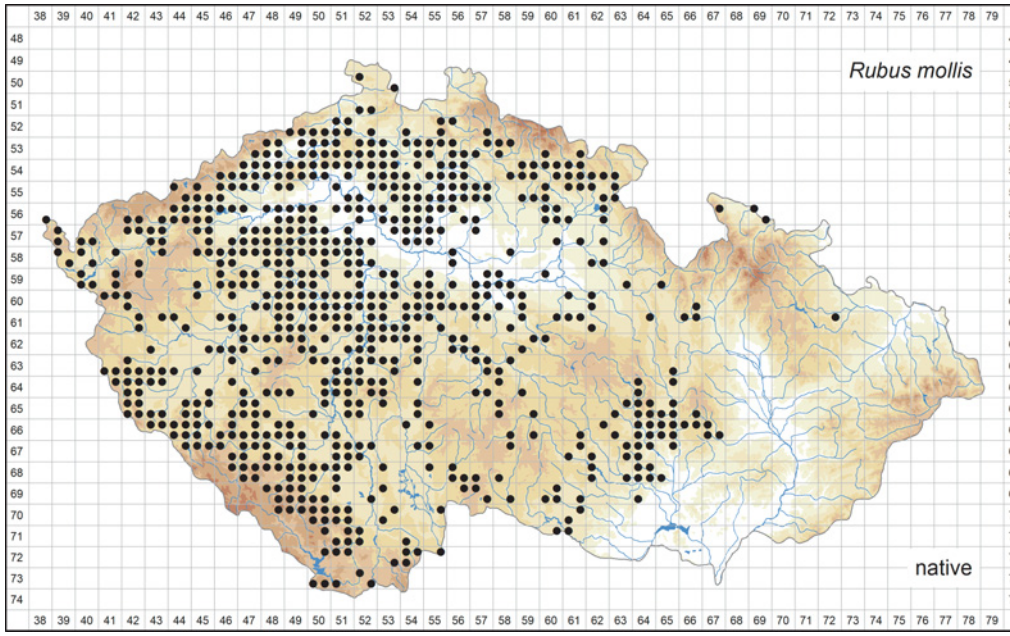

Fig. 80. Distribution of *Rubus mollis* in the Czech Republic (723 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

Rubus schleicheri (Fig. 81)

The continuous distribution of *Rubus schleicheri* extends from north-western France (Ferrez & Royer 2021) through the Netherlands, northern, central and eastern Germany to the western half of the Czech Republic and south-western Poland. An isolated record is known from eastern Poland (Kurtto et al. 2010). The localities in the Czech Republic are situated at the south-eastern limit of its distribution. In this country *R. schleicheri* is found predominantly in mixed and coniferous forests and tree plantations, usually in shaded to semi-shaded places, in their clearings, along roads and thickets. It prefers permeable, moderately wet to mesic, sandy, or loamy, often acidic, non-calcareous soils usually rich in humus. The occurrence of *R. schleicheri* in the Czech Republic is confined to Bohemia, where it is distributed unevenly. The main area of its distribution is the south-western part of Bohemia along with the Brdy hills and its foothills, the Křivoklátsko area and the foothills of the Šumava Mts. In other parts of Bohemia *R. schleicheri* is also locally common in the northernmost border area, along the lower Sázava valley in central Bohemia and around the city of České Budějovice in southern Bohemia. Elsewhere in Bohemia the species has been recorded in isolated localities. Most of the sites are situated at elevations of 300–500 m, with the elevational maximum at 1,040 m on Mt Javorná in the Šumava Mts.

Rubus tabanimontanus (Fig. 82)

Rubus tabanimontanus is mainly distributed in the Czech Republic and the western half of Slovakia. It extends marginally into south-western Poland, northern and western Hungary and northern Austria, and has been recorded at a single locality in Upper Lusatia in

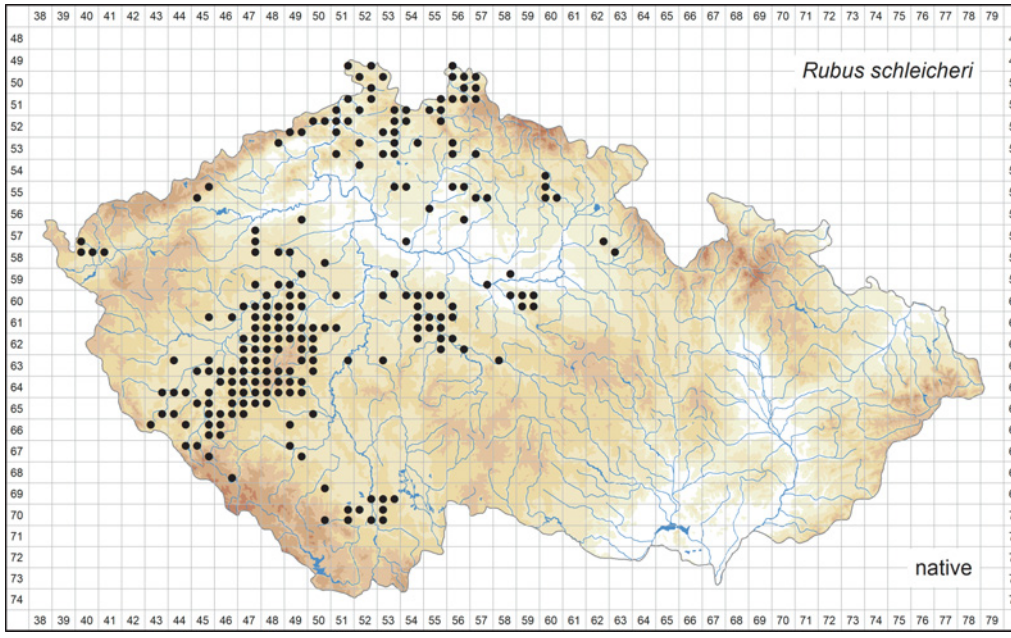

Fig. 81. Distribution of *Rubus schleicheri* in the Czech Republic (218 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

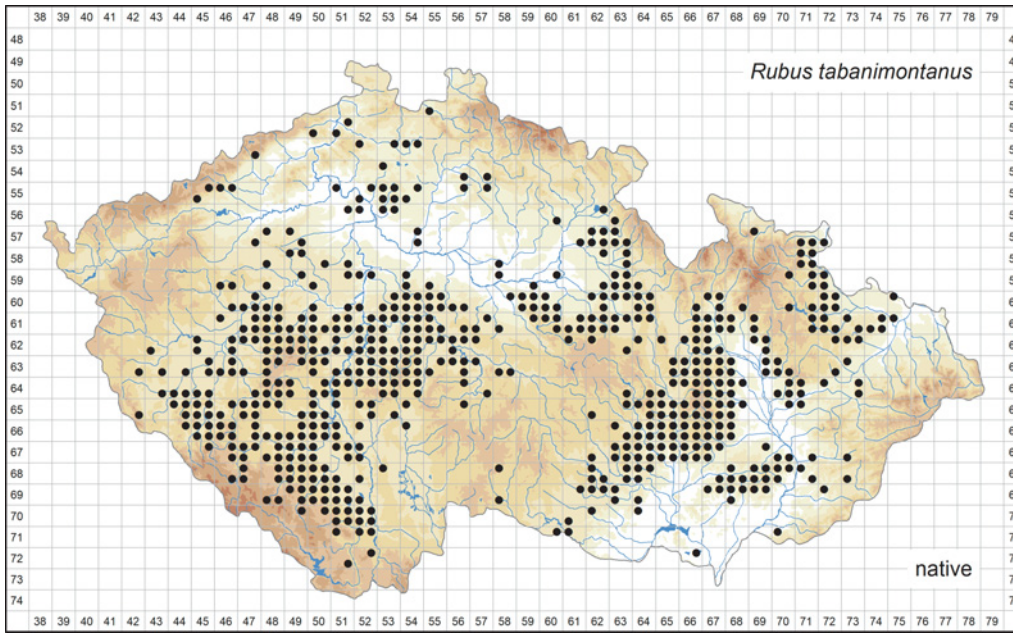

Fig. 82. Distribution of *Rubus tabanimontanus* in the Czech Republic (604 occupied quadrants). Prepared by Bohumil Trávníček, Petr Havlíček, Martin Lepší, Petr Lepší & Jiří Velebil.

Saxony, Germany (Kurtto et al. 2010, Király et al. 2013, Sander 2022). In the Czech Republic *R. tabanimontanus* occurs in forest fringes, clearings, openings and thickets. It is found predominantly on moderately rich, loamy to loamy-sandy soils that are fresh to rather dry, slightly acidic to neutral, and developed over siliceous substrates. In this country this species is scattered to locally common (e.g. in central, eastern, and south-western Bohemia, western Moravia and northern Silesia). However, it is absent from or very rare over large areas in northern, western and south-eastern Bohemia and southern Moravia. It prefers moderately warm climates; therefore, it is rare in warm deforested areas and in cold forest landscapes at high elevations. Most of the sites are situated at elevations of 250–600 m, with the elevational maximum at 985 m on Mt Kamenná hora near the village of Zdíkov in the Šumava Mts.

Sagina alexandrae (Fig. 83)

Sagina alexandrae is better known by the illegitimate name *S. subulata* (cf. Iamonico 2016). It is a European species with a sub-Atlantic distribution. Its range extends from the Iberian Peninsula in the west to Poland, Slovakia, Romania, Greece and the European part of Turkey in the east, reaching as far north as Iceland and the southern half of Scandinavia (Hultén & Fries 1986, Marhold 2011, Popiela & Łysko 2014). The ecological characteristics of *S. alexandrae* at its former localities in the Czech Republic are not well known; it has been recorded on wet or intermittently wet sandy soils, in open sandy habitats, sandy forest clearings and on sandy banks of water bodies, at elevations ~185–290 m. The species occurred very rarely in this country in two separate areas. The first was situated

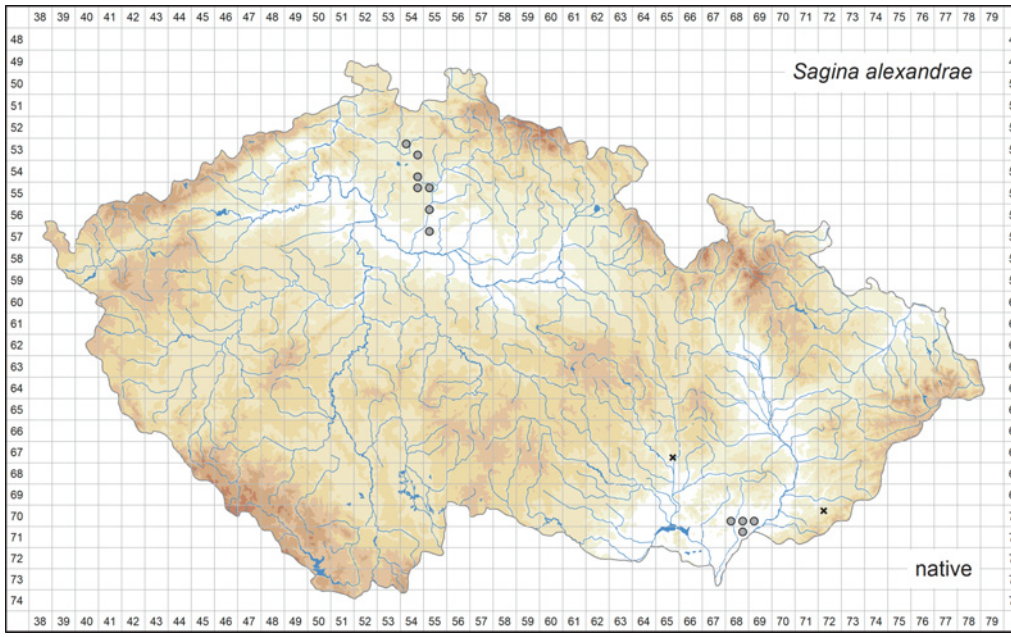

Fig. 83. Distribution of *Sagina alexandrae* in the Czech Republic: ● pre-2000 native records (11 quadrants), × alien only (2 quadrants). Prepared by Jan Prančl.

in the sandstone area of the Ralská pahorkatina hills between the towns of Mimoň and Mladá Boleslav at the border of northern and central Bohemia and in the adjacent basin of the Jizera river south of this area; the records date from 1853–1909. The second was located in the northern surroundings of the town of Hodonín in southern Moravia; the last occurrence of the species was recorded at the edge of the village of Ratíškovice in 1976. Nowadays, the species is classified as missing (Grulich 2012). The taxonomically unclear, most often completely glabrous morphotypes, which are also classified as *S. alexandrae*, are mainly cultivated in cemeteries and rockeries. The escapes of these cultivars outside gardens and cemeteries have been recorded only twice in southern Moravia, namely in the city of Brno (1976) and in the village of Suchá Loz at the foot of the Bílé Karpaty Mts (2002).

Sagina apetala (Figs 84–86)

The *Sagina apetala* complex is distributed in Europe, northern Africa and Asia from the Middle East to the Himalayas (Hultén & Fries 1986). The species is currently listed as a native or archaeophyte for most European countries (Marhold 2011). However, it is widespread in southern and western Europe, while to the north and east its occurrence is much more scattered and its native status in some areas may be questionable. *Sagina apetala* is often introduced outside its native range, and non-native occurrences are known from many areas of the Americas, south-western Asia, Japan, Australia, New Zealand, Ethiopia, Tanzania and South Africa (Hultén & Fries 1986, Thulin 2022). The complex of *S. apetala* is a taxonomically unresolved group of highly autogamous annual

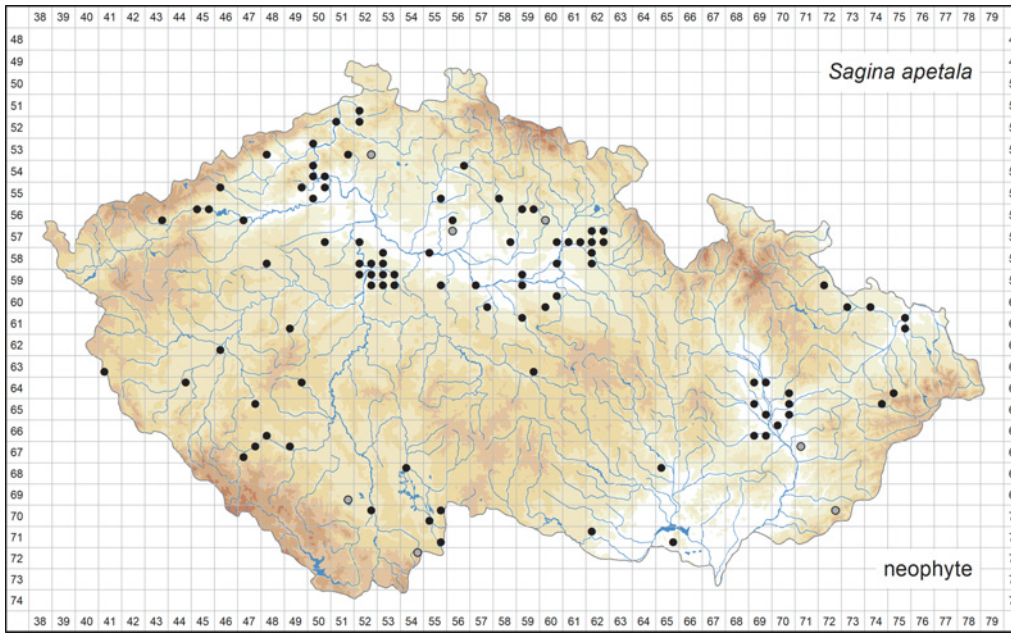

Fig. 84. Distribution of *Sagina apetala* in the Czech Republic: ● at least one record in 2000–2024 (93 quadrants), ● pre-2000 records only (7 quadrants). Prepared by Jan Prančl.

