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## Contributions to the Knowledge of the Flora of Slovenia and Adjacent Regions: Taxonomic Revision and Distributional Patterns of Ten Selected Species

By

Božo FRAJMAN\*) and Tinka BAČIČ\*\*)

With 10 Figures

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### Summary

FRAJMAN B. & BAČIČ T. 2011. Contributions to the knowledge of the flora of Slovenia and adjacent regions: taxonomic revision and distributional patterns of ten selected species. – *Phyton* (Horn, Austria) 50(2): 231–262, with 10 figures.

The Angiosperm flora of the Slovenian Dinaric phytogeographic region is, with the exception of some famous localities such as Mt. Snežnik and Cerkniško jezero, relatively poorly studied. We here present new floristic records for ten taxa. Their distribution in Slovenia (based on revision of the herbarium material in LJU, our own data as well as literature data) is discussed and where necessary presented on maps. The distribution patterns are often in disagreement with the information provided in standard Slovenian floristic and biogeographic literature. In some cases we discuss taxonomically difficult groups and present new data about the distribution of infraspecific taxa. Moreover, we evaluate the conservation status of the taxa in Slovenia. In Slovenia, *Ballota nigra* is represented by two subspecies, the western subsp. *meridionalis* and the eastern subsp. *nigra*. Their distributions largely overlap in central Slovenia and subsp. *meridionalis* has much wider distribution than pre-

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\*) Dr. B. FRAJMAN, Institute of Botany, University of Innsbruck, Sternwartes-trasse 15, 6020 Innsbruck, Austria, Europe; e-mail: bozo.frajman@uibk.ac.at

\*\*) Dr. T. BAČIČ, Biology Department, Biotechnical Faculty, University of Ljubljana, Večna pot 111, 1000 Ljubljana, Slovenia; e-mail: martina.bacic@bf.uni-lj.si

viously assumed. *Chaerophyllum aromaticum* is an enigmatic species, in the past erroneously listed for Slovenia. *Eschscholzia californica* is an alien species neglected by the Slovenian standard floristic literature, even if its occurrence in the wild has been known for several years. We here present its distribution in Slovenia for the first time. *Galium elongatum*, an octoploid species from the *G. palustre* group, is sometimes difficult to distinguish from *G. palustre*. We used the stomata length as an additional character to resolve the taxonomic alliance of the *G. palustre* group. *Isolepis setacea* was after 100 years rediscovered in central Slovenia. *Laserpitium archangelica* was believed to be very rare in Slovenia, where it reaches its north-western distribution margin, but the here presented map shows that it is distributed in major parts of the Dinaric phytogeographic region. We present an updated distribution map of the alien species *Phacelia tanacetifolia*. *Ranunculus polyanthemophyllus* from the *R. polyanthemus* group is a neglected species of the Slovenian flora, not treated by standard floristic works. The revision shows that it is scattered in the western part of Slovenia, whereas the occurrence of *R. polyanthemus* could not be confirmed. *Ranunculus reptans* was erroneously listed for Cerklješko jezero and does actually not occur in Slovenia. *Thalictrum simplex* and its infraspecific taxa have been revised and only subsp. *tenuifolium* has been confirmed for Slovenia. In some cases our results are of broader international importance, as they provide new insights into the distribution of some poorly studied European taxa.

### Zusammenfassung

FRAJMAN B. & BAČIČ T. 2011. Contributions to the knowledge of the flora of Slovenia and adjacent regions: taxonomic revision and distributional patterns of ten selected species. [Beiträge zur Kenntnis der Flora Sloweniens und angrenzender Gebiete: taxonomische Revision und Verbreitung zehn ausgewählter Arten]. – *Phyton* (Horn, Austria) 50(2): 231–262, mit 10 Abbildungen.

Die Angiospermen-Flora der dinarischen phytogeographischen Region (DN) innerhalb Sloweniens ist mit Ausnahme einiger bekannter Lokalitäten, wie z.B. Snežnik und Cerklješko jezero, relativ schlecht bekannt. In dieser Arbeit präsentieren wir neue Daten zur Verbreitung von zehn ausgewählten Arten in Slowenien (basierend auf der Revision von Herbarmaterial in LJU, unseren eigenen Funden und Literaturangaben). Die Verbreitungsmuster sind oft im Widerspruch zu Angaben in der slowenischen floristischen und biogeographischen Standardliteratur. Taxonomisch schwierige Gruppen werden diskutiert und neue Daten über die Verbreitung intraspezifischer Sippen präsentiert. Der Naturschutz-Status einiger Sippen wurde überprüft. Zwei Subspecies von *Ballota nigra* kommen in Slowenien vor, die westlich verbreitete subsp. *meridionalis* und die östliche subsp. *nigra*. Die Areale der beiden überlappen in Zentralslowenien und subsp. *meridionalis* ist weiter verbreitet als bisher bekannt. *Chaerophyllum aromaticum* wurde in der Vergangenheit irrtümlich für Slowenien angegeben. Der Neophyt *Eschscholzia californica* ist eine in der slowenischen floristischen Standardliteratur übersehene Art, obwohl Verwildierungen dieser Art seit Jahren bekannt sind. Wir präsentieren die erste Verbreitungskarte dieser Art für Slowenien. *Galium elongatum*, eine oktoploide Sippe aus der *G. palustre*-Gruppe, ist manchmal schwierig von *G. palustre* zu unterscheiden. Wir verwenden die Länge der Stomata-Geleitzellen als zusätzliches Merkmal bei der Revision dieser Gruppe. *Isolepis setacea* wurde nach 100 Jahren wieder in Zen-

tralslowenien gefunden. *Laserpitium archangelica* wurde früher als rare Art der slowenischen Flora betrachtet, aber unsere Verbreitungskarte zeigt, dass es in DN, an der Nordost-Grenze seines Areals, nicht selten ist. Wir bringen eine aktualisierte Verbreitungskarte der oft verwilderten *Phacelia tanacetifolia*. *Ranunculus polyanthemophyllus* aus der Gruppe des *R. polyanthemus* ist eine bisher übersehene Art der slowenischen Flora, die in Westslowenien zerstreut verbreitet ist. Das Vorkommen von *R. polyanthemus* konnte hingegen nicht bestätigt werden. *Ranunculus reptans* wurde irrtümlich für den Cerknjško jezero angegeben, kommt aber in Slowenien nicht vor. Wir revidierten auch die *Thalictrum simplex*-Gruppe und können nur das Vorkommen von subsp. *tenuifolium* bestätigen. Insgesamt sind unsere Resultate nicht nur für Slowenien, sondern auch für angrenzende Gebiete interessant, weil sie die Verbreitung einiger in Europa wenig bekannter und taxonomisch problematischer Arten oder Artengruppen betreffen.

## 1. Introduction

With 3452 registered taxa of vascular plants, 3119 of them native or naturalised (MARTINČIČ & al. 2007), the Slovenian flora is relatively rich as compared with neighbouring areas. For Austria (7.7 times bigger than Slovenia) 3606 taxa are listed (FISCHER & al. 2008), out of which 2214 for Kärnten (roughly half the size of Slovenia) and 2331 for Steiermark (80 % of the size of Slovenia). For Friuli Venezia Giulia (Italy), which is c. 40 % of the size of Slovenia, 3388 taxa were listed by POLDINI 2002, in Croatia (almost 3 times bigger than Slovenia) 5347 taxa are registered (NIKOLIĆ & TOPIĆ 2005), and in Hungary (4.6 times the size of Slovenia), 2721 (KIRÁLY 2009), out of which roughly 2300 are native (KIRÁLY, pers. com.). Some differences in the number of taxa are based on diverse taxonomic concepts as well as on different treatments of taxonomically critical groups (e.g. *Taraxacum* and *Hieracium*) in various countries, and the number of taxa is not proportional with the size of the area and is related to different factors, e.g. existence of different landscape types, but the given numbers still roughly show the richness of Slovenian vascular flora compared to neighbouring areas (with exception of Friuli Venezia Giulia which has an even more diverse flora). Such biotic richness of Slovenia was observed also in other groups of organisms (MRŠIČ 1997).

The reasons for such a diversity are various, among the most important being the geographic position of Slovenia on the junction of different (bio)geographic regions: Alps, Mediterranean, Dinaric mountains and Pannonian area (see also MRŠIČ 1997). Different biogeographic divisions of Slovenia have been proposed (e.g., WRABER 1969, ZUPANČIČ & al. 1989, ZUPANČIČ & ŽAGAR 1995), dividing Slovenia into six phytogeographic regions (Fig. 1): Alpine (AL), Prealpine (PA), Submediterranean (SM), Dinaric (DN), Predinaric (PD) and Subpannonian (SP). The one mostly used by Slovenian botanists is the division by M. WRABER 1969 (Fig. 1), which was also adopted by the authors of the Slovenian floristic reference work

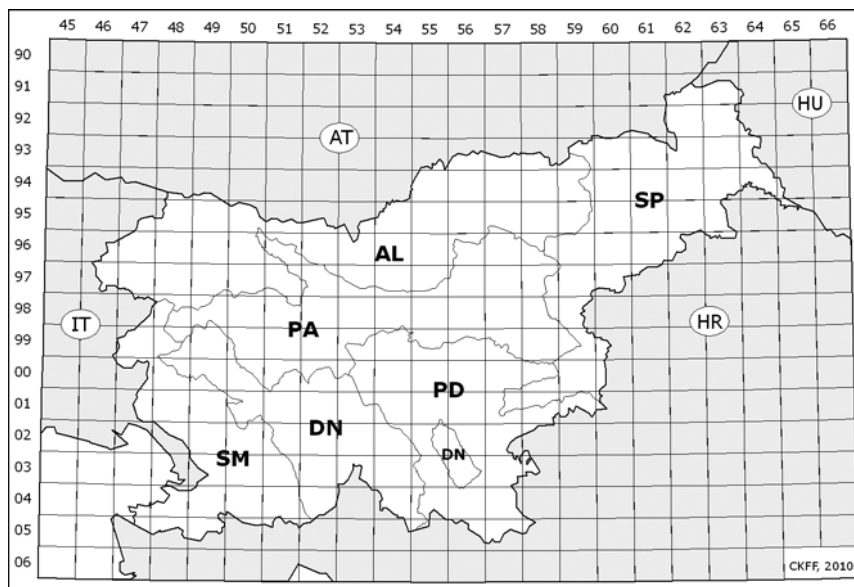


Fig. 1. Phytogeographic regions in Slovenia, according to M. WRABER 1969: Alpine (AL), Prealpine (PA), Submediterranean (SM), Dinaric (DN), Predinaric (PD) and Subpannonian (SP).