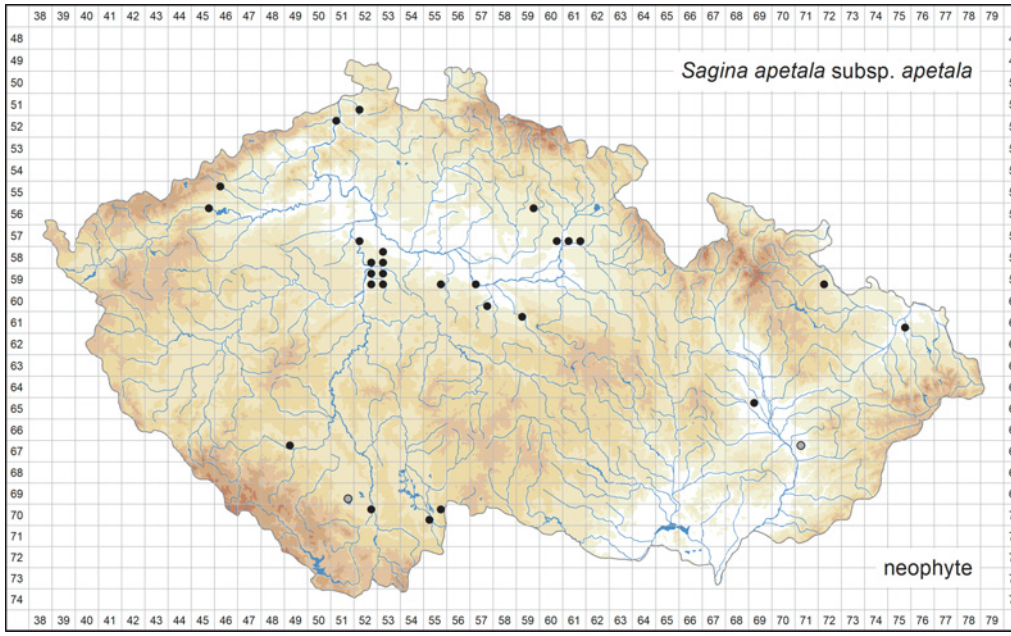

Fig. 85. Distribution of *Sagina apetala* subsp. *apetala* in the Czech Republic: ● at least one record in 2000–2024 (27 quadrants), ● pre-2000 records only (2 quadrants). Prepared by Jan Prančl.

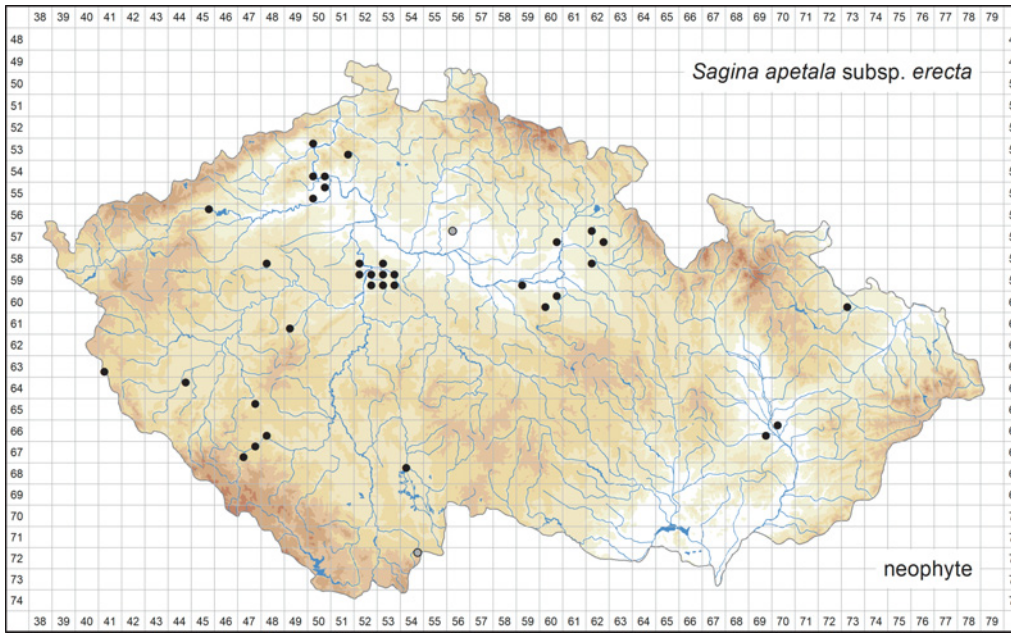

Fig. 86. Distribution of *Sagina apetala* subsp. *erecta* in the Czech Republic: ● at least one record in 2000–2024 (35 quadrants), ● pre-2000 records only (2 quadrants). Prepared by Jan Prančl.

plants that are either classified as a single variable species or divided into two largely sympatric species (*S. apetala* and *S. micropetala*) or subspecies (subsp. *apetala* and subsp. *erecta*; Dillenberger & Kadereit 2022, Thulin 2022). In the Czech Republic *S. apetala* s. l. grows mainly in cities, towns and villages, most often in pavement joints and cracks in asphalt in places with high traffic of people and cars, such as squares, streets in town centres and parking lots of department stores, less often in other disturbed man-made habitats such as verges of dirt roads, trampled lawns, bare places in grasslands and on fallow land. It prefers warm, dry and sunny habitats, sometimes even on sandy soils; otherwise it is very indifferent to pH and nutrient content. In this country *S. apetala* is probably a neophyte, despite previous suggestions about its native occurrence (Sutorý 1990, Grulich 2012). It was for the first time found introduced in 1880 at the edge of the village of Loučeň near the town of Nymburk in central Bohemia. Until recently, the species was only occasionally introduced to this country; there are records from five sites between 1880 and 1939, and in the second half of the 20th century it was found only once, in 1974. These localities are randomly distributed, showing no clear phytogeographical pattern and it is unlikely that the species was present in the Czech Republic long ago. Recently, the species was first recorded in 2012 at a campsite in the village of Staňkov in southern Bohemia (Lepší & Lepší 2014). It was very likely present elsewhere even at that time but remained overlooked. It has been spreading throughout this country very rapidly in recent years. The maps inevitably do not correspond to the actual distribution; *S. apetala* is probably already widespread in this country, particularly in warm areas, but due to its inconspicuous appearance and confusion with *S. procumbens*, it has only begun to be recorded in the past few years. The current elevational maximum was recorded at 515 m

at the border crossing near the village of Rozvadov in western Bohemia. Distinguishing intraspecific taxa within *S. apetala* in the Czech Republic is difficult and does not correspond to the seemingly unambiguous separation of the two taxa as recently outlined by Dillenberger & Kadereit (2022). Many populations include morphologically intermediate plants and/or plants morphologically corresponding to both (sub)species, and no differences in ecology or rate of spread can be observed between the two morphotypes (Prančl 2024). A distribution map of *S. apetala* s. l. (including all records) and tentative distribution maps of subsp. *apetala* and subsp. *erecta* containing only records clearly assignable to the two extreme morphotypes are provided here; however, the taxonomic value of both morphological variants is probably rather low. *Sagina apetala* is listed as missing in this country (both subspecies; Grulich 2012) and it is not currently included in the national catalogue of alien species (Pyšek et al. 2022), but we suggest its re-classification as an invasive neophyte.

Sagina nodosa (Fig. 87)

Sagina nodosa is a Holarctic species distributed in the boreal and temperate regions of the Northern Hemisphere. In Europe it is most frequent in northern parts, while in southern Europe it is very rare, extending southwards as far as Portugal, Corsica and the Caucasus (Meusel et al. 1965, Hultén & Fries 1986, Marhold 2011). According to some sources, two subspecies are distinguished based on the presence/absence of glandular hairs. Their overall distribution is not fully known; both subspecies are found in Europe, of which subsp. *borealis* is native to northern Europe and North America while subsp. *nodosa* probably

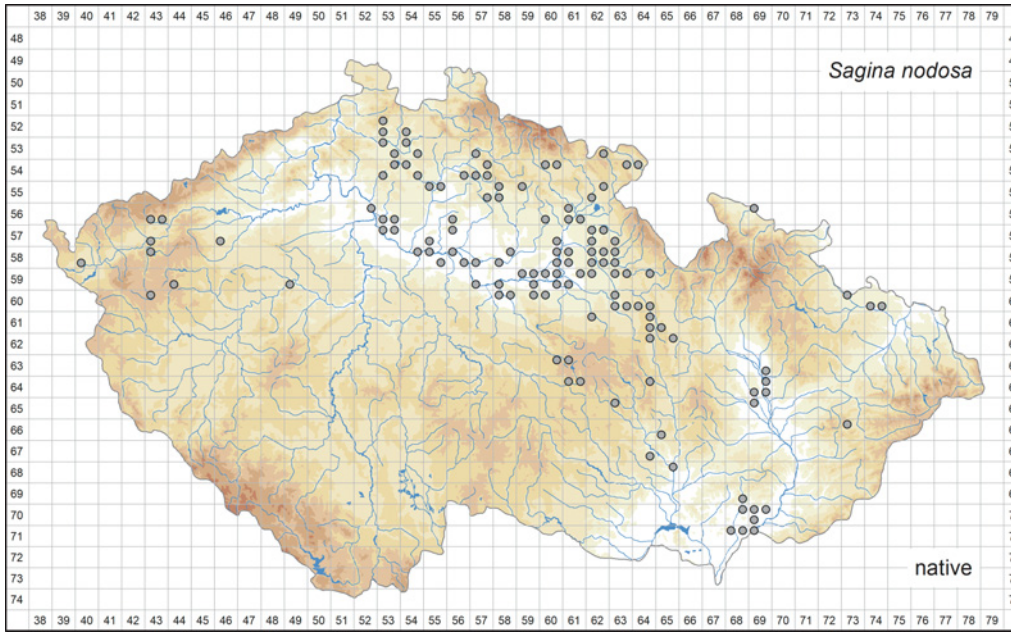

Fig. 87. Distribution of *Sagina nodosa* in the Czech Republic: ● pre-2000 records only (129 quadrants). Prepared by Jan Prančl.

occurs in the whole of the European part of its distribution area and has been introduced to the east coast of North America (Crow 1978, 2005). In the Czech Republic *S. nodosa* grew in wet meadows, often on peaty substrates (especially in fens), on wet open sandy places, the banks of water bodies and drainage ditches. It required wet or periodically flooded habitats under regular disturbance on neutral to basic, nutrient-poor soils. Most of its localities were situated in the lowlands of central and eastern Bohemia, especially in the Labe river basin, also in the sandstone area between the towns of Nový Bor and Jičín in northern Bohemia. It was significantly less frequent in western Bohemia, the north-eastern part of the Českomoravská vrchovina highlands and in the lowlands of Moravia and Silesia. Elsewhere it was recorded only sporadically, being absent from southern and north-western Bohemia. *Sagina nodosa* has strongly declined after World War II due to abandonment, intensive use and the retreat of traditional management of wet meadows, along with their drainage, fertilization and conversion to arable land. Since 1980 it has been recorded at only four sites, with the last record in 1993 near the village of Políkno near Toužim in western Bohemia. At this site the species also reached its elevational maximum at ~630 m. *Sagina nodosa* is classified as missing in this country (Grulich 2012).

Sagina procumbens (Fig. 88)

Sagina procumbens is probably native to Europe, western Asia and northern Africa, but its native range is not sufficiently known due to spread with humans. It is considered introduced in large parts of the Americas, eastern Asia, the Cape, Australia, New Zealand and sub-Antarctic islands. In Europe it is widespread except for its south-eastern part

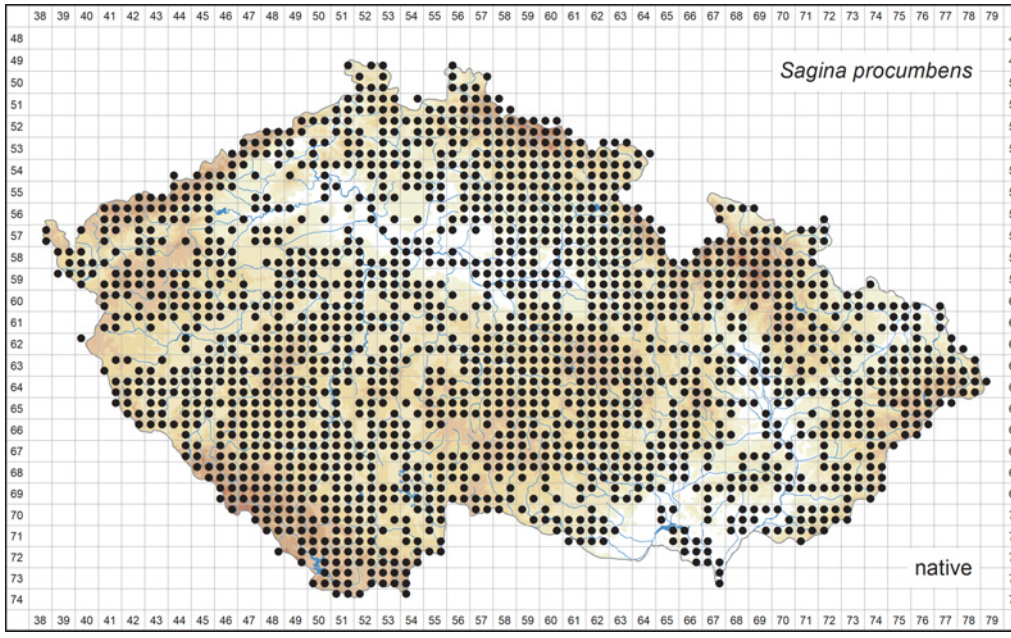

Fig. 88. Distribution of *Sagina procumbens* in the Czech Republic (1,788 occupied quadrants). Prepared by Jan Prančl.

(Meusel et al. 1965, Hultén & Fries 1986, Crow 2005, Marhold 2011). *Sagina procumbens* is widespread in the Czech Republic, growing in a wide range of habitats such as forest paths and roads, banks of water bodies, quarry bottoms, around springs and disturbed sites in wetlands, in waterlogged arable land, in pavement joints and cracks in asphalt or beds of ornamental plants in towns and villages. It prefers wet to moderately wet loamy and sandy soils, while it is indifferent to pH and nutrient content. In this country the species is continuously distributed from the lowlands to the highest subalpine elevations of the mountains. It is less frequent in the driest deforested areas in lowlands, but even there it is probably present in all quadrants of the mapping grid. Gaps on the map are numerous, but these are most likely due to under-recording rather than true absences.

Sagina saginoides (Fig. 89)

Sagina saginoides is a Holarctic species occurring in the mountain and subarctic regions of Eurasia, North America, Greenland and the northernmost part of Africa (Morocco). In Europe the species is distributed in Iceland, Scandinavia, Scotland, the Massif Central, Alps, Carpathians and the other mountains of southern and central Europe (Hultén & Fries 1986, Marhold 2011). In the Czech Republic it grows mostly in the highest mountain ranges in subalpine wind-swept grasslands and snow-bed vegetation, on rocks and debris, on the edges of springs, in disturbed parts of mountain pastures, often also in man-made habitats such as path edges, logging stock dumps near forest roads and around mountain huts, up to 1,603 m at the top of Mt Sněžka in the Krkonoše Mts. It occurs on wet loamy or peaty soils; it is indifferent to pH or nutrient content, growing in both nutrient-poor and

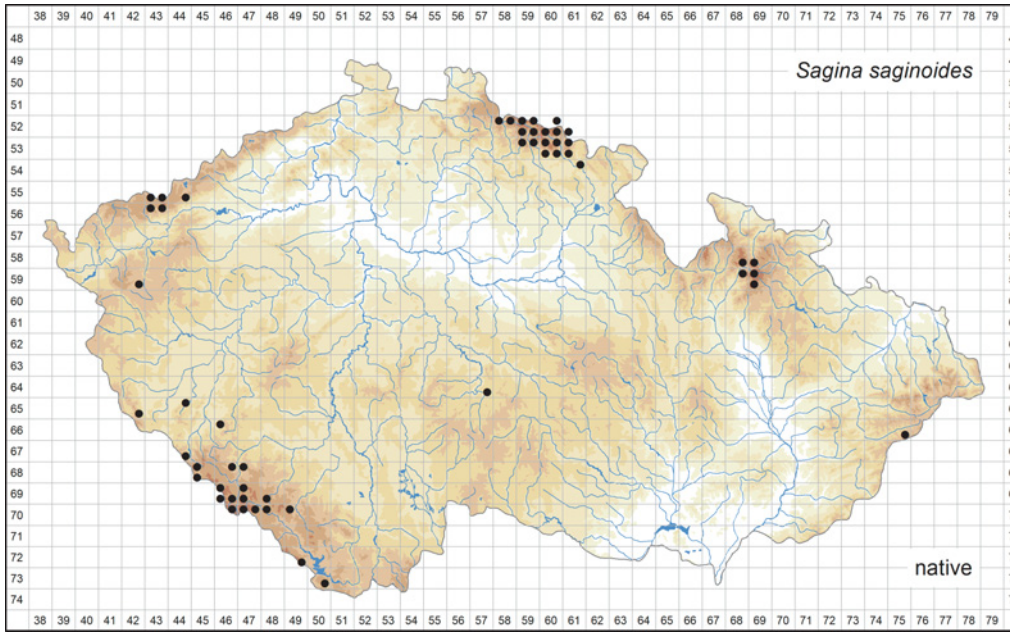

Fig. 89. Distribution of *Sagina saginoides* in the Czech Republic (53 occupied quadrants). Prepared by Jan Prančl.

ruderalized, nitrogen-rich habitats. In this country *S. saginoides* is predominantly distributed on acidic bedrock, which is due to the lack of suitable base-rich habitats in the mountains. It is more or less restricted to the mountains along the country's borders, being most abundant in the Krkonoše Mts, less frequent in the Šumava Mts, and rare in the Krušné hory and Hrubý Jeseník Mts. It has been sporadically recorded elsewhere in the foothill areas; most of these records, if not all, probably represent only temporary introductions. The elevational minimum was recorded at ~500 m between the villages of Těšovice and Zichov in western Bohemia. *Sagina saginoides* is considered endangered in the Czech Republic (Grulich 2012) due to the abandonment of subalpine pastures, successional changes leading to the replacement of subalpine meadows by dwarf-shrub communities dominated by *Vaccinium myrtillus* or by more dense and closed grasslands, and perhaps also due to hybridization with *S. procumbens* (see below under *S.* ×*normaniana*). However, it is also frequently overlooked.