Mala flora Slovenije ("Small flora of Slovenia"; MARTINČIČ & al. 2007), where these regions are used when presenting the distribution of taxa in Slovenia. Another reference work for distributional data of Slovenian flowering plants and pteridophytes are Materials for the Atlas of Flora of Slovenia (JOGAN & al. 2001) where the distribution maps of most taxa are shown. Unfortunately, the distributions presented in both mentioned works are in several cases not congruent and sometimes erroneous and thus misleading. Especially infraspecific taxa as well as taxa from taxonomically critical groups were often insufficiently revised and their distribution is inadequately known. Herbarium data (e.g. from herbarium LJU, which is the richest herbarium with plants from Slovenia) are often not considered. Deficient knowledge about distribution, ecology and threat factors can cause serious problems in considerations and judgments when proposing nature conservation strategies and composing red data lists. This was also a problem when composing the red data list of threatened vascular plants of Slovenia (Anonymous 2002): some threatened taxa are therefore not included and some have an unsuitable status (see BAČIČ 2006).

One of the floristically most insufficiently studied areas in Slovenia is the Dinaric phytogeographic region, where the Dinaric mountains reach their north-western end in the Trnovski gozd area. It is also the only region

in Slovenia included in the study of ANDRIČ & WILLIS 2003 (AL and PA were not included!) that appears to have been relatively unchanged despite the onset of human activity (at c. 1700 before present) and thus having a vegetation that could be classified as climax. Whereas the floristically famous parts of DN, as Trnovski gozd, Snežnik and Cerknjsko jezero, have gained much attention by botanists in the past (see e.g., WRABER 1990 for Trnovski gozd, WRABER 1965, and WRABER 2004 for Snežnik, and MARTINČIČ & LESKOVAR 2002, and MARTINČIČ 2002 for Cerknjsko jezero), other parts of DN remain poorly studied (but see e.g., STRGAR 1966, PETKOVŠEK & SELIŠKAR 1979, LESKOVAR 1996, ACCETTO 1998, 2006, POBOLJŠAJ & al. 1999a).

During the past years we have mapped the flora in the central and southwestern parts of DN and some floristic discoveries encouraged us to critically revise their taxonomic alliance, mostly using herbarium material from LJU and our own collections. Moreover, we critically review the distribution of all taxa studied, using literature, herbarium data and our own field observations and provide distribution maps for Slovenia. Last, but not least, the nature conservation status of the taxa is discussed and changes suggested where necessary. Some of the taxa are neophytes, neglected in recent botanical literature.

## 2. Material and Methods

The taxa presented here were mapped during field excursions, mostly to the Dinaric phytogeographic region of Slovenia (DN), and determined using standard floristic literature (mostly MARTINČIČ & al. 2007, and FISCHER & al. 2008).

For each of the presented species, we revised the available herbarium material in LJU (Department of Biology, University of Ljubljana), including also closely related taxa in taxonomically critical groups. Where necessary, characters were observed and measured using a stereomicroscope. In the case of differentiation between *Galium palustre* and *G. elongatum* stomatal lengths were measured. A sample of well developed cauline leaves from the middle of the stem was rehydrated in boiling water. For each plant, the maximal length of the guard cells of c. 10–15 stomata in the central part of the abaxial epidermis were measured under the light microscope (400 × magnification) and mean values were calculated.

For the preparation of the distribution maps we gathered all available distribution data for Slovenia: literature records, authors' own unpublished field observations, herbarium data from LJU and partly unpublished data stored in the database Flora Slovenije at the Centre for Cartography of Fauna and Flora (CKFF) where also the distribution maps were produced. Distribution patterns are presented in MTB grid system (NIKLFELD 1971).

We used the Mala flora Slovenije (MARTINČIČ & al. 2007) as a nomenclatural standard. For taxa not treated by MARTINČIČ & al. 2007, names of authors are given in the text. Mala flora Slovenije and Materials for the Atlas of Flora of Slovenia (JOGAN & al. 2001) are used as standard works when referring to distributions. When dis-

cussing the distribution patterns, we used the phytogeographic division of Slovenia proposed by M. WRABER 1969 (see also Fig. 1).

### 3. Results and Discussion

#### 3.1. *Ballota nigra* (Lamiaceae)

*Ballota nigra* is a variable taxon with two subspecies currently recognised in Central Europe: subsp. *nigra* is distributed in eastern parts of Europe, whereas subsp. *meridionalis* can be found in more western parts (GAMS 1927). The distribution areas of both come into contact in the territory of Slovenia (JOGAN in MARTINČIČ & al. 2007), as well as in Austria (HARTL & al. 1992, FISCHER & al. 2008). In areas westerly adjacent to Slovenia, only subsp. *meridionalis* has been observed (POLDINI 2002), whereas in Hungary only the nominate subspecies has been found (KIRÁLY 2009). Until recently a third subspecies *B. nigra* subsp. *velutina* (POSP.) PATZAK was listed for Slovenian territory, but WRABER 1992a considers it synonymous with subsp. *meridionalis*.