Sagina ×*normaniana* (Fig. 90)

Sagina ×*normaniana* is a presumed hybrid of *S. procumbens* and *S. saginoides*. It is partially fertile and apparently capable of backcrossing with parental species and forming hybrid swarms; however, this has not yet been confirmed by contemporary genetic methods, and the actual patterns of hybridization between both species must be further studied. This hybrid is reported to occur in Scotland, Scandinavia, the Alps and the Czech Republic, but is likely to occur elsewhere (Gams 1953, Sutorý 1990, Clapham & Jardine 1993). In the Czech Republic plants morphologically corresponding to *S.* ×*normaniana*

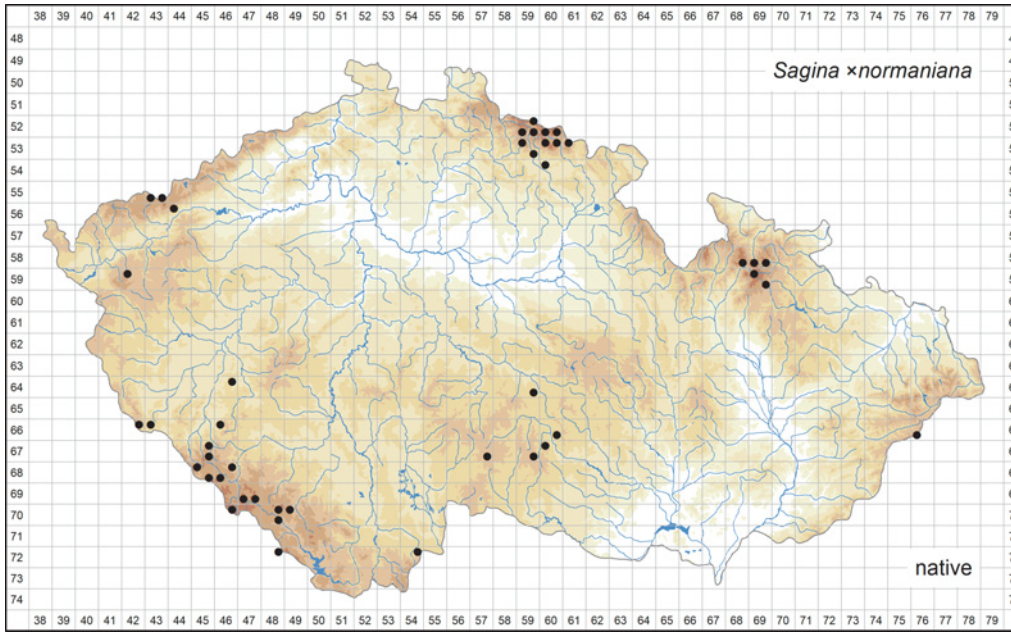

Fig. 90. Distribution of *Sagina* ×*normaniana* in the Czech Republic (44 occupied quadrants). Prepared by Jan Prančl.

occur in similar habitats to *S. saginoides*. The hybrid has been recorded quite frequently in all mountain areas where *S. saginoides* is present. It has also been repeatedly collected from lower elevations; particularly striking is the accumulation of records in the Českomoravská vrchovina highlands (where it is now extinct). Such occurrences are perhaps remnants of introductions of *S. saginoides* into these areas. The elevational minimum was recorded at ~450 m near the village of Fořt in the foothills of the Krkonoše Mts.

Samolus valerandi (Fig. 91)

Samolus valerandi occurs mainly in the Mediterranean area, western Europe, along the Baltic coast and in the steppe zone of western Asia, extending eastwards to Pakistan and north-western India. It is also found in southern Africa. Its distribution in central Europe is discontinuous, restricted mainly to saline marshes (Meusel et al. 1978). The populations in the Americas are now distinguished as a separate species, *S. parviflorus* (Choleva 2009). In the Czech Republic *S. valerandi* is found in saline marshes and wet saline grasslands, in ditches, on the bottoms of drained fishponds and in temporary pools on arable land. The soils are usually well-moistened to wet, basic, moderately rich to rich in nutrients and with moderate to high salt content. All occurrences of *S. valerandi* are situated in lowlands and adjacent hilly areas, with an elevational maximum of 215 m north of the town of Hustopeče in southern Moravia. In this country *S. valerandi* occurs west of the town of Neratovice in central Bohemia and in a small area south to south-east of the city of Brno in southern Moravia. There are also three old records from rather isolated sites, the latest dating to 1926. However, this record, from arable fields next to the village of

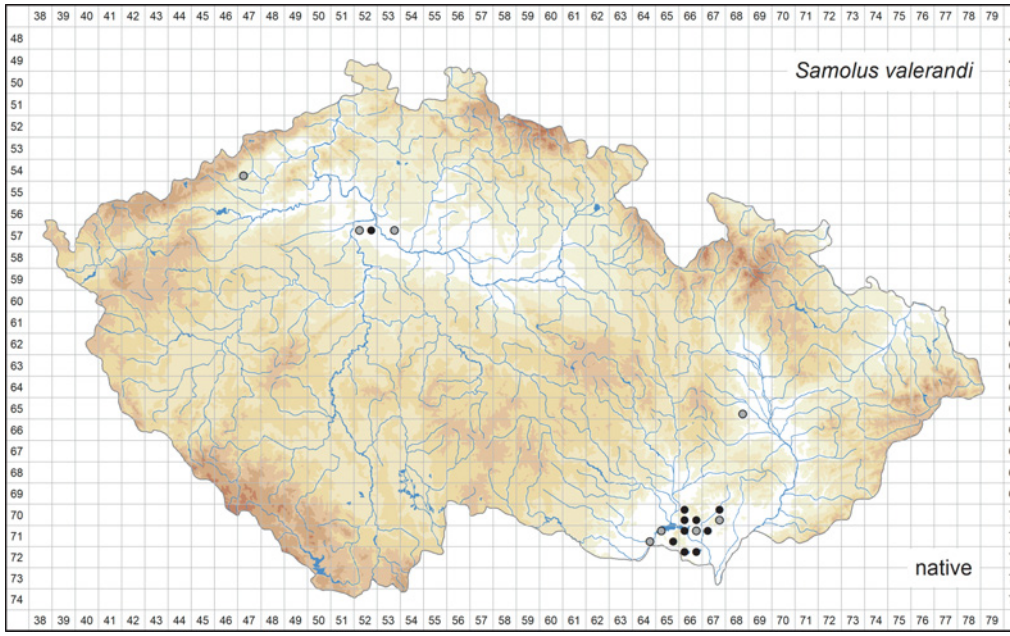

Fig. 91. Distribution of *Samolus valerandi* in the Czech Republic: ● at least one record in 2000–2024 (10 quadrants), ◍ pre-2000 records only (8 quadrants). Prepared by Jiří Danihelka, Petr Hubatka & Pavel Dřevojan.

Kelčice in central Moravia, is somewhat doubtful (it may be a later labelling mistake) as this remarkable find has never been published. Some habitats of *S. valerandi* were destroyed by drainage and subsequent desalinization, but the species has survived at one site in central Bohemia and at several sites in southern Moravia. There is a stable population in the Lednice fishponds, with repeated records from their drained bottoms, as well as in salt marshland near the village of Rakvice. Large populations of *S. valerandi* were recently found in restored saline wetlands and on wet arable land between the villages of Šakvice and Starovičky (Chytrý & Danihelka 2021). *Samolus valerandi* is classified as critically threatened due to its decline (Grulich 2012).

Smyrnium perfoliatum (Fig. 92)

Smyrnium perfoliatum is mainly distributed in the Mediterranean region. Its native range extends from the Iberian Peninsula to the Caucasus, with the distribution's centre in south-eastern Europe, extending northwards to Hungary, Romania and Crimea. It also occurs in North Africa, Israel and Jordan. Three subspecies are recognized, classified as separate species by some authors (Stinca & Pignatti 2016); of these, subsp. *perfoliatum* has been introduced into several European countries, reaching as far north as Great Britain and Scandinavia (Křísa et al. 1968, Hand 2011). In some areas it is difficult to distinguish between native and non-native occurrences, e.g. in southern Slovakia it has long been considered an important relict species, but recently it has been reassessed as an archaeophyte or neophyte (Peniašteková et al. 1996, Medvecká et al. 2012). In the Czech Republic *S. perfoliatum* grows in the open-canopy deciduous forests, forest fringes and clearings in warm areas,

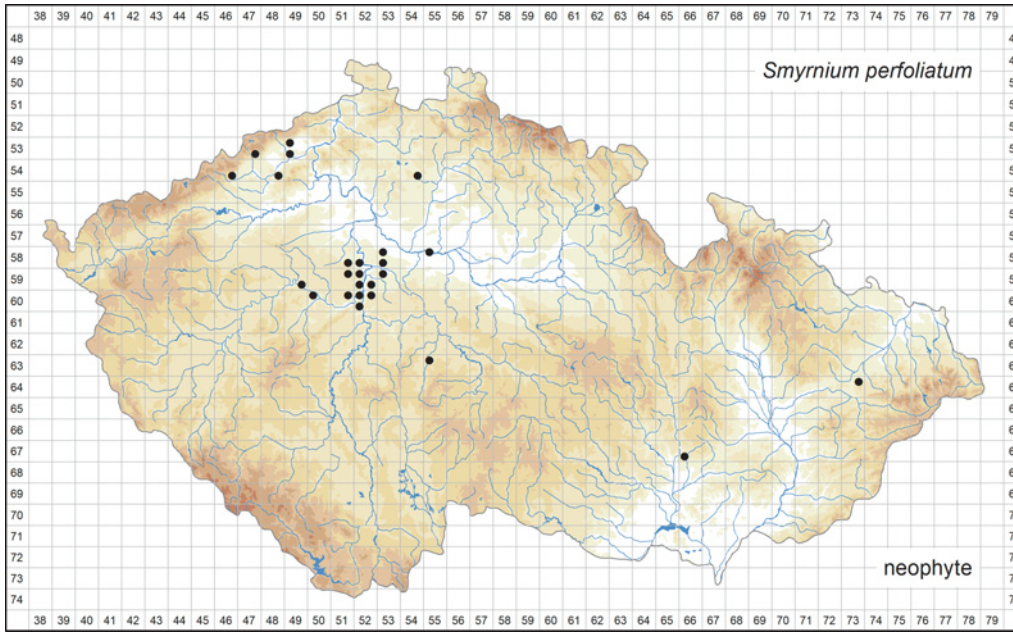

Fig. 92. Distribution of *Smyrnium perfoliatum* in the Czech Republic (25 occupied quadrants). Prepared by Jan Prančl.

most often occupying secondary plantations (including those with *Robinia pseudoacacia*). It is also found in park woods and man-made habitats such as road verges and waste places. It prefers neutral to basic, nutrient-rich but rather shallow soils. In this country the species was for the first time recorded in 1886 in the Břežanské údolí valley near the settlement of Závist in the southern outskirts of Prague. Most of its occurrences are situated in Prague and its surroundings, where it is locally abundant and forms large stands. Several populations are known in north-western Bohemia, where it was first recorded in 1949. Elsewhere it occurs sporadically: only two sites are known in Moravia, namely at the north-eastern edge of the city of Brno and at the edge of the town of Nový Jičín. *Smyrnium perfoliatum* is classified as a naturalized neophyte in this country (Pyšek et al. 2022). It is an early-growing species forming dense stands that could pose a threat to spring forest plants. Although it is not yet a common species, it has generally persisted in its habitat for many decades and recently seems to be spreading, possibly as a result of climate change.

Spiranthes spiralis (Fig. 93)

Spiranthes spiralis is mainly a European species, distributed in the mountains of southern Europe and extending northwards to the British Isles, southern Denmark, northern Poland and the Balkan Peninsula; isolated occurrences are in western Ukraine, central Romania and the Caucasus. Outside Europe, a few outposts are in Morocco, Algeria, Tunisia, Turkey and Lebanon (Baumann & Künkele 1982, Hultén & Fries 1986). In the Czech Republic *S. spiralis* grows in short grasslands (mainly in nutrient-poor pastures) and meadows on humid to dry, acidic to basic, loamy to peaty soils. In the past this

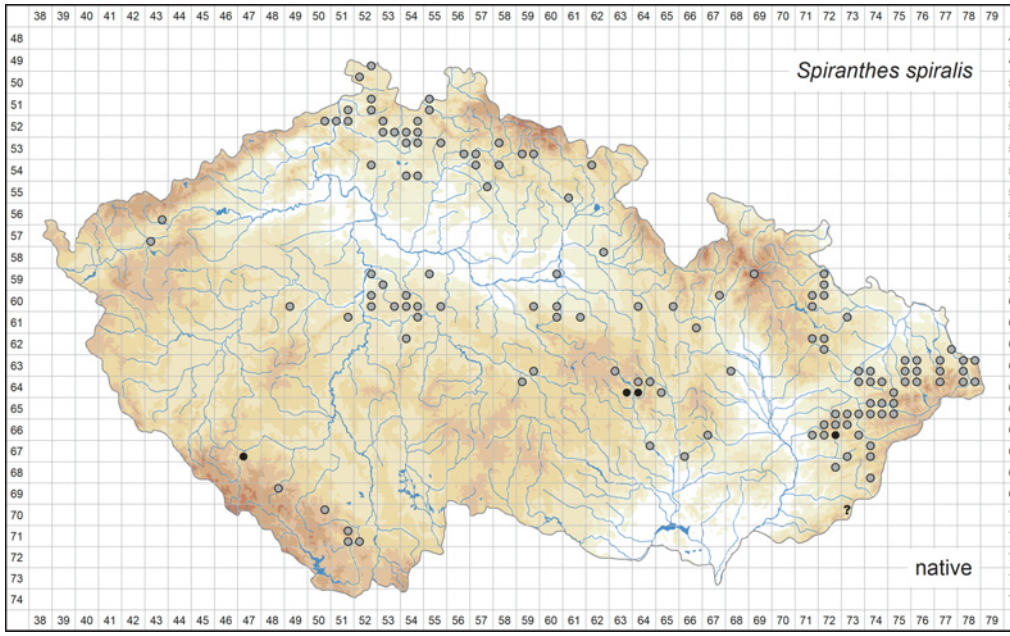

Fig. 93. Distribution of *Spiranthes spiralis* in the Czech Republic: ● at least one record in 2000–2024 (4 quadrants), ● pre-2000 records only (124 quadrants). Prepared by Zdeněk Kaplan & Jiří Danihelka.

species used to be scattered in northern and central Bohemia and in eastern Moravia, while being rare in or absent from other parts of the country. The vast majority of the populations have vanished due to abandonment of low-intensity grazing, succession of grasslands to shrub communities, intensification of land use and overall eutrophication. Only four occurrences have been recorded after 2000: at the village of Albrechtice near the town of Sušice in south-western Bohemia, at the villages of Vrtěžíř and Švařec near the town of Bystřice nad Pernštejnem in western Moravia and at the village of Vlčková near the town of Zlín in eastern Moravia. Because of this enormous decline, *S. spiralis* is classified as critically threatened (Grulich 2012).

Stipa borysthenica (Fig. 94)

Stipa borysthenica (incl. *S. graniticola*) is very similar to, and likely closely related to, *S. pennata* (s. str.). The morphological differences between these taxa are subtle but consistent over the large area where these species co-occur. Therefore, the specific rank for *S. borysthenica* appears justified. This Euro-Siberian species ranges from central Europe through Ukraine, southern European Russia and northern Kazakhstan, extending as far as Krasnoyarsk province and the Republic of Tuva in Siberia, and possibly reaching Xinjiang province of China and north-western Mongolia. In Europe this species is found in central Germany, north-western Poland, Czech Republic, north-eastern Austria, southern Slovakia, Serbia, eastern Romania and eastern Bulgaria (Lomonosova 1990, Gonzalo et al. 2013, Nobis et al. 2020). In the Czech Republic *S. borysthenica* grows in acidophilous dry grasslands, *Festuca* grasslands on acidic sands and in open vegetation

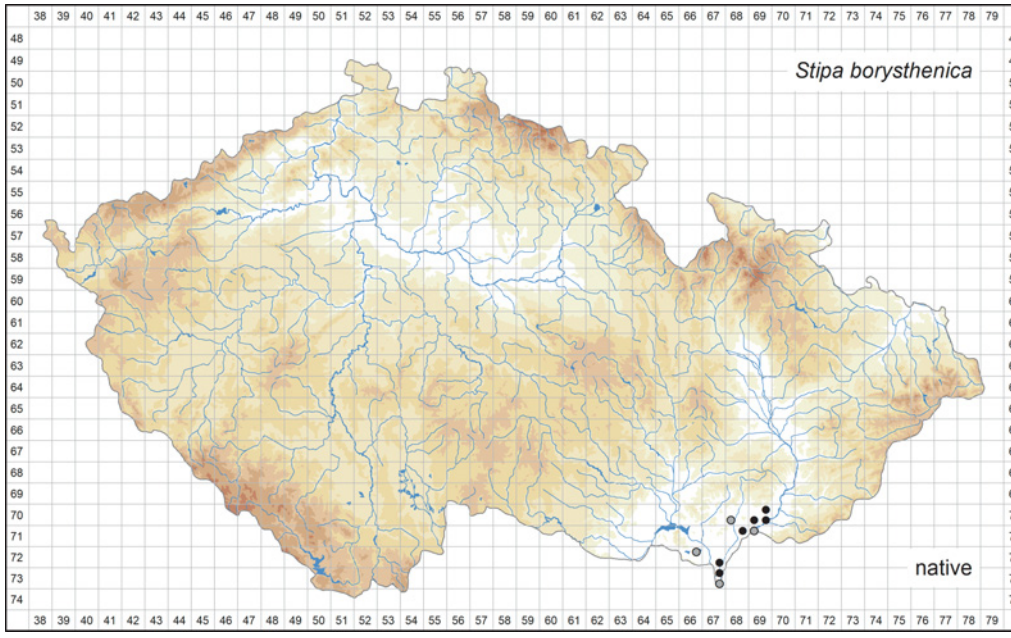

Fig. 94. Distribution of *Stipa borysthenica* in the Czech Republic: ● at least one record in 2000–2024 (6 quadrants), ● pre-2000 records only (4 quadrants). Prepared by Jiří Danihelka.

of acidic sands. The soils are sandy, dry, usually moderately acidic and nutrient-poor. In this country *S. borysthenica* is found only in southern Moravia, in two small areas. Large populations exist in the area of pine plantations north and north-east of the town of Hodonín, with extensive stands particularly along the railway between the towns of Rohatec and Moravský Písek. Three small populations existed on sand hummocks in the floodplain of the river south-east of the town of Břeclav but one of them disappeared in the late 1990s. The occurrence of *S. borysthenica* in the Boří les forest west of Břeclav is documented by a single gathering from 1937. Until recently, the *Stipa* populations in the Dyje floodplain upstream of Břeclav were also assigned to this species, but they most likely belong to *S. pennata*. All Moravian populations of *S. borysthenica* are found in lowland areas at elevations of 150–200 m. *Stipa borysthenica* is classified as critically threatened due to both its rarity and decline (Grulich 2012).

Stipa capillata (Fig. 95)

Stipa capillata is a Euro-Siberian species distributed from the western part of the Iberian Peninsula in the west to the Lena river basin in Yakutia, Buryatia and Chita province in the east. In western and central Europe its distribution is discontinuous, towards the north extending as far as central Germany and north-western Poland, towards the south as far as northern Italy (with isolated occurrences in the Central Apennines), Albania and northern Greece. The continuous part of its range begins in south-eastern Europe, extending through Ukraine and southern Russia up to the Ural Mountains. In Asia *S. capillata* is found in the Caucasus, Central Asia and all of southern Siberia. The southern limit of the

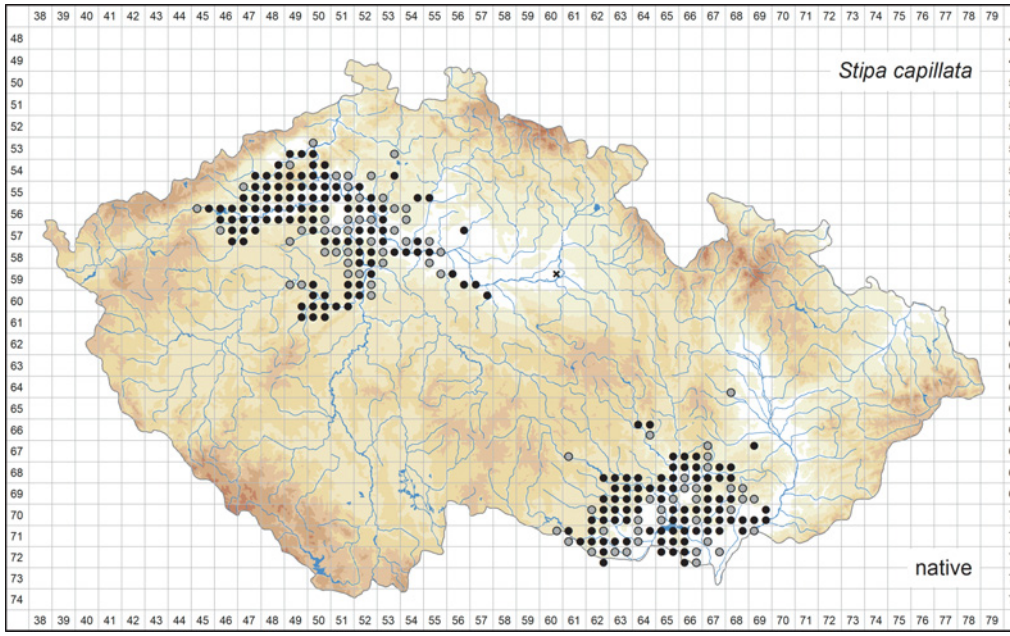

Fig. 95. Distribution of *Stipa capillata* in the Czech Republic: ● native, at least one record in 2000–2024 (187 quadrants), ● native, pre-2000 records only (78 quadrants), × alien only (1 quadrant). Prepared by Jiří Danihelka.

Asian part of the range runs through north-eastern Turkey, along the southern coast of the Caspian Sea, through northern Iran, northern Afghanistan, the Indian province of Kashmir, north-western China, and western Mongolia (Meusel et al. 1965 [in the eastern part of the range also including related species], Hensen et al. 2010). In the Czech Republic *S. capillata* occurs in various types of dry grasslands, often on rock outcrops and sands, in forest fringes, low xeric scrub and open-canopy oak and pine forests and rarely in thermophilous ruderal vegetation and open *Robinia* plantations. The soils are dry, usually basic and rich in calcium, and nutrient-poor. *Stipa capillata* occurs in the warmest, driest parts of the Czech Republic in north-western and central Bohemia and in southern Moravia. In both of these local ranges, its distribution is quite continuous. In addition, there are isolated occurrences, for instance, on rock outcrops in river valleys or on hills, such as in the Berounka valley near the town of Křivoklát, near the towns of Mladá Boleslav and Česká Lípa, and south-east of the town of Kolín in Bohemia, as well as near the town of Třebíč in south-western and at two sites in central Moravia. *Stipa capillata* is capable of local spread to abandoned arable land and subruderal sites along railways and river embankments. It occurs from the lowlands up to ~500 m, reaching its elevational maximum at ~600 m on Štěpánovská hora hill in the České středohoří Mts in north-western Bohemia. The only secondary occurrence shown in the map is due to planting. *Stipa capillata* has declined slightly, mainly due to the abandonment of pastures, elimination of fires along railways and elsewhere, and eutrophication, followed by the succession of scrub. Therefore, it is classified as lower risk – near threatened (Grulich 2012).

Stipa dasyphylla (Fig. 96)

Stipa dasyphylla is a member of a taxonomically intricate group of *Stipa* taxa with hairy leaves, with the centre of diversity in southern Ukraine and southern European Russia. In the Czech Republic this group is represented by *S. dasyphylla*, *S. glabrata* (*S. zalesskii* s. l.) and *S. smirnovii*. *Stipa dasyphylla* is a Euro-Siberian species. In central Europe it occurs in Germany at a single location (near the town of Nebra in Saxony-Anhalt), north-western Bohemia, southern Moravia (extending into Lower Austria near the town of Hardegg), southern Slovakia and in Hungary; in eastern Europe, it is found in Romania, Moldova, Ukraine, and southern Russia (Valdés et al. 2009). In Asia it occurs in south-western Siberia, reaching its easternmost limit in the southern part of the Krasnoyarsk province east of the Yenisei River (Lomonosova 1990). In the Czech Republic *S. dasyphylla* grows in dry grasslands on rock outcrops and in narrow-leaved continental steppes. The soils are slightly acidic to slightly basic and nutrient-poor, forming over basalt, calcareous conglomerate, loess and serpentinite, but not limestone. In this country *S. dasyphylla* occurs in north-western Bohemia, primarily in the western part of the České středohoří Mts, as well as in south-western and southern Moravia. There are also late-19th-century records from the southern periphery of Prague that may represent this species rather than *S. smirnovii*, as their assignment to the latter is tentative due to the poor quality of all three available herbarium specimens. While some populations of *S. dasyphylla* are very abundant (e.g. those on Oblík hill in the České středohoří Mts or near the town of Mohelno in south-western Moravia), others consist of only a small number of individuals and have, therefore, remained neglected for a long time (e.g. those south-east of the city of Brno in southern Moravia). Some of these small populations may have disappeared, but this decline has remained limited. *Stipa dasyphylla* is classified as endangered due to its rarity (Grulich 2012).

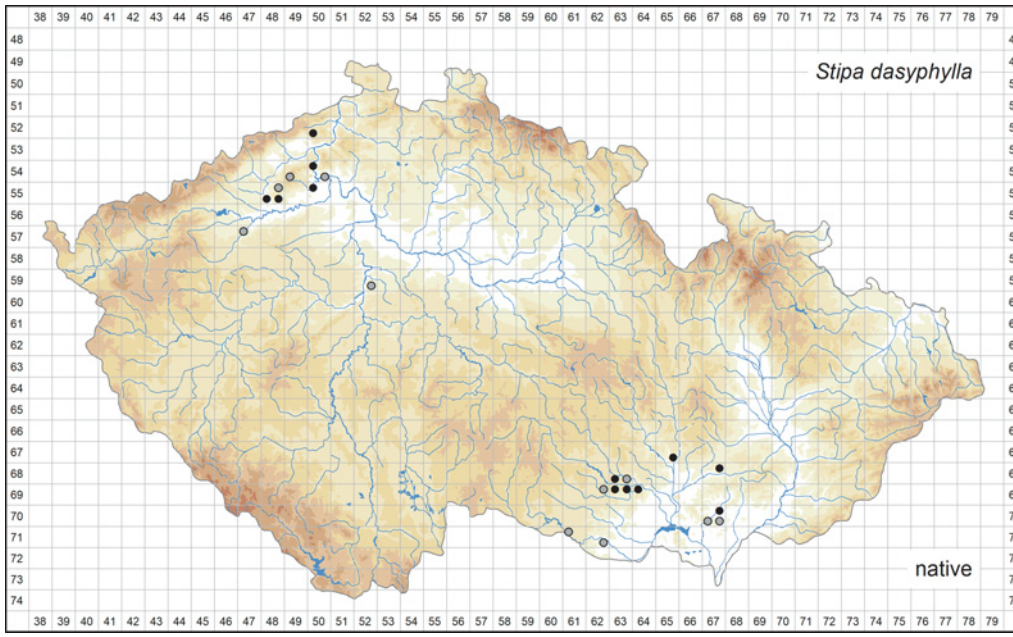

Fig. 96. Distribution of *Stipa dasyphylla* in the Czech Republic: ● at least one record in 2000–2024 (12 quadrants), ● pre-2000 records only (11 quadrants). Prepared by Jiří Danihelka & Karel Kubát.

Stipa eriocaulis (Fig. 97)

The range of this sub-Mediterranean species in its broadest circumscription includes Spain, France, southern Germany, Switzerland, the Czech Republic, Austria, southern Slovakia, Hungary, Romania, the Apennine Peninsula, Slovenia, the Balkan Peninsula and Crimea (Valdés et al. 2009 [records for some areas/countries may be erroneous]). Seven subspecies have been accepted by Valdés et al. (2009) within this highly varied species, but a taxonomic revision across the entire species' range is lacking. The plants occurring in the Czech Republic formally correspond to subsp. *austriaca* but its taxonomic value is uncertain. In the Czech Republic it was not until 1996 that *S. eriocaulis* was discovered to occur in the country. At that time, it was found on Svatý kopeček hill in the Pavlovské vrchy hills near the town of Mikulov in southernmost Moravia (Danihelka et al. 2000). The species is locally abundant in dry grassland on limestone outcrops on a south-facing slope, co-occurring there with *S. capillata* and *S. pulcherrima*. At this site, *S. eriocaulis* is able to colonize places with shallower soils than the co-occurring *S. pulcherrima*. In 2022, several dozen plants of *S. eriocaulis* were discovered on Děvín hill about 6 km north of Mikulov, also co-occurring there with *S. pulcherrima* (Hubatka 2023). *Stipa eriocaulis* is most likely native at both sites, as recent examination of a herbarium specimen collected from Svatý kopeček hill in 1911 revealed it to be this species. At both sites, the soil is shallow rendzina: it is very dry, rich in calcium and nutrient-poor. The Moravian occurrences are situated at elevations of 300–400 m. *Stipa eriocaulis* is classified as critically threatened due to its rarity (Grulich 2012), but both populations are in nature reserves and appear to be stable.

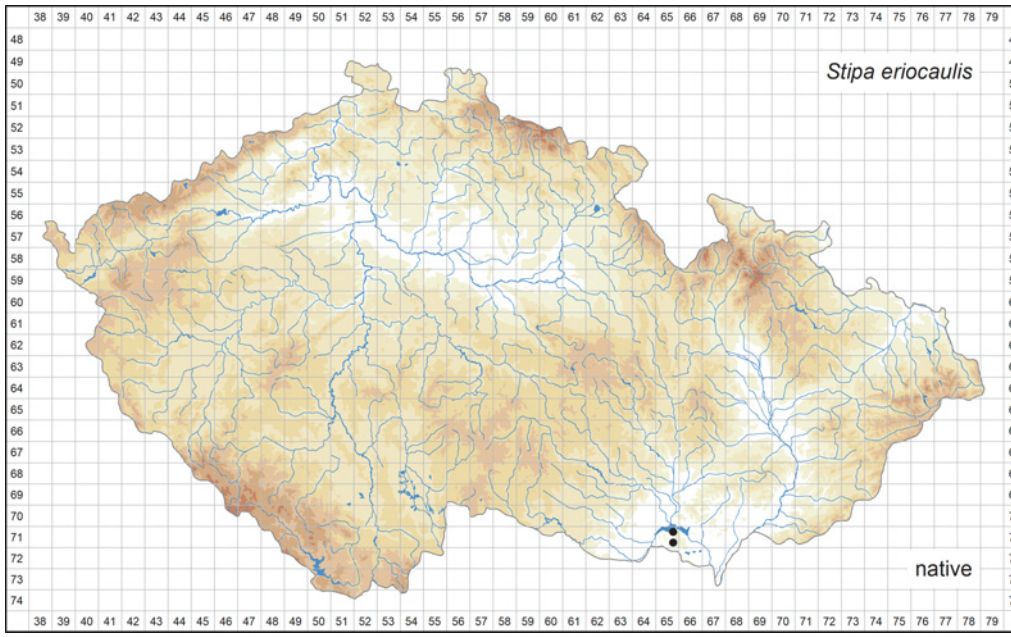

Fig. 97. Distribution of *Stipa eriocaulis* in the Czech Republic: ● at least one record in 2000–2024 (2 quadrants), ◍ pre-2000 records only (0 quadrants). Prepared by Jiří Danihelka.