*B. nigra* (s. lato) occurs scattered in the lowlands of Slovenia (JOGAN & al. 2001, JOGAN in MARTINČIČ & al. 2007). The nominate subspecies is listed for the entire Slovenian territory, whereas subsp. *meridionalis* is reported to occur in SM, rarely also in PA and SP (JOGAN in MARTINČIČ & al. 2007).

During the last years, we have encountered *B. nigra* in different parts of Slovenia, and mostly determined the plants as subsp. *meridionalis*. This observation led us to doubt the distributions of both subspecies described by Slovenian reference floristic works (JOGAN & al. 2001, JOGAN in MARTINČIČ & al. 2007). The revision of herbarium material kept in LJU confirmed our doubts. The distribution of both taxa, based on the revision of the herbarium material, literature data (BABJI 2000, COHRS 1953–1954, ČARNI 1991 & 1994, DAKSKOBLER & al. 2009, KALIGARIČ 1992, MARCHESETTI 1896–97, MARKOVIĆ 1984 & 2007, PODOBNIK & WRABER 1982, POSPICHAL 1897–99, REICHARDT 1860, SOLLA 1878, STERGARŠEK 2009, TURK 1990, VREŠ 1987, WRABER 1973, 1992a & 1992b) and our own records is presented in Fig. 2.

The subsp. *meridionalis* is in Slovenia more common than previously assumed; it is mostly distributed in the western half of Slovenia (common in SM, scattered in PA, AL, DN, PD and SP), whereas subsp. *nigra* occurs in the eastern half (PA, AL, PD, SP). In central Slovenia distributions of both subspecies overlap and three specimens from this area (LJU10006258, LJU10006261, LJU10006266) could not be unambiguously assigned to any of the two taxa.

An additional result of the herbarium revision was the observation that the characters given for the delimitation of both subspecies (e.g., JOGAN in MARTINČIČ & al. 2007, FISCHER & al. 2008) do not always correlate, and are thus unreliable. The most stable and useful character is the shape

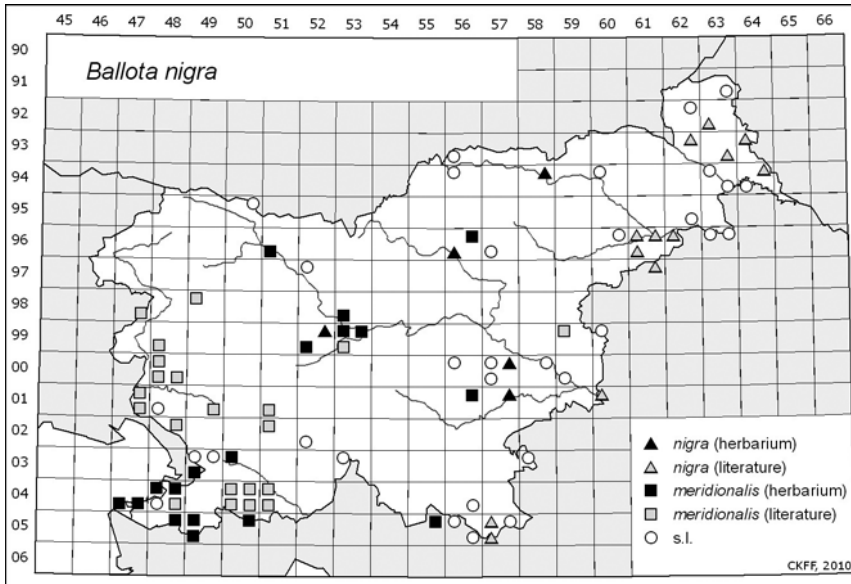


Fig. 2. Distribution of *Ballota nigra* in Slovenia. The black triangles and squares correspond to the data from revised herbarium material as well as our own data, whereas the grey triangles and squares present the data from the literature, for subsp. *nigra* and subsp. *meridionalis*, respectively. The circles (s.l.) represent the literature, herbarium and our own data determined to the species level only.

of the calyx teeth, which are longer, narrowly triangular to awl-shaped in the nominate subspecies, and shorter, broadly triangular in subsp. *meridionalis*. As it is sometimes difficult to distinguish between both shapes (without material for comparison), we here reproduce the picture of calyx teeth from GAMS 1927 (Fig. 3). The size of the leaves given for both subspecies by JOGAN (in MARTINČIČ & al. 2007) and FISCHER & al. 2008 is not always correlated with the shape of the calyx-teeth: some specimens of subsp. *meridionalis* have leaves of the size, given for the nominate subspecies. Moreover, the difference in length of the trichomes on the inflorescence bracts, given as distinguishing character by JOGAN (in MARTINČIČ & al. 2007), was not confirmed by our revision.

*B. nigra* is listed as insufficiently known (K) in the red list of the Slovenian flora (Anonymous 2002). This might be based on the treatment of *B. nigra* subsp. *velutina* (“žametna lahkotnica” in Slovenian) as insufficiently known by WRABER & SKOBERNE 1989 as the Slovenian name “žametna lahkotnica” occurs next to the latin name *B. nigra* in the current red list (Anonymous 2002), whereas the correct Slovenian name is “črna lahkotnica”. *Ballota nigra* can thus be excluded from the red list of the Slovenian flora. The species is not rare in Slovenia, and was several times observed in

the recent past, indicating that its distribution range is not decreasing. It is also not included in any of the red data lists in the neighbouring countries, with exception of *B. nigra* subsp. *meridionalis*, which is threatened in some parts of Austria (NIKL FELD & SCHRATT-EHRENDORFER 1999).

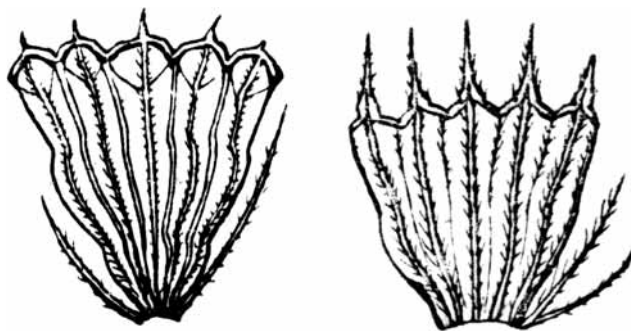


Fig. 3. Shape of the calyx-teeth in the two subspecies of *Ballota nigra*: *B. n.* subsp. *meridionalis* (left) and *B. n.* subsp. *nigra* (right; modified from GAMS 1927).

Specimina visa:

*Ballota nigra* subsp. *nigra*

9458/2 Slovenija: Pohorje, Ruše, Činžat, Ruta, 31.7.2005, leg. B. FRAJMAN & M. TURJAK (LJU10120332).

9656/3 Slovenija: Savinjska dolina, Letuš, left bank of Savinja, 1.8.1985, leg. D. NAGLIČ (LJU10006262).

9952/2 Slovenija: Ljubljana, Šiška, June 1960, leg. T. WRABER (LJU10006260).

0057/2 Slovenija: Krško hribovje, Osredok near Hubajnica, 400 m, 23.9.1989, leg. M. KAČIČNIK (LJU10006272).

0157/2 Slovenija: Dolenjska, Lakniška dolina, near Šmarjeta, 1.8.1907, leg. R. JUSTIN (LJU10006268).

0557/2 Slovenija: Bela krajina, Vinica, 2.9.1980, leg. A. PODOBNIK (LJU10006265).

*Ballota nigra* subsp. *meridionalis*

9651/3 Slovenija: surroundings of Radovljica, 17.8.1905, leg. R. JUSTIN (LJU10006253).

9656/2 Slovenija: Velenje castle, 27.7.1978 & 31.7.1985, leg. D. NAGLIČ (LJU10006263, LJU10006264).

9853/3 Slovenija, Rašica near Ljubljana, 10.7.1956, leg. F. ŠUŠTAR (LJU10006267).

9952/3 Slovenija: Ljubljana, Derčeva ulica, 1.7.1992, leg. T. WRABER (LJU10006254).

9953/1 Slovenija: Ljubljana, 14.9.1911, leg. R. JUSTIN (LJU10006252). Tomačevo, 18.6.1937, leg. M. ZALOKAR (LJU10006251); In rudertis prope urbem Ljubljana, August, leg. A. PAULIN (Fl. exsic. Carniol. 1749; LJU 10006259); leg. F. DOLŠAK (LJU10006269).

9953/2 Slovenija: Ljubljana, in rudertis prope pagum Zalog, 2.8.1925, leg. F. DOLŠAK (LJU10006270).

0156/2 Slovenija: Dolenjska, Orkljevec E of Mirna peč, 3.6.1990, leg. M. KREVS (LJU10006247); Brezje near Trebelno, 25.6.1908, leg. R. JUSTIN (LJU10006271).

0350/1 Slovenija: Primorska, Reška dolina, Britof, 1896, leg. R. JUSTIN (LJU10006246).

0447/3 Slovenija: Primorska, Piran (at different places), 28.6.1959, 28.7.1968, 25.7.1972, 1.8.1976 & 24.7.1988, leg. T. WRABER (LJU10006250, LJU10006245, LJU10006257, LJU10006249, LJU10006248).

0447/4 Slovenija: Istra, Strunjan, 19.7.1972, leg. T. WRABER (LJU10006255).

0448/1 Slovenija: Primorska, NW above Ankaran, 17.7.2005, leg. P. GLASNOVIĆ (LJU10134583).

0448/2 Slovenija: Primorska, Sp. Škofije, Tinjan, 11.8.2005, leg. P. GLASNOVIĆ (LJU10134584).

0548/2 Slovenija: Primorska, Marezige, S of Boršt, 14.7.2004, leg. T. BAČIČ & B. FRAJMAN (LJU10060931).

0550/2 Slovenija: Istra, Poljane near Podgrad, beneath Žabnik, 17.8.1965, leg. M. WRABER (LJU10006256).

0555/2 Slovenija: Kolpa valley, Vrt, 25.7.2008, leg. B. FRAJMAN (LJU10135640).

*Ballota nigra* s.l.

9550/2 Slovenija: Gorenjska, Javornik, 21.7.1874, leg. V. PLEMEL (LJU10006261).

9953/3 Slovenija: Ljubljana, subsponaneous in the Botanical garden, 13.8.1925, leg. F. DOLŠAK (LJU10006258).

0557/2 Slovenija: Bela krajina, Golek near Vinica, 1.7.1979, leg. A. PODOBNIK & T. WRABER (LJU10006266).

Mapping data without vouchers:

*Ballota nigra* s.l.