Stipa glabrata (Fig. 98)

Stipa glabrata occurs in southern and south-eastern Ukraine (described as *S. asperella*; Tzvelev & Probatova 2019), south-eastern European Russia, south-western Siberia (Kurgan and Altai provinces) and possibly the adjacent areas of Kazakhstan. Additionally, geographically isolated populations exist in the north-western Czech Republic (Martinovský 1965 [incl. *S. zalesskii*], Lomonosova 1990). In the Czech Republic *S. glabrata* occurs on south-facing basalt slopes on moderately deep soils in narrow-leaved dry grasslands. The soils are dry, usually basic and nutrient-poor. In this country the occurrences of *S. glabrata* are restricted to the southern part of the České středohoří Mts in north-western Bohemia. In total, six populations have been recorded, of which only four remain whereas two were destroyed by stone quarrying. Only the populations on Oblík hill and Brník hill are abundant, while the two small populations in the eastern part of the České středohoří Mts consist of 10–25 tussocks. The occurrences of *S. glabrata* are situated in hilly areas at elevations of 240–460 m. The species is classified as critically threatened due to its rarity (Grulich 2012).

Stipa pennata (Fig. 99)

Stipa pennata is a Euro-Siberian species. Its European range includes central, south-eastern and eastern Europe. It extends west into France, south-west into northern Italy and Slovenia, north into Germany and Poland (with an outpost of uncertain status near Gothenburg in southern Sweden) and south into the Balkan Peninsula and Romania. In Asia it is found in the Caucasus, Transcaucasia, possibly also in eastern Anatolia and

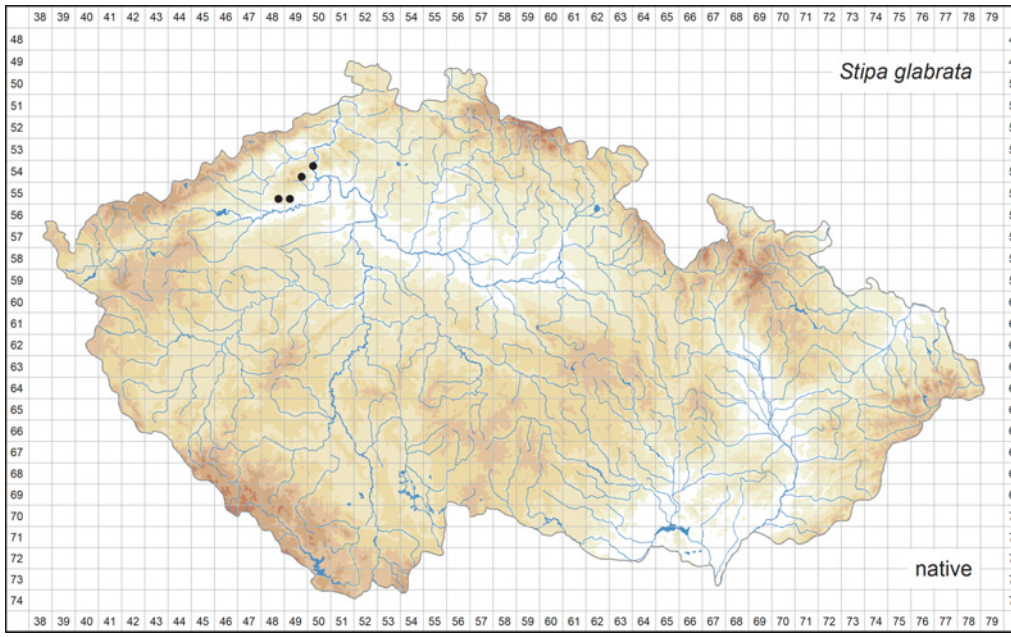

Fig. 98. Distribution of *Stipa glabrata* in the Czech Republic: ● at least one record in 2000–2024 (4 quadrants), ◍ pre-2000 records only (0 quadrants). Prepared by Jiří Danihelka & Karel Kubát.

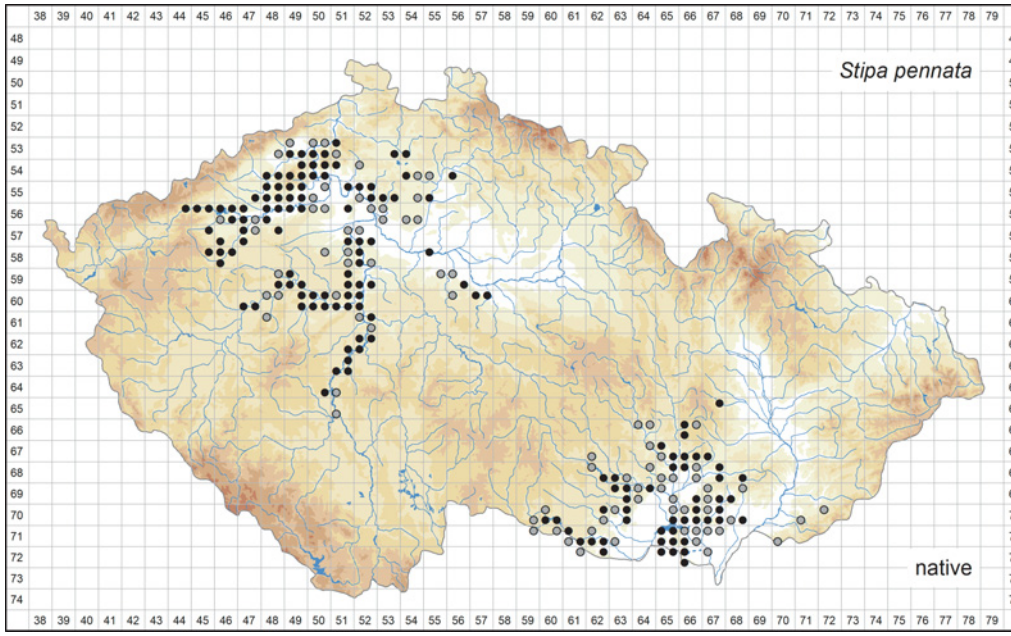

Fig. 99. Distribution of *Stipa pennata* in the Czech Republic: ● at least one record in 2000–2024 (146 quadrants), ◍ pre-2000 records only (83 quadrants). Prepared by Jiří Danihelka.

north-western Iran. It occurs throughout southern Siberia (reaching as far east as southern Buryatia, east of the Selenga river), as well as in Central Asia and Mongolia (Hultén & Fries 1986, Lomonosova 1990, Wagner et al. 2012, Gonzalo et al. 2013). Specimens of *S. pennata* with hairs on the adaxial side of ground leaves and pubescent leaf sheaths are sometimes separated as a distinct taxon at various ranks (e.g. *S. pennata* var. *puberula*, *S. pennata* subsp. *okensis* and *S. disjuncta*). However, they occur sporadically throughout the species' range, showing no distinct geographical or ecological pattern, and barely merit taxonomic recognition above the variety level. In the Czech Republic *S. pennata* occurs in various types of dry grasslands, most frequently on rock outcrops and in narrow-leaved sub-continental steppes, including grasslands on sandy soils, as well as in low xeric scrub and openings of various thermophilous forests. The soils are usually dry, slightly acidic to slightly basic and nutrient-poor. In the Czech Republic *S. pennata*, together with *S. capillata*, is the most widespread species of its genus. It occurs in the areas with warm and relatively dry climates in north-western and central Bohemia, as well as southern Moravia. Along deep river valleys with rock outcrops, including the Berounka and Vltava rivers in Bohemia, as well as the Jihlava and Dyje rivers in south-western Moravia, it extends considerably into the areas with moderately warm climates. Several outposts exist also on prominent hills and sandstone rocks south-east of the town of Česká Lípa in northern Bohemia, west of Mnichovo Hradiště in central Bohemia, and elsewhere. *Stipa pennata* var. *puberula* was recorded at several sites in both north-western Bohemia and southern Moravia, usually co-occurring with the typical variety, but we do not map this taxon separately. Most of the localities of *S. pennata* are in hilly areas at elevations of 200–500 m, with maximum elevations of 600–630 m on Mt Milešovka and on Solanská hora hill in the České středohoří Mts. In southern Moravia *S. pennata* also occurs in the lowlands and on sandy hummocks in the Dyje floodplain, with its lowest recorded elevation here being ~170 m. *Stipa pennata* has declined somewhat, primarily due to abandonment of pastures, elimination of fires along railways and elsewhere in dry grasslands, and general eutrophication, followed by succession and likely also due to the conversion of dry meadows into arable land, e.g. in the southern part of the Bílé Karpaty Mts. However, this decline was only moderate and localized, and abundant populations still persist, often in protected areas with appropriate management. The species is also able to colonize abandoned arable land as well as railway and road embankments when source populations are nearby. Therefore, the classification of the species as vulnerable (Grulich 2012) seems appropriate.

Stipa pulcherrima (Fig. 100)

Stipa pulcherrima, as circumscribed here, is native to Europe and temperate western Asia. In Europe it is discontinuously distributed in southern and central Germany (toward the west not reaching the Rhine), western and south-eastern Poland, the Czech Republic and Slovakia, eastern Austria, Hungary, eastern Serbia, Romania, Bulgaria, and Moldova, southwards extending to northern and central Italy; in eastern Europe it is found in southern Ukraine, including Crimea, and southern Russia. The Asian part of its range includes a small part of south-western Siberia (extending beyond the Irtysh River), the Caucasus Mts, Transcaucasia and possibly also Anatolia (Lomonosova 1990, Valdés et al. 2009, POWO 2024 [in a broad circumscription]). In the Czech Republic *S. pulcherrima* grows mainly

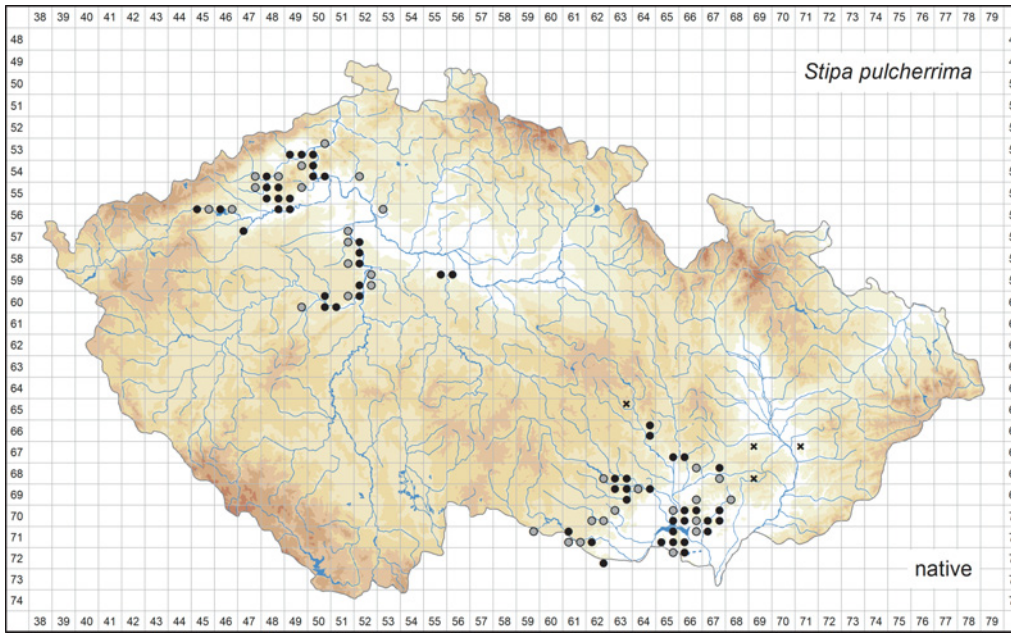

Fig. 100. Distribution of *Stipa pulcherrima* in the Czech Republic: ● native, at least one record in 2000–2024 (54 quadrants), ◍ native, pre-2000 records only (33 quadrants), × alien only (4 quadrants). Prepared by Jiří Danihelka.

in various types of dry grasslands, particularly in narrow-leaved sub-continental steppe, and less frequently in thermophilous forest fringe vegetation and xeric scrub. The soils are usually dry, slightly acidic to basic and nutrient-poor. In this country *S. pulcherrima* occurs in the areas with the warmest, driest climates. In Bohemia it is found in its north-western part, mainly in the České středohoří Mts, Český kras karst area and the Vltava river valley north of Prague. In Moravia it is found mainly in the south-eastern margin of the Českomoravská vrchovina highlands south-west of the city of Brno, in the Pavlovské vrchy hills and in the hilly area south and south-east of Brno. In both parts of its local range, outposts exist on rocky slopes in river valleys and on prominent hills. *Stipa pulcherrima* forms fairly abundant and stable populations at several sites situated in nature reserves. In addition, *S. pulcherrima* was introduced to four sites in southern and central Moravia, mainly abandoned stone quarries. The distribution map is preferentially based on examined herbarium specimens because confusion with *S. pennata* was particularly frequent in herbaria. Consequently, the species' distribution may be somewhat underestimated, as some of the undocumented records may not necessarily be erroneous. *Stipa pulcherrima* is classified as vulnerable (Grulich 2012), probably due to its scarcity and local decline.

Stipa smirnovii (Fig. 101)

Stipa smirnovii is morphologically defined as intermediate between *S. dasyphylla* and *S. glabrata* (Martinovský 1975). We accept this taxonomic hypothesis, although identifying

single specimens without the context of a population is sometimes difficult. Additionally, populations vary in the degree of leaf indumentum. A molecular study is required to assess the genetic relationships among the populations identified as *S. smirnovii*, *S. dasyphylla* and *S. glabrata*. *Stipa smirnovii* was first described from the Czech Republic. Similar plants have been recorded at one site in western Slovakia (near the village of Trenčianske Bohuslavice; Martinovský 1975), in southern and eastern Ukraine, as well as southern European Russia, though they were identified as *S. dasyphylla* or included in *S. glabrata* (Tzvelev & Probatova 2019, as *S. rubens*). In the Czech Republic *S. smirnovii* inhabits narrow-leaved dry grasslands and xeric scrub. The soils are usually dry, slightly acidic to basic and nutrient-poor. In this country it occurs in the areas with warm and dry, relatively continental climates in north-western Bohemia and south-western Moravia. In north-western Bohemia the most abundant populations are found on the volcanic hills of the České středohoří Mts, particularly on Oblík hill, where it co-occurs with *S. dasyphylla* and *S. glabrata*, and on Úhošť hill south-west of the town of Kadaň. In Moravia around ten populations of *S. smirnovii* are located along the south-western margin of the Českomoravská vrchovina highlands in a strip between the northern outskirts of the city of Brno and the town of Znojmo. Most of these populations are relatively small, consisting of either a few or several dozen tussocks. All occurrences of *S. smirnovii* are in hilly areas at elevations of 230–500 m, with a maximum elevation of ~550 m on the slopes of Úhošť hill. *Stipa smirnovii* is classified as critically threatened due to its rarity (Grulich 2012).

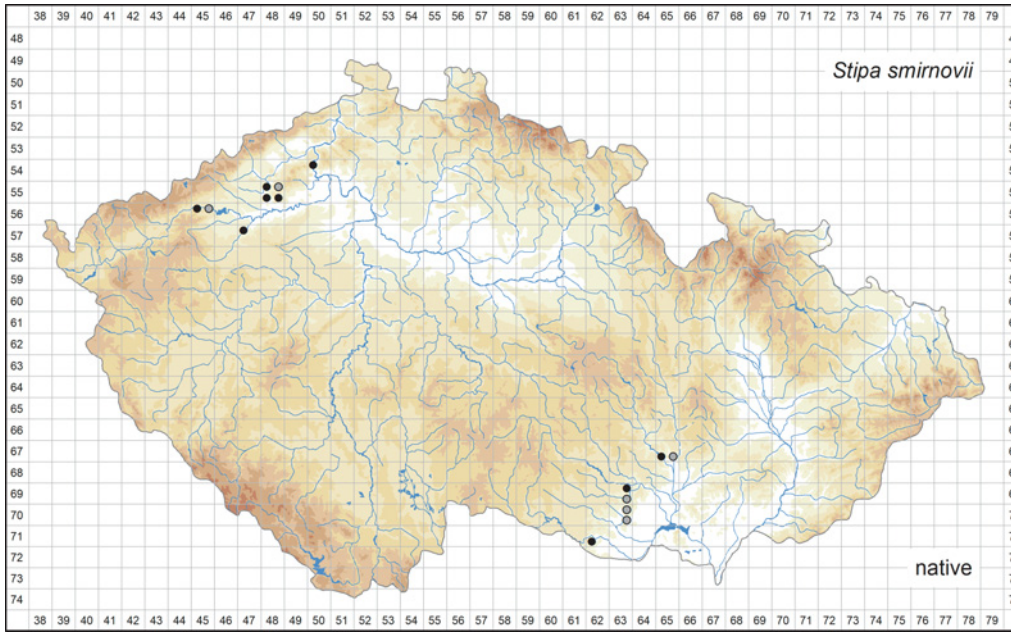

Fig. 101. Distribution of *Stipa smirnovii* in the Czech Republic: ● at least one record in 2000–2024 (9 quadrants), ● pre-2000 records only (6 quadrants). Prepared by Jiří Danihelka & Karel Kubát.