0252/3 Slovenija: Notranjska, Gorenje Jezero, 20.7.2006, obs. T. BAČIČ & M. TURJAK.

0353/1 Slovenija: Notranjska, Babna polica, 22.7.2006, obs. B. FRAJMAN & P. SCHÖNSWETTER.

0358/1 Slovenija: Bela Krajina, Radovica near Metlika, 1.8.2001, obs. B. FRAJMAN.

0556/4 Slovenija: Bela Krajina, Breg near Sinji vrh, 19.7.2008, obs. T. BAČIČ & M. TURJAK.

0456/4 Slovenija: Bela Krajina, Tanča gora, 18.7.2008, obs. T. BAČIČ & B. FRAJMAN.

*Ballota nigra* subsp. *nigra*

9661/3 Slovenija: Štajerska, Dežno near Podlehnik, S of the farm Vidovič, 14.7.2002, obs. B. FRAJMAN.

*Ballota nigra* subsp. *meridionalis*

0448/1 Slovenija: Primorska, Ankaran, 21.7.2004, obs. B. FRAJMAN.

0448/2 Slovenija: Primorska, Hrvatini, 20.7.2004, obs. B. FRAJMAN.

0549/3 Slovenija: Primorska, Pregara, 16.7.2004, obs. B. FRAJMAN.

0549/1 Slovenija: Primorska, Trebeše, 17.7.2004, obs. B. FRAJMAN.

### 3.2. *Chaerophyllum aromaticum* (Apiaceae)

*Chaerophyllum aromaticum* is distributed in central and eastern Europe, on the Balkan Peninsula and in northern Italy (CANNON 1968). In Austria it is scattered to rare, limited to the northeast of the country, in

Steiermark it occurs only adventive, whereas no records are given for Kärnten (FISCHER & al. 2008). There are also no records for Friuli Venezia Giulia in Italy. It has been reported for Croatia (NIKOLIĆ 2010) as well as for Hungary (KIRALY 2009). This nitrophilous and hygrophilous species thrives in shady humid forests and on brook banks mostly on non-calcareous grounds (FISCHER & al. 2008).

In the Slovene red data list (Anonymous 2002) *C. aromaticum* is ranked as an insufficiently known species (K) with only four known localities in Slovenia (JOGAN & al. 2001). One of them is according to an old observation from the Štajerska region between Celje and Laško (9857/1, obs. Tomaschek; MALY 1864, HAYEK 1908–14). Also MAYER's 1952 report of this species for Štajerska is based on this observation, and the distribution given for Dolenjska and Gorenjska (?) on the distribution data provided by THELLUNG 1926 (among other "Krain", but without any specific localities!). Further three records provided by JOGAN & al. 2001 are from student herbaria, collected by students of biology at the University of Ljubljana. Only one of the records is documented in LJU (LJU10013914), but this is in fact *Aegopodium podagraria*. Vegetative specimens of *C. aromaticum* can be mistaken for *A. podagraria*, *Angelica sylvestris* or *Laserpitium archangelica* (FISCHER & al. 2008, pers. obs.). Consequently, we have to regard the student records as doubtful and not consider them further. To check for possible misdeterminations and to look for misplaced material of *C. aromaticum* in the herbarium, we also checked the material of *Aegopodium*, *Angelica* and *L. archangelica* in LJU, but have not found any specimens of *C. aromaticum*. Based on the revision of herbarium material as well as the lack of field observations we conclude that *C. aromaticum* may not be present in Slovenia, but attention should be paid during floristic field work.

To distinguish it from the similar *A. podagraria* we provide some reliable determination characters: the leaves of both species are similar in shape, but in *C. aromaticum* they are pubescent with scattered, c. 0.5–1 mm long hairs on upper and lower leaf surfaces and not glabrous as in *A. podagraria*. The inflorescences of both taxa are similar in habit, but differ in the presence of ciliate, broadly-lanceolate bracteoles in *C. aromaticum*, whereas in *A. podagraria* bracteoles are absent. In addition, the fruits of *C. aromaticum* are about 1–1.5 cm long whereas those of *A. podagraria* are only c. 0.5 cm long.

### 3.3. *Eschscholzia californica* CHAM. in NEES (*Papaveraceae*)

*Eschscholzia californica* is an annual herb (occasionally perennial in the wild), native to western parts of North America and often cultivated in gardens as ornamental plant (CULLEN 1995). It can be recognised by bluish-green, three times pinnately divided leaves and large, yellow to orange

flowers (FISCHER & al. 2008). The species occurs subspontaneously but rarely in Austria (FISCHER & al. 2008), for now without ecological effects (ESSL & RABITSCH 2002). It was reported for Hungary (KIRÁLY 2009), but neither for Friuli-Venezia Giulia (see POLDINI 2002) nor Croatia (see NIKOLIĆ 2010).