Stipa tirsa (Fig. 102)

Stipa tirsa is native to Europe and north-western Asia. In Europe it is discontinuously distributed from central France in the west to the southern Ural Mts in the east; it occurs in Germany, Italy (Lombardy and Tuscany), the Czech Republic, Lower Austria, southern Slovakia, Hungary and Transylvania in Romania, as well as the northern part of the Balkan Peninsula, Moldova, Ukraine (including Crimea) and southern Russia. In Asia it is found in the Caucasus and Transcaucasia, north-eastern Anatolia, northern Iran, northern Kazakhstan and south-western Siberia, extending eastward to the Irtysh River (Meusel et al. 1965, Lomonosova 1990, Gonzalo et al. 2013). In the Czech Republic *S. tirsa* grows in dry grasslands, including narrow-leaved sub-continental steppes, broad-leaved dry grasslands, less frequently in xeric scrub and open-canopy mesic scrub. The soils are relatively dry, slightly acidic to slightly basic and usually nutrient-poor. In this country *S. tirsa* occurs in north-western Bohemia, mainly in the western part of the České středohoří Mts, in Prague and along the Vltava river north of it, as well as in south-western, southern and south-eastern Moravia. Extremely abundant populations covering large tracts of steppic meadows once existed in the southern part of the Bílé Karpaty Mts, but they were destroyed by ploughing mainly in the 1950s and 1960s, leaving only a small stand of *S. tirsa* at a single site that has survived to the present (the two other extant populations in the area were established by planting). While some populations are abundant, others consist only of few specimens and are neglected, probably due to the confusion with *S. pennata*. This may be the explanation for rather recent additional records of this species in the Dunajovické kopce hills and near the village of Sedlec in southernmost Moravia. In

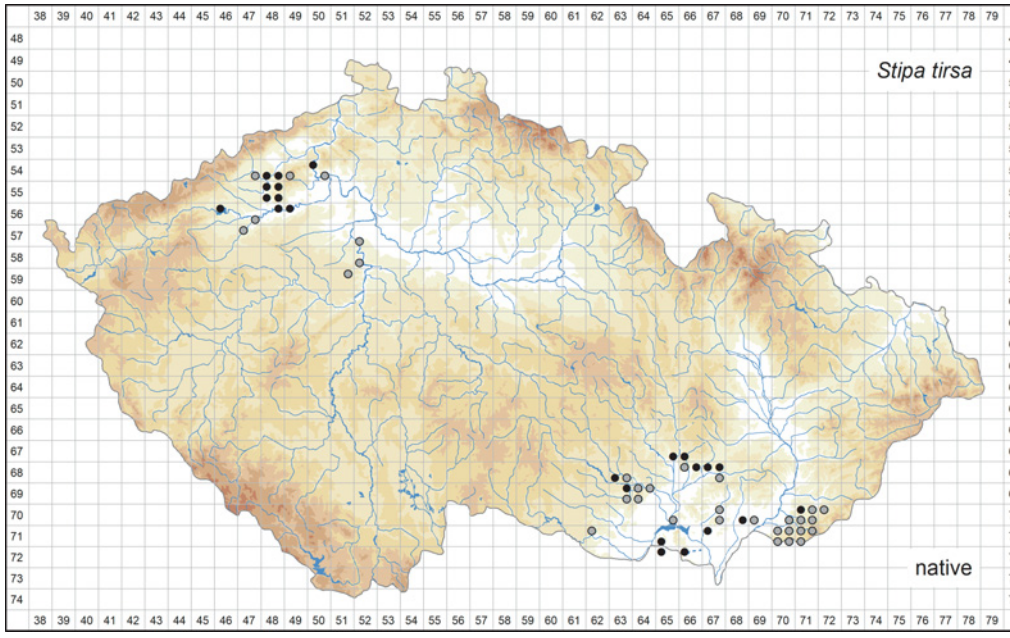

Fig. 102. Distribution of *Stipa tirsa* in the Czech Republic: ● at least one record in 2000–2024 (23 quadrants), ● pre-2000 records only (32 quadrants). Prepared by Jiří Danihelka.

contrast, the new record from the city of Brno (Ponava city district) may be due to planting or an escape from the botanical garden nearby. *Stipa tirsa* occurs in hilly areas, usually at elevations 200–450 m, with elevational maxima at ~500 m on Oblík hill in north-western Bohemia and ~600 m north-east of the village of Nová Lhota in south-eastern Moravia. Due to frequent confusion with *S. pennata* (s. str.), the distribution map is based preferentially on examined herbarium specimens. *Stipa tirsa* is classified as endangered because of its rarity and decline (Grulich 2012).

Traunsteinera globosa (Fig. 103)

Traunsteinera globosa occurs in mountains of central and southern Europe, from the Pyrenees in the west through southern France, the Alps, the Sudetes and the Carpathians to Bulgaria in the east (Baumann & Künkele 1982, Delforge 2006). In the Czech Republic this species grows in meadows, subalpine tall-forb communities and around springs. It prefers damp, basic to slightly acidic loamy soils that are rich in humus and nutrients. It is mainly found in the Carpathian flysch belt in eastern Moravia, namely in the Bílé Karpaty, Hostýnské vrchy, Vsetínské vrchy, Javorníky and Moravskoslezské Beskydy Mts. Elsewhere in Moravia it is rare: several sites are in the Hrubý Jeseník Mts and in the past one or two populations were recorded from each of Mt Králický Sněžník, the Chřiby hills and the surroundings of the town of Příbor. In Bohemia it is restricted to small areas in its northern and eastern parts. A dozen populations have been recorded in the Orlické hory Mts, but only one of them has been confirmed to exist during the past decade. About five sites have been recorded in the foothills of the Orlické hory Mts, around the town of

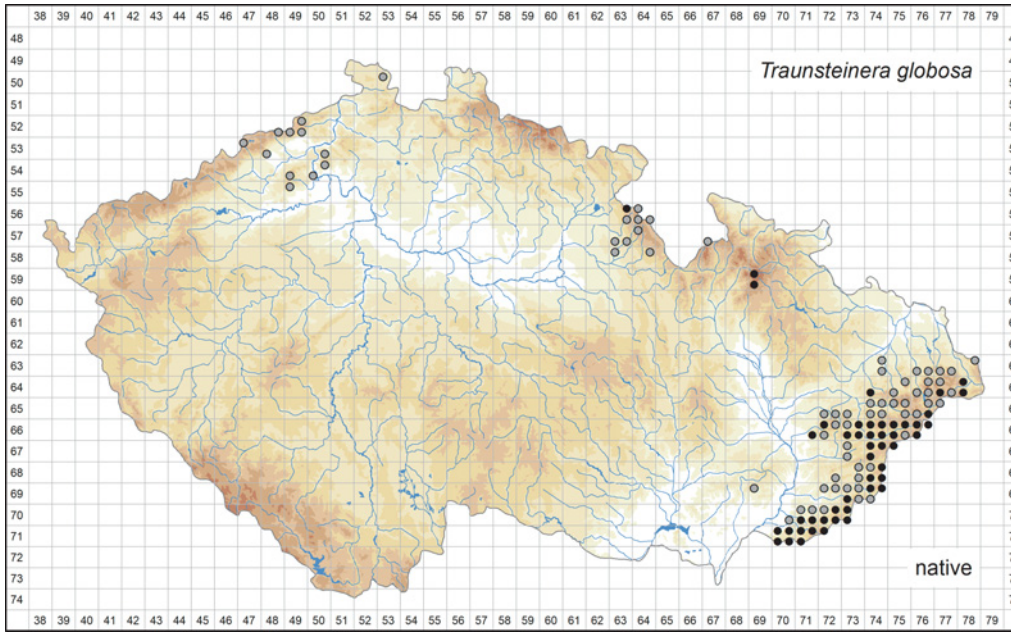

Fig. 103. Distribution of *Traunsteinera globosa* in the Czech Republic: ● at least one record in 2000–2024 (48 quadrants), ● pre-2000 records only (70 quadrants). Prepared by Vojtěch Taraška & Zdeněk Kaplan.

Solnice, but these occurrences vanished probably by the end of the 19th century. About seven populations have been recorded the České středohoří Mts and a similar number from the eastern Krušné hory Mts, and two isolated occurrences existed in northernmost Bohemia near the towns of Jiříkov and Rumburk. Most of these records are from the late 19th century, with the last of them dating to the 1940s from the eastern České středohoří Mts. *Traunsteinera globosa* has considerably declined due to changes in landscape management and general eutrophication of the landscape that suppresses symbiotic fungi. The species is therefore classified as endangered (Grulich 2012).

Supplementary materials

Data S1–S103. Records used for producing maps.

Supplementary materials are available at www.preslia.cz

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References

Auge H. & Brandl R. (1997) Seedling recruitment in the invasive clonal shrub, *Mahonia aquifolium* Pursh (Nutt.). – Oecologia 110: 205–211.

Ball P. W. & Tutin T. G. (1976) *Inula* L. – In: Tutin T. G., Heywood V. H., Burges N. A., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (eds), Flora Europaea 4: 133–136, Cambridge University Press, Cambridge.

Barkworth M. E. (2007) *Nassella*. – In: Flora of North America Editorial Committee (eds), Flora of North America North of Mexico 24: 170–177, Oxford University Press, New York & Oxford.

Baumann H. & Künkele S. (1982) Die wildwachsenden Orchideen Europas. – Kosmos Verlag, Stuttgart.

Beck G. (1891) Inulae Europae. Die europäischen *Inula*-Arten. – Denkschriften der Kaiserlichen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, 44: 280–339.

Bock B. (2011) Révisions nomenclaturales et taxonomiques (note n° 1). – Bulletin de la Société botanique du Centre-Ouest, nouvelle série, 42: 263–278.

Bolsheva N. L., Zelenin A. V., Nosova I. V., Amosova A. V., Samatadze T. E., Yurkevich O. Yu., Melnikova N. V., Zelenina D. A., Volkov A. A. & Muravenko O. V. (2015) The diversity of karyotypes and genomes within section *Syllinum* of the genus *Linum* (*Linaceae*) revealed by molecular cytogenetic markers and RAPD analysis. – PLoS ONE 10: e0122015.

Catling P. M. & Magrath L. K. (2002) *Malaxis*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 26: 627–632, Oxford University Press, New York & Oxford.

Čeřovský J. & Grulich V. (1999) *Dianthus moravicus* Kovanda. – In: Čeřovský J., Feráková V., Holub J., Maglocký Š. & Procházka F. (eds), Červená kniha ohrožených a vzácných druhů rostlin a živočichů ČR a SR. Vol. 5. Vyšší rostliny [Red Data Book of threatened plants and animals of the Czech Republic and Slovak Republic. Vol. 5. Higher plants], p. 130, Príroda, Bratislava.

Choleva A. F. (2009) *Samolus*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 8: 254–256, Oxford University Press, New York & Oxford.

Chytrý M. & Danihelka J. (2021) Obnova zaniklých slanisk u Šakvic na jižní Moravě [Restoration of vanished saline habitats near Šakvice in southern Moravia]. – Zprávy České botanické společnosti 56: 229–248.

Chytrý M., Danihelka J., Kaplan Z., Wild J., Holubová D., Novotný P., Řezníčková M., Rohn M., Dřevojan P., Grulich V., Klimešová J., Lepš J., Lososová Z., Pergl J., Sádlo J., Šmarda P., Štěpánková P., Tichý L., Axmanová I., Bartušková A., Blažek P., Chrtek J. Jr., Fischer F. M., Guo W.-Y., Herben T., Janovský Z., Konečná M., Kühn I., Moravcová L., Petřík P., Pierce S., Prach K., Prokešová H., Štech M., Těšitel J., Těšitelová T., Večeřa M., Zelený D. & Pyšek P. (2021) Pladias database of the Czech flora and vegetation. – Preslia 93: 1–87.

Clapham A. R. & Jardine N. (1993) *Sagina*. – In: Tutin T. G., Burges N. A., Chater A. O., Edmondson J. R., Heywood V. H., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (eds), Flora Europaea, ed. 2, 1: 176–178, Cambridge University Press, Cambridge.

Conti F., Abbate G., Alessandrini A. & Blasi C. (eds) (2005) An annotated checklist of the Italian vascular flora. – Ministero dell'Ambiente e della Tutela del Territorio & Università degli Studi di Roma "La Sapienza", Rome.

Crow G. E. (1978) A taxonomic revision of *Sagina* (*Caryophyllaceae*) in North America. – Rhodora 80: 1–91.

Crow G. E. (2005) *Sagina*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 5: 140–147, Oxford University Press, New York & Oxford.

Danihelka J., Chytrý M., Grulich V. & Tichý L. (2000) *Stipa eriocaulis* – přehlížený druh české flóry [*Stipa eriocaulis* – a neglected species of the Czech flora]. – Preslia 72: 399–410.

Delforge P. (2006) Orchids of Europe, North Africa and the Middle East. Ed. 3. – A & C Black, London.

Dillenberger M. S. & Kadereit J. W. (2022) The distinction between *Sagina apetala* and *S. micropetala* (*Caryophyllaceae*: *Sagineae*), their phylogenetic relationships, and a note on the coastal origin of some widespread ruderals. – Willdenowia 52: 5–23.

Dostál J. et al. (1948–1950) Květena ČSR [Flora of the Czechoslovak Republic]. – Česká botanická společnost a Přírodovědecké nakladatelství, Praha.

Fassou G., Korotkova N., Nersesyan A., Koch M. A., Dimopoulos P. & Borsch T. (2022) Taxonomy of *Dianthus* (*Caryophyllaceae*) – overall phylogenetic relationships and assessment of species diversity based on a first comprehensive checklist of the genus. – PhytoKeys 196: 91–214.

Ferrez Y. & Royer J.-M. (2021) Le genre *Rubus* dans le nord-est de la France. Description, détermination, écologie et phytosociologie. – SBFC, CBNFC-ORI, Greffe.

Fu D. & Robinson O. R. (2001) *Adonis*. – In: Wu Z.-Y., Raven P. H. & Hong D.-Y. (eds), Flora of China 6: 389–391, Science Press, Beijing & Missouri Botanical Garden press, St. Louis.

Futák J. (1982) *Linum* L. – In: Futák J. & Bertová L. (eds), Flóra Slovenska [Flora of Slovakia] 3: 512–533, Veda, Bratislava.

Gams H. (1953) Beiträge zur Kenntnis der arktisch-alpinen Saginen. – Phyton 5: 107–117.

GBIF (2024) GBIF: The global biodiversity information facility. – URL: https://www.gbif.org (accessed July 2024).

Gillespie L. J. (2016) *Mercurialis*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 12: 161–162, Oxford University Press, New York & Oxford.
Gonzalo R., Aedo C. & García M. A. (2013) Taxonomic revision of the Euroasian *Stipa* subsections *Stipa* and *Tirsae* (*Poaceae*). – Systematic Botany 38: 344–378.
Greimler J. & Gutermann W. (2008) Typifications of Kerner names 3: *Dianthus pontederae* (*Caryophyllaceae*). – Annalen des Naturhistorischen Museums in Wien, ser. B, 110: 267.
Grulich V. (2012) Red List of vascular plants of the Czech Republic: 3rd edition. – Preslia 84: 631–645.
Gu C.-Z. & Robertson K. R. (2003) *Rosa*. – In: Wu Z.-Y., Raven P. H. & Hong D.-Y. (eds), Flora of China 9: 339–381, Science Press, Beijing and Missouri Botanical Garden Press, St. Luis.
Gubanov I. A. (1994) Devyasil – *Inula* L. – In: Tzvelev N. N. (ed.), Flora evropeiskoi chasti SSSR [Flora of the European part of the USSR] 7: 80–87, Nauka, Sankt-Peterburg.
Hand R. (2011) *Apiaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity, URL: http://europlusmed.org (accessed June 2024).
Hardion L., Perrier A., Martinez M., Navrot N., Gaquerel E., Tournay F., Nguefack J. & Combroux I. (2020) Integrative revision of *Dianthus superbus* subspecies reveals different degrees of differentiation, from plasticity to species distinction. – Systematics and Biodiversity 18: 255–268.
Hendrych R. (1980) *Laser trilobum* v Československu [*Laser trilobum* in Czechoslovakia]. – Zprávy Československé botanické společnosti 15: 17–23.
Henker H. (2017) *Rosa* L. – Rose. – In: Jäger E. (ed.), Rothmaler, Exkursionsflora von Deutschland. Gefässpflanzen: Grundband, ed. 21, p. 444–453, Springer Spektrum, Berlin & Heidelberg.
Hensen I., Kilian C., Wagner V., Durka W., Pusch J. & Wesche K. (2010) Low genetic variability and strong differentiation among isolated populations of the rare steppe grass *Stipa capillata* L. in Central Europe. – Plant Biology 12: 526–536.
Holub J. (1991) Eight new *Rubus* species described from Czech Republic. – Folia Geobotanica et Phytotaxonomica 26: 331–340.
Holub J. (1995) *Rubus* L. – ostružiník (maliník, moruška, ostružinec, ostružiníček). – In: Slavík B., Smejkal M., Dvořáková M. & Grulich V. (eds), Květena České republiky [Flora of the Czech Republic] 4: 54–206, Academia, Praha.
Hrouda L. (1972) *Inula germanica* L. in der Tschechoslowakei. – Preslia 44: 227–243.
Hrouda L. (1974a) *Inula oculus-christi* L. in der Tschechoslowakei. – Preslia 46: 172–185.
Hrouda L. (1974b) Taxonomie und Verbreitung von *Inula salicina* L. s. l. in der Tschechoslowakei. – Preslia 46: 32–56.
Hrouda L. (1997) *Linum* L. – len. – In: Slavík B., Chrtek J. jun. & Tomšovic P. (eds), Květena České republiky [Flora of the Czech Republic] 5: 168–178, Academia, Praha.
Hrouda L. (2004) *Inula* L. – oman. – In: Slavík B., Štěpánková J. & Štěpánek J. (eds), Květena České republiky [Flora of the Czech Republic] 7: 69–80, Academia, Praha.
Hrouda L. (2019) *Linaceae* Perleb – lnovité. – In: Kaplan Z., Danihelka J., Chrtek J. jun., Kirschner J., Kubát K., Štech M. & Štěpánek J. (eds), Klíč ke květeně České republiky [Key to the flora of the Czech Republic], ed. 2, p. 589–591, Academia, Praha.
Hubatka P. (2023) *Stipa eriocaulis*. – In: Lustyk P. & Doležal J. (eds), Additamenta ad floram Reipublicae Bohemicae [Additions to the flora of the Czech Republic]. XXI, Zprávy České botanické společnosti 58: 132–133.
Hultén E. & Fries M. (1986) Atlas of North European vascular plants north of the Tropic of Cancer. Vols 1–3. – Koeltz Scientific Books, Königstein.
Iamonico D. (2016) A new name in *Sagina*, *Sagina alexandrae* (*Caryophyllaceae*). – Phytotaxa 282: 164 –165.
Jalas J. & Suominen J. (eds) (1986) Atlas Florae Europaeae. Vol. 7. *Caryophyllaceae* (*Silenoideae*). – The Committee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo, Helsinki.
Jalas J. & Suominen J. (eds) (1989) Atlas florae europaeae. Vol. 8. *Nymphaceae* to *Ranunculaceae*. – The Committee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo, Helsinki.
Kaplan Z., Danihelka J., Chrtek J. jun., Kirschner J., Kubát K., Štech M. & Štěpánek J. (eds) (2019a) Klíč ke květeně České republiky [Key to the flora of the Czech Republic]. Ed. 2. – Academia, Praha.
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. (2018a) Distributions of vascular plants in the Czech Republic. Part 7. – Preslia 90: 425–531.
Kaplan Z., Danihelka J., Chrtek J. Jr., Prančl J., Grulich V., Jelínek B., Úradníček L., Řepka R., Šmarda P., Vašut R. J. & Wild J. (2022) Distributions of vascular plants in the Czech Republic. Part 11. – Preslia 94: 335–427.

Kaplan Z., Danihelka J., Chrtek J. Jr., Zázvorka J., Koutecký P., Ekrt L., Řepka R., Štěpánková J., Jelínek B., Grulich V., Prančl J. & Wild J. (2019b) Distributions of vascular plants in the Czech Republic. Part 8. – Preslia 91: 257–368.

Kaplan Z., Danihelka J., Dřevojan P., Řepka R., Koutecký P., Grulich V. & Wild J. (2021) Distributions of vascular plants in the Czech Republic. Part 10. – Preslia 93: 255–304.

Kaplan Z., Danihelka J., Ekrt L., Štech M., Řepka R., Chrtek J. Jr., Grulich V., Rotreklová O., Dřevojan P., Šumberová K. & Wild J. (2020) Distributions of vascular plants in the Czech Republic. Part 9. – Preslia 92: 255–340.

Kaplan Z., Danihelka J., Koutecký P., Šumberová K., Ekrt L., Grulich V., Řepka R., Hroudová Z., Štěpánková J., Dvořák V., Dančák M., Dřevojan P. & Wild J. (2017a) Distributions of vascular plants in the Czech Republic. Part 4. – Preslia 89: 115–201.

Kaplan Z., Danihelka J., Lepší M., Lepší P., Ekrt L., Chrtek J. Jr., Kocián J., Prančl J., Kobrlová L., Hroneš M. & Šulc V. (2016a) Distributions of vascular plants in the Czech Republic. Part 3. – Preslia 88: 459–544.

Kaplan Z., Danihelka J., Prančl J., Chrtek J. Jr., Ducháček M., Šumberová K., Nunvářová Kabátová K., Taraška V. & Wild J. (2024) Distributions of vascular plants in the Czech Republic. Part 13. – Preslia 96: 1–96.

Kaplan Z., Danihelka J., Štěpánková J., Bureš P., Zázvorka J., Hroudová Z., Ducháček M., Grulich V., Řepka R., Dančák M., Prančl J., Šumberová K., Wild J. & Trávníček B. (2015) Distributions of vascular plants in the Czech Republic. Part 1. – Preslia 87: 417–500.

Kaplan Z., Danihelka J., Štěpánková J., Ekrt L., Chrtek J. Jr., Zázvorka J., Grulich V., Řepka R., Prančl J., Ducháček M., Kúr P., Šumberová K. & Brůna J. (2016b) Distributions of vascular plants in the Czech Republic. Part 2. – Preslia 88: 229–322.

Kaplan Z., Danihelka J., Šumberová K., Chrtek J. Jr., Rotreklová O., Ekrt L., Štěpánková J., Taraška V., Trávníček B., Prančl J., Ducháček M., Hroneš M., Kobrlová L., Horák D. & Wild J. (2017b) Distributions of vascular plants in the Czech Republic. Part 5. – Preslia 89: 333–439.

Kaplan Z., Danihelka J., Šumberová K., Prančl J., Velebil J., Dřevojan P., Ducháček M., Businský R., Řepka R., Maděra P., Galušková H., Wild J. & Brůna J. (2023) Distributions of vascular plants in the Czech Republic. Part 12. – Preslia 95: 1–118.

Kaplan Z., Koutecký P., Danihelka J., Šumberová K., Ducháček M., Štěpánková J., Ekrt L., Grulich V., Řepka R., Kubát K., Mráz P., Wild J. & Brůna J. (2018b) Distributions of vascular plants in the Czech Republic. Part 6. – Preslia 90: 235–346.

Király G. (ed.) (2009) Új magyar füvészkönyv. Magyarország hajtásos növényei. Határozókulcsok [New Hungarian herbal. The vascular plants of Hungary. Identification key]. – Aggteleki Nemzeti Park Igazgatóság, Jósvafő.

Király G. (2015) The first record of *Rubus apricus* in Hungary – on the southernmost point of the distribution area. – Studia Botanica Hungarica 46: 141–148.

Király G. & Hohla M. (2021) Contributions to *Rubus* sect. *Corylifolii* (*Rosaceae*) in the Eastern Alps and adjacent regions. – Neilreichia 12: 145–182.

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.

Kirschner J. & Štěpánek J. (1995) *Ononis* L. – jehlice. – In: Slavík B., Smejkal M., Dvořáková M. & Grulich V. (eds), Květena České republiky [Flora of the Czech Republic] 4: 438–444, Academia, Praha.

Klášterský I. (1968) *Rosa* L. – In: Tutin E. G., Heywood V. H., Burges N. A., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (eds), Flora Europaea 2: 25–32, Cambridge University Press, Cambridge.

Klein E. (2000) *Pseudorchis albida* subsp. *tricuspis* (Beck) Klein stat. nov., eine weitgehend übersehene, calcicole, alpischboreale Sippe (*Orchidaceae* – *Orchideae*). – Phyton (Horn) 40: 141–159.

Klinkovská K., Glaser M., Danihelka J., Kaplan Z., Knollová I., Novotný P., Pyšek P., Řezníčková M., Wild J. & Chytrý M. (2024) Dynamics of the Czech flora over the last 60 years: winners, losers and causes of changes. – Biological Conservation 292: 110502.

Kloda J. M., Dean P. D. G., Maddren C., MacDonald D. W. & Mayes S. (2008) Using principle component analysis to compare genetic diversity across polyploidy levels within plant complexes: an example from British Restharrows (*Ononis spinosa* and *Ononis repens*). – Heredity 100: 253–260.

Kmeťová E. (1985) Taxonómia druhu *Dianthus praecox* Kit. na Slovensku [Taxonomy of *Dianthus praecox* Kit. in Slovakia]. – Biologické práce 31/5: 3–87.

Kodela P. G. & Morley B. D. (2018) *Berberis aquifolium*. – In: Kodela P. G. (ed.), Flora of Australia, Australian Biological Resources Study, Department of Climate Change, Energy, the Environment and Water, Canberra, URL: https://profiles.ala.org.au/opus/foa/profile/Berberis%20aquifolium (accessed June 2024).

Kovanda M. (1982) *Dianthus gratianopolitanus*: variability, differentiation and relationships. – Preslia 54: 223–242.

Kovanda M. (1984) Chromosome numbers in selected Angiosperms (2). – Preslia 56: 289–301.

Kovanda M. (1990) *Dianthus* L. – hvozdík. – In: Hejný S., Slavík B., Hrouda L. & Skalický V. (eds), Květena České republiky [Flora of the Czech Republic] 2: 200–213, Academia, Praha.

Kowarik I. (1992) Einführung und Ausbreitung nichteinheimischer Gehölzarten in Berlin und Brandenburg. – Verhandlungen des Botanischen Vereins von Berlin und Brandenburg 3: 1–188.

Krahulcová A. & Holub J. (1996) Chromosome number variation in the genus *Rubus* in the Czech Republic. I. – Preslia 68: 241–255.

Krahulcová A. & Holub J. (1997) Chromosome number variation in the genus *Rubus* in the Czech Republic. II. – Preslia 69: 289–310.

Krahulcová A. & Holub J. (1998) Chromosome number variation in the genus *Rubus* in the Czech Republic. III. – Preslia 70: 33–50.

Křísa B., Chrtek J. & Slavíková Z. (1968) Poznámky k rozšíření druhu *Smyrnium perfoliatum* L. v ČSSR [Notes on the distribution of *Smyrnium perfoliatum* L. in Czechoslovakia]. – Zprávy Československé botanické společnosti 3: 65–68.

Kubát K. (1992) *Mercurialis* L. – bažanka. – In: Hejný S., Slavík B., Kirschner J. & Křísa B. (eds), Květena České republiky [Flora of the Czech Republic] 3: 346–350, Academia, Praha.

Kurtto A., Lampinen R. & Junikka L. (eds) (2004) Atlas Florae Europaeae. Vol. 13. *Rosaceae* (*Spiraea* to *Fragaria*, excl. *Rubus*). – The Committee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo, Helsinki.

Kurtto A., Sennikov A. N. & Lampinen R. (eds) (2013) Atlas Florae Europaeae. Distribution of Vascular Plants in Europe. 16. *Rosaceae* (*Cydonia* to *Prunus*, excl. *Sorbus*). – The Committee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo, Helsinki.

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

Lepší M. & Lepší P. (eds) (2014) Nálezy zajímavých a nových druhů v květeně jižní části Čech XX [Records of interesting and new plants of the South Bohemian flora XX]. – Sborník Jihočeského muzea v Českých Budějovicích, Přírodní vědy 54: 101–121.

Lepší M., Lepší P. & Boublík K. (eds) (2024) Nálezy zajímavých a nových druhů v květeně jižní části Čech XXX [Records of interesting and new plants of the South Bohemian flora XXX]. – Sborník Jihočeského muzea v Českých Budějovicích, Přírodní vědy 64: 14–43.

Lepší P. & Lepší M. (2021) *Rubus brdensis* – first record for Germany. – Hoppea, Denkschriften der Regensburgischen Botanischen Gesellschaft 82: 183–188.

Lewis W. H., Ertter B. & Bruneau A. (2014) *Rosa*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 9: 75–119, Oxford University Press, Oxford & New York.

Liu Q.-R. & Zhou L. (2008) *Linaceae*. – In: Wu Z.-Y., Raven P. H. & Hong D.-Y. (eds), Flora of China 11: 34–37, Science Press, Beijing & Missouri Botanical Garden Press, St. Louis.

Lomonosova M. N. (1990) *Stipa* L. – Kovyl'. – In: Malyshev L. I. & Peshkova G. A. (eds), Flora Sibiri [Flora of Siberia] 2: 222–230, Nauka, Novosibirsk.

Lu D.-Q. & Turland N. J. (2001) *Dianthus* Linnaeus. – In: Wu Z.-Y., Raven P. H. & Hong D.-Y. (eds), Flora of China 6: 102–107, Science Press, Beijing & Missouri Botanical Garden Press, St. Louis.

Marhold K. (2011) *Caryophyllaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity, URL: http://www.europlusmed.org (accessed July 2024).

Martínez Labarga J. M. & Muńoz Garmendia F. (2015) *Linum* L. – In: Castroviejo S., Muńoz Garmendia F. & Navarro C. (eds), Flora iberica 9: 173–266, Real Jardín Botánico & CSIC, Madrid.

Martinovský J. (1960) Len rakouský v ČSSR [*Linum austriacum* in the CSSR]. – Ochrana přírody 15: 161–167.

Martinovský J. (1965) *Stipa rubens* P. Smirn. – das Rötliche Federgras – eine für die Tschechoslowakei und für Mitteleuropa neue Art. – Preslia 37: 156–169.

Martinovský J. O. (1975) Taxonomische Studie über die *Stipa*-Serie *Dasyphyllae*. XXV. Beitrag zur Kenntnis der Gattung *Stipa*. – Preslia 47: 249–261.