The species is not included in MARTINČIČ & al. 2007, although it has been observed in the wild before 2007. The first record is from Krško hribovje, where KAČIČNIK-JANČAR 1990 (LJU10021845) collected *E. californica* on sandy ground of a quarry in Mala Hubajnica and observed the vitality

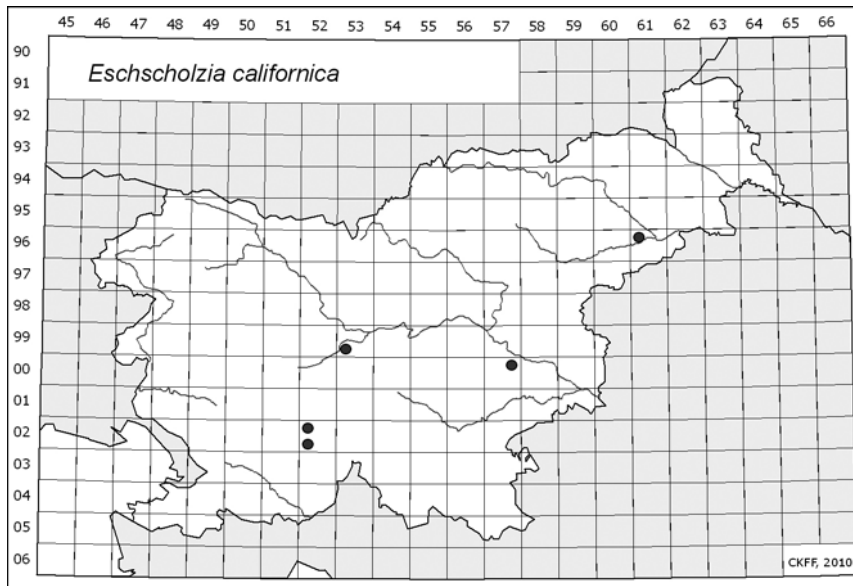


Fig. 4. Distribution of *Eschscholzia californica* in Slovenia.

of the population for a couple of years, thus observing that it is locally naturalised. In Ljubljana the species was recorded by BABIJ 1998 (LJU1002184) at the cemetery, where it spread from graves where it was cultivated. BABIJ 1998 considered it as an ephemerophyte. In 2002 N. JOGAN recorded *E. californica* in the vicinity of Ptuj (9661/1; Videm z Dravinjskim vrhom, database Flora Slovenije of CKFF), and we recorded it on two localities near Cerknica (0252/3: Gorenje Jezero, obs. T. BAČIČ & M. TURJAK, 20.7.2006; 0252/1: LJU10134332). The species probably spread from local gardens.

Based on the mentioned localities we present the distribution map of *E. californica* in Slovenia (Fig. 4) and conclude that the species is not invasive in Slovenia, but maybe occasionally naturalised. As it prefers sunny and sandy grounds, it is expected to occur along roads, highways and other disturbed areas, especially in SM.

## Specimina visa:

9953/3 Slovenia: Ljubljana, Žale, leg. V. BABIJ (LJU1002184).

0057/2 Slovenia: Krško hribovje, quarry in Mala Hubajnica, 24.6.1989 (flowers), 8.8.1989 (fruits), leg. M. KAČIČNIK (LJU10021845).

0252/1 Slovenia: Notranjska, Cerknica, 20.7.2006, leg. T. BAČIČ, B. FRAJMAN & M. TURJAK (LJU10134332).

3.4. *Galium elongatum* (Rubiaceae)

*Galium elongatum* belongs to the polyploid *G. palustre* group, characterised by obtuse to rounded leaves, which are never apiculate or mucronate at apex, and rough stems with pricklets (TEPPNER & al. 1976, FISCHER & al. 2008). *G. palustre* s. str. is diploid ( $2n=24$ ), whereas *G. elongatum* is octoploid ( $2n=96$ ; TEPPNER & al. 1976, FISCHER & al. 2008). However, also tetraploid and dodecaploid individuals were found; as it was difficult to distinguish them morphologically from diploids and octoploids, respectively, TEPPNER & al. 1976 applied a pragmatic solution and treated tetraploids as *G. palustre* and dodecaploids as *G. elongatum*.

*G. palustre* is rather common in Slovenia and is distributed throughout the country, whereas *G. elongatum* is less common and was reported for DN, PA (near Ljubljana), PD and SP (JOGAN & al. 2001; MARTINČIČ in MARTINČIČ & al. 2007). The situation is similar in neighbouring areas, from where distribution data are available: *G. palustre* is more and *G. elongatum* less common (POLDINI 2002, FISCHER & al. 2008, GERGELY, pers. com.). Both taxa are ecologically similar and can be found in damp meadows, marshes and fens, ditches, and damp forests (TEPPNER & al. 1976, MARTINČIČ in MARTINČIČ & al. 2007, FISCHER & al. 2008).

We have encountered plants from this group at some localities in the Cerkniško jezero area, but it was not always possible to unambiguously assign them to *G. elongatum* or *G. palustre*, what led us to revise the herbarium material at LJU. Most specimens could be assigned to either *G. palustre* or *G. elongatum*, following the characters provided by MARTINČIČ (in MARTINČIČ & al. 2007) and FISCHER & al. 2008, but there were also some specimens, whose determinations were not so clear. For this reason we have measured the length of stomata cells of 28 specimens (of some a priori determined as *G. palustre*, all determined as *G. elongatum* and all intermediate specimens), as this character is usually correlated with the ploidy level (e.g., JAROLÍMOVÁ & KIRSCHNER 1995, VILHAR & al. 2002). Specimens determined as *G. palustre* have stomata between 24 and 29  $\mu\text{m}$  long, whereas all the others measure between 30 and 43  $\mu\text{m}$ . As the stomata length was rather continuously distributed among the specimens and we did not have any data about the ploidy level of the inspected specimens, we related the values higher than 35  $\mu\text{m}$  to *G. elongatum*, as most of the specimens with stomata lengths between 35 and 43  $\mu\text{m}$  also morphologically corresponded to *G. elongatum*. We revised five specimens with stomata length