Matthiolus P. O. (1562) Herbarz, ginak Bylinář, welmi užitečný… [original title: Commentarii in sex libros Pedacii Dioscoridis Anazarbei de Medica materia…]. – Wytisstieno w Starém Miestie Pražském u Giržijka Melantrycha z Awentynu. [translated by T. Hájek z Hájku]

Medvecká J., Kliment J., Májeková J., Halada Ľ., Zaliberová M., Gojdičová E., Feráková V. & Jarolímek I. (2012) Inventory of the alien flora of Slovakia. – Preslia 84: 257–309.
Meusel H. & Jäger E. J. (eds) (1992) Vergleichende Chorologie der zentraleuropäischen Flora. Vol. 3. – Gustav Fischer, Jena, Stuttgart & New York.
Meusel H., Jäger E., Rauschert S. & Weinert E. (1978) Vergleichende Chorologie der zentraleuropäischen Flora. Vol. 2. – Gustav Fischer, Jena.
Meusel H., Jäger E. & Weinert E. (1965) Vergleichende Chorologie der zentraleuropäischen Flora. Vol. 1. – Gustav Fischer, Jena.
Morin N. R. (2016) *Linum*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 12: 373–394, Oxford University Press, New York & Oxford.
Munz A. (1967–1968) A synopsis of the Asian species of *Delphinium* sensu stricto. – Journal of the Arnold Arboretum 48: 249–302, 476–545, 49: 73–166, 233–259.
Nienartowicz A., Kamiński D., Kunz M., Deptuła M. & Adamska E. (2014) Changes in the plant cover of the dune hill in Folusz near Szubin (NW Poland) between 1959 and 2013: the problem of preservation of xerothermic grasslands in the agricultural landscape. – Ecological Questions 20: 23–38.
Niklfeld H. (1997) Mapping the flora of Austria and the eastern Alps. – Revue valdôtaine d'histoire naturelle 51, Suppl.: 53–62.
Nobis M., Gudkova P. D., Nowak A., Sawicki J. & Nobis A. (2020) A synopsis of the genus *Stipa* (*Poaceae*) in Middle Asia, including a key to species identification, an annotated checklist, and phytogeographic analysis. – Annals of the Missouri Botanical Garden 105: 1–63.
Novák F. A. (1915) Kritická studie o *Dianthus arenarius* L. a jemu blízce příbuzných druzích, a o jeho stanovišti v Čechách [Critical study of *Dianthus arenarius* L. and closely related species, and of its habitat in Bohemia]. – Věstník Královské české společnosti nauk, cl. math.-natur., 1915/8: 1–27.
NYBG (2024) Index herbariorum. – Steere Herbarium, New York Botanical Garden, URL: http://sweetgum.nybg.org/science/ih (accessed in September 2024).
NZPCN (2024) New Zealand plant conservation network. – URL: https://www.nzpcn.org.nz/ (accessed July 2024).
Oborny A. (1886) Flora von Mähren und österr. Schlesien. – Carl Winiker, Brünn.
Ockendon D. J. (1971) Taxonomy of the *Linum perenne* group in Europe. – Watsonia 8: 205–235.
Ockendon D. J. & Walters S. M. (1968) *Linum* L. – In: Tutin T. G., Heywood V. H., Burges N. A., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (eds), Flora Europaea 2: 206–211, Cambridge University Press, Cambridge.
Pagitz K. (2013) Neues zur Brombeer-Flora der Ostalpen. – Gredleriana 13: 45–70.
Parfitt B. D. (1997) *Adonis*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 3: 184–187, Oxford University Press, New York & Oxford.
Paudel R., Fristoe T. S., Kinlock N. L., Davis A., Zhao W., Van Calster H., Chytrý M., Danihelka J., Decocq G., Ehrendorfer-Schratt L., Kaplan Z., Wild J., Dawson W., Essl F., Kreft H., Pergl J., Pyšek P., Winter M. & van Kleunen M. (2025) Many plants that have naturalized as aliens abroad have also become more common within their native regions. – Nature Communications (in review).
Pejchal M., Sádlo J. & Štefl L. (2021) Nepůvodní dřeviny v památkách zahradního umění [Non-native woody plants in the monuments of garden art]. – Botanický ústav AV ČR, Průhonice.
Peniašteková M., Pišút I., Letz R. & Feráková V. (1996) Poznámky k rozšíreniu, ekológii a pôvodu druhu *Smyrnium perfoliatum* L. na Slovensku [Notes on distribution, ecology and origin of the species *Smyrnium perfoliatum* L. in Slovakia]. – Bulletin Slovenskej botanickej spoločnosti 18: 92–97.
Popiela A. & Łysko A. (2014) *Sagina subulata*. – In: Kaźmierczakowa R., Zarzycki K. & Mirek Z. (eds), Polska czerwona księga roślin. Paprotniki i rośliny kwiatowe [Polish Red Data Book of plants. Pteridophytes and flowering plants], ed. 3: 127–128, Instytut Ochrony Przyrody PAN, Kraków.
POWO (2024) Plants of the World online. – Royal Botanic Gardens, Kew, URL: https://powo.science.kew.org/ (accessed July 2024).
Prančl J. (2024) *Sagina apetala*. – In: Lustyk P. & Doležal J. (eds), Additamenta ad floram Reipublicae Bohemicae [Additions to the flora of the Czech Republic] XXII, Zprávy České botanické společnosti 59: 106–116.
Presl J. S. & Presl K. B. (1819) Flora čechica. Kwětena Česká [Bohemian flora]. – J. G. Calve, Pragae.
Presl J. S. & Presl K. B. (1822) Mantissa I ad Floram Čechicam, sistens diagnoses et descriptiones XVIII plantarum novarum Čechiae indigenarum. – In: Presl J. S. & Presl K. B., Deliciae pragenses, historiam naturalem spectantes, p. 211–231, Pragae.

Putz C. M., Schmid C. & Reisch C. (2015) Living in isolation – population structure, reproduction, and genetic variation of the endangered plant species *Dianthus gratianopolitanus* (Cheddar pink). – Ecology and Evolution 5: 3610–3621.

Pyšek P., Sádlo J., Chrtek Jr. J., Chytrý M., Kaplan Z., Pergl J., Pokorná A., Axmanová I., Čuda J., Doležal J., Dřevojan P., Hejda M., Kočár P., Kortz A., Lososová Z., Lustyk P., Skálová H., Štajerová K., Večeřa M., Vítková M., Wild J. & Danihelka J. (2022) Catalogue of alien plants of the Czech Republic (3rd edition): species richness, status, distributions, habitats, regional invasion levels, introduction pathways and impacts. – Preslia 94: 447–577.

Raab-Straube E. von (2015) *Berberis*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity, URL: http://europlusmed.org (accessed June 2024).

Raab-Straube E. von (2018) *Linaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity, URL: http://www.europlusmed.org (accessed 19 July 2024).

Raab-Straube E. von, Hand R., Hörandl E. & Nardi E. (2014) *Ranunculaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity, URL: http://www.europlusmed.org (accessed August 2024).

Rabeler R. K. & Hartman R. L. (2005) *Dianthus*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 5: 159–162, Oxford University Press, New York & Oxford.

Reeve H. (1967) *Dianthus*. – In: Davis P. H. (ed.), Flora of Turkey and the East Aegean Islands 2: 99–131, Edinburgh University Press, Edinburgh.

Řepka R., Sádlo J., Němec R. & Láníková D. (2021) *Nassella tenuissima*. – In: Lustyk P. & Doležal J. (eds), Additamenta ad floram Reipublicae Bohemicae [Additions to the flora of the Czech Republic] – XIX, Zprávy České botanické společnosti 56: 127–130.

Ross C. A., Auge H. & Durka W. (2008) Genetic relationships among three native North-American *Mahonia* species, invasive *Mahonia* populations from Europe, and commercial cultivars. – Plant Systematics and Evolution 275: 219–229.

Sander F. W. (2022) Bemerkungen zu einigen in der Oberlausitz angepflanzten oder natürlich vorkommenden Brombeeren (Gattung *Rubus* Linnaeus, *Rosaceae*). – Berichte der Naturforschenden Gesellschaft der Oberlausitz 30: 77–83.

Santos-Vicente M., Gutiérrez-Larruscain D., Martínez-Ortega M. M. & Rico E. (2019) *Inula* L. – In: Benedí C., Buira A., Rico E., Crespo M. B., Quintanar A. & Aeedo C. (eds), Flora iberica 16/3: 2050–2067, Real Jardín Botánico & C.S.I.C., Madrid.

Schönfelder P. (1999) Mapping the flora of Germany. – Acta Botanica Fennica 162: 43–53.

Schur P. J. F. (1866) Enumeratio plantarum Transsilvaniae exhibens: stirpes phanerogamas sponte crescentes atque frequentius cultas, cryptogamas vasculares, charceas, etiam muscos hepaticasque. – G. Braumüller, Vienna.

Shahada C., Morya S. & Awuchi C. G. (2024) A narrative review on nutraceutical, food and industrial applications of flaxseed (*Linum usitatissimum* L.). – Cogent Food & Agriculture 10: 2306017.

Sheviak C. J. (2002a) *Cypripedium*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 26: 499–507, Oxford University Press, New York & Oxford.

Sheviak C. J. (2002b) *Pseudorchis*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 26: 499–507, Oxford University Press, New York & Oxford.

Soó R. (1966) A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve [Systematic and geobotanical manual of the Hungarian flora and vegetation]. Vol. 2. – Akadémiai Kiadó, Budapest.

Steinberg C. (1971) Revisione sistematica e distributiva delle «*Adonis*» annuali in Italia [Revision of the systematics and distribution of annual *Adonis* in Italy]. – Webbia 25: 299–351.

Stinca A. & Pignatti S. (2016) A new combination in *Smyrnium* (*Apiaceae*). – Phytotaxa 284: 137.

Sutorý K. (1990) *Sagina* L. – úrazník. – In: Hejný S., Slavík B., Hrouda L. & Skalický V. (eds), Květena České republiky [Flora of the Czech Republic] 2: 109–112, Academia, Praha.

Svetlova A. (2010) Taksonomicheskii obzor roda *Linum* L. (*Linaceae*) flory Rossii i sopredel'nykh gosudarstv [The taxonomic review of the genus *Linum* L. (*Linaceae*) of the flora of Russia and adjacent states]. – Novitates systematicae plantarum vascularium 41: 99–165.

Talebi S. M., Rashnou-Taei M., Sheidai M. & Noormohammadi Z. (2015) Use of anatomical characteristics for taxonomical study of some Iranian *Linum* taxa. – Environmental and Experimental Biology 13: 123–131.

Thulin M. (2022) Typification of *Sagina ciliata* and *S. stricta* (*Caryophyllaceae*), two taxa described from Sweden, and notes on the taxonomy of the *S. apetala* complex. – Phytotaxa 572: 222–224.

Tork D. G., Anderson N. O., Wyse D. L. & Betts K. J. (2022) Perennial flax: a potential cut flower crop. – HortScience 57: 221–230.

Tutin T. G. & Walters S. M. (1993) *Dianthus* L. – In: Tutin T. G., Burges N. A., Chater A. O., Edmondson J. R., Heywood V. H., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (eds), Flora Europaea, ed. 2, 1: 227–246, Cambridge University Press, Cambridge.

Tzvelev N. N. & Probatova N. S. (2019) Zlaki Rossii [Grasses of Russia]. – Tovarishchestvo nauchnyh izdanii KMK, Moskva.

Valdés B., Scholz H., Raab-Straube E. von & Parolly G. (2009) *Poaceae* (pro parte majore). – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity, URL: http://www.europlusmed.org (accessed August 2024).

Valdés-Florido A., Tan L., Maguilla E., Simón-Porcar V. I., Zhou Y.-H., Arroyo J. & Escudero M. (2023) Drivers of diversification in *Linum* (*Linaceae*) by means of chromosome evolution: correlations with biogeography, breeding system and habit. – Annals of Botany 132: 949–961.

Verloove F. (2005) A synopsis of *Jarava* Ruiz & Pav. and *Nassella* E. Desv. (*Stipa* L. s.l.) (*Poaceae*: *Stipeae*) in southwestern Europe. – Candollea 60: 97–117.

Verloove F. (2015) *Linum austriacum*. – In: Manual of the alien plants of Belgium, Botanic Garden of Meise, URL: https://alienplantsbelgium.myspecies.info/content/linum-austriacum (accessed July 2024).

Verloove F. (2017) *Delphinium hispanicum*. – In: Manual of the alien plants of Belgium, Botanic Garden of Meise, URL: https://alienplantsbelgium.myspecies.info/content/delphinium-orientale (accessed July 2024).

Verloove F. (2020) *Berberis aquifolium*. – In: Manual of the alien plants of Belgium, Botanic Garden of Meise, URL: https://alienplantsbelgium.myspecies.info/content/berberis-aquifolium (accessed June 2024).

Větvička V. (1995) *Rosa* L. – růže. – In: Slavík B., Smejkal M., Dvořáková M. & Grulich V. (eds), Květena České republiky [Flora of the Czech Republic] 4: 206–233, Academia, Praha.

Větvička V. & Kirschner J. (2019) *Rosa* L. – růže. – In: Kaplan Z., Danihelka J., Chrtek J. jun., Kirschner J., Kubát K., Štech M. & Štěpánek J. (eds), Klíč ke květeně České republiky [Key to the flora of the Czech Republic], ed. 2, p. 489–498, Academia, Praha.

Vítová J., Vít P. & Suda J. (2015) Rare occurrence of reciprocal hybridization in a sympatric population of the Czech stenoendemic *Dianthus arenarius* subsp. *bohemicus* and widespread *D. carthusianorum*. – Preslia 87: 329–345.

Vromans J. (2006) Molecular genetic studies in flax (*Linum usitatissimum* L.). – PhD thesis, Wageningen University, Netherlands.

Wagner V., Treiber J., Danihelka J., Ruprecht E., Wesche K. & Hensen I. (2012) Declining genetic diversity and increasing genetic isolation toward the range periphery of *Stipa pennata*, a Eurasian feather grass. – International Journal of Plant Sciences 173: 802–811.

Whittemore A. T. (1997) *Berberis*. – In: Flora of North America Editorial Committee (eds), Flora of North America north of Mexico 3: 276–286, Oxford University Press, New York & Oxford.

Wild J., Kaplan Z., Danihelka J., Petřík P., Chytrý M., Novotný P., Rohn M., Šulc V., Brůna J., Chobot K., Ekrt L., Holubová D., Knollová I., Kocián P., Štech M., Štěpánek J. & Zouhar V. (2019) Plant distribution data for the Czech Republic integrated in the Pladias database. – Preslia 91: 1–24.

Wilkoń-Michalska J. & Bohr R. (1960) Stanowisko lnu trwałego (*Linum perenne* L.) w Foluszu koło Szubina [A locality of *Linum perenne* L. in Folusz near Szubin]. – Fragmenta Floristica et Geobotanica 6: 239–243.

Yılmaz Ö. & Kaynak G. (2006) *Linum hirsutum* subsp. *platyphyllum*, stat. nov. (*Linaceae*). – Annales Botanici Fennici 43: 62–63.

ZOBODAT (2024) Zoological-Botanical Database. Biogeographical data record. – URL: https://www.zobodat.at/arten.php?id=58643&view=map (accessed May 2024).

Rozšíření cévnatých rostlin v České republice. Část 14

Čtrnáctá část ze série prací o rozšíření cévnatých rostlin v České republice obsahuje síťové mapy a komentáře ke 103 taxonům rodů *Achnatherum*, *Adonis*, *Consolida*, *Corallorhiza*, *Cypripedium*, *Dianthus*, *Glaux*, *Inula*, *Juncus*, *Laser*, *Linum*, *Mahonia*, *Malaxis*, *Mercurialis*, *Nassella*, *Ononis*, *Pseudorchis*, *Pyracantha*, *Rosa*, *Rubus*, *Sagina*, *Samolus*, *Smyrnium*, *Spiranthes*, *Stipa* a *Traunsteinera*. Základem jsou údaje získané excerpcí herbářů a literatury, terénní zápisy a databázové údaje, které prověřili taxonomičtí experti. Mezi mapovanými rostlinami je zastoupeno široké spektrum ekologických skupin. K druhům specifických stanovišť patří halofyty *Glaux maritima*, *Juncus gerardii* a *Samolus valerandi*, psamofyty *Dianthus arenarius* subsp. *bohemicus* a *Stipa borysthenica*, petrofyty *Dianthus gratianopolitanus*, *D. lumnitzeri* a *D. moravicus*, jakož i serpentinofyt *Dianthus carthusianorum* subsp. *capillifrons*. Všechny jsou kriticky nebo silně ohrožené, podobně jako orchideje *Corallorhiza trifida*, *Cypripedium calceolus*, *Malaxis monophyllos*, *Pseudorchis albida*, *Spiranthes spiralis* a *Traunsteinera globosa*, plevel obilných polí *Adonis flammea*, druhy suchých trávníků *Inula germanica*, *Stipa dasyphylla*, *S. eriocaulis*, *S. glabrata*, *S. smirnovii* a *S. tirsa*, druh teplomilných bazických doubrav *Laser trilobum* a vysokohorská *Sagina saginoides*. Tři z pojednávaných taxonů jsou české endemity (*Dianthus arenarius* subsp. *bohemicus*, *D. carthusianorum* subsp. *sudeticus* a *D. moravicus*) a dva jsou subendemity, s výskytem přesahujícím do sousedních zemí (*Dianthus carthusianorum* subsp. *capillifrons* a *Rubus brdensis*). Bezmála polovina mapovaných druhů je s různou mírou ohrožení zařazena do červeného seznamu České republiky. Výskyty druhu *Linum perenne* zanikly před více než stoletím, a proto se u nás považuje za vyhynulý. *Sagina alexandrae* a *S. nodosa* nebyly pozorovány více než tři desetiletí a jsou hodnoceny jako nezvěstné. Kromě původních druhů jsou v článku zastoupeny i druhy nepůvodní. Již dříve zavlečené nebo zplanělé neofyty *Mahonia aquifolium*, *Pyracantha coccinea*, *Sagina apetala* a *Smyrnium perfoliatum* se v posledních desetiletích začaly intenzivně šířit nebo častěji zplaňují. Okrasná tráva *Nassella tenuissima* začala zplaňovat teprve nedávno. Oproti tomu některé již dříve zavlečené a v minulosti častější druhy, zvláště polní plevele, např. *Adonis aestivalis*, výrazně ustoupily. Celkový obraz rozšíření zpracovávaných taxonů v České republice poskytují mapy; konkrétní floristické údaje, které zachycují frekvenci výskytu v různých oblastech a v různých obdobích, případně dokumentují ústup, nebo naopak šíření některých druhů, jsou uloženy v databázi Pladias a dostupné v přílohách tohoto článku. Každou mapu doprovází komentář, který obsahuje nástin celkového areálu, výčet nejčastějších stanovišť a stručnou charakteristiku rozšíření v České republice, případně i doplňující informace k taxonomii, biologii, změnám v rozšíření a míře ohrožení.

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