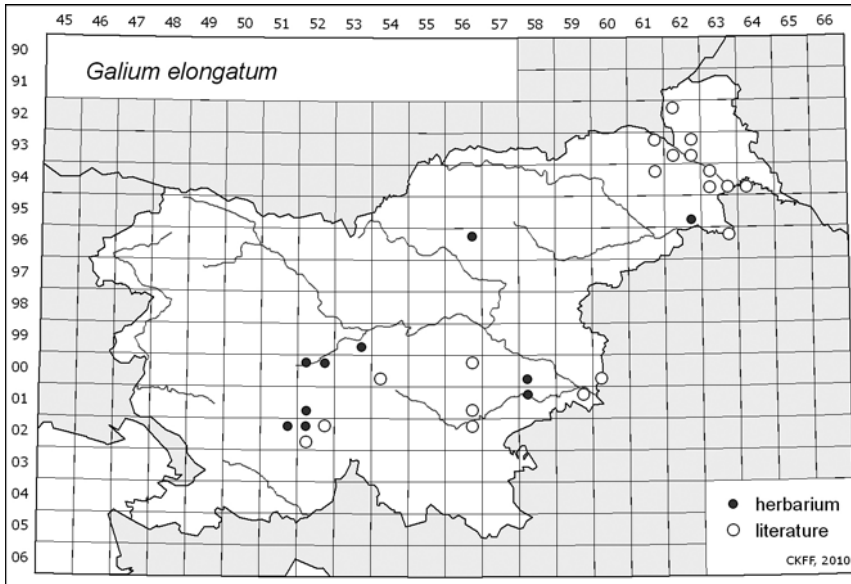


Fig. 5. Distribution of *Galium elongatum* in Slovenia based on herbarium review and own data (black dots) and literature as well as mapping data without vouchers (circles).

between 30 and 35  $\mu\text{m}$  as *G. palustre* agg. and these were mostly also morphologically intermediate between *G. palustre* and *G. elongatum*. It is possible that these are tetraploids or even hexaploids with unclear taxonomic status. The use of genome size measurements (see e.g., KOLÁR & al. 2009) in combination with classical cytological analyses ideally spanning the entire distribution area could elucidate the polyploid evolution within this group and clarify the distribution of various karyotypes, and thus bolster a sound taxonomic revision.

Based on the re-evaluation of the herbarium material, some unpublished data as well as the data published by JOGAN & al. 2001 we here provide a revised distribution map of *G. elongatum* for Slovenia (Fig. 5): it was recorded in DN, PA, PD, and SP, what is in agreement with already published information (see above). Based on the data provided by POLDINI 2002, we can also expect it in the SM and AL regions of western Slovenia. As its distribution in Slovenia is scattered and because of its occurrence in endangered habitats under strong negative human influence, we suggest its inclusion in the Slovenian red data list as vulnerable (V). In the neighbouring countries it is only listed in the Austrian red data list (NIKLFELD & SCHRATT-EHRENDORFER 1999) as endangered ("r") in the Alps, and the northern and south-eastern forelands of all federal states with the exception of Kärnten, where it is said to be extinct.

## Specimina visa:

9562/4 Slovenija: Štajerska, Velika Nedelja, 12.6.1955, leg. A. MARTINČIČ (LJU10024922; Stomata length – SL: 38,8 µm).

9656/2 Slovenija: Štajerska, Bevče near Velenje, leg. D. NAGLIČ (LJU10025170; SL: 42,8 µm).

9953/4 Slovenija: Ljubljana, Vevče, 27.6.1937, leg. M. ZALOKAR (LJU10025206; SL: 36,8 µm).

0052/1 Slovenija: Ljubljansko Barje, near Bevke, 2.6.1972, leg. T. KNEZ (LJU10025165; SL: 39 µm).

0052/2 Slovenija: Ljubljansko Barje, 1891, leg. R. JUSTIN (LJU; SL: 43 µm); along Ljubljana, 31.7.1928, leg. R. JUSTIN (LJU; SL: 35,2 µm); Mali Plac, 11.9.2001, leg. A. MARTINČIČ (LJU10024920; SL: 36,9 µm).

0058/3 Slovenija: Dolenjska, Zaloke – V. Koren, 2.8.1992, leg. N. JOGAN (LJU10024921; SL: 39,4 µm).

0152/3 Slovenija: Notranjska, along Cerknjšica near Begunje, 21.7.2006, leg. B. FRAJMAN (LJU 10134381; SL: 35,3 µm).

0158/1 Slovenija: Dolenjska, Kostanjevica – Malence, 15.7.1967, leg. R. LUŠTEK (LJU10024925; SL: 43,2 µm); Koprivnik near Šentjernej, 1.8.1967, leg. R. LUŠTEK (LJU10024924; SL: 40,9 µm).

0251/2 Slovenija: Notranjska, Cerknjško jezero, Velika Karlovica, 22.7.1953, leg. A. MARTINČIČ (LJU10025200; SL: 39,9 µm).

## Mapping data without vouchers:

0159/2 Slovenija: Dolenjska, near Prilipe, 10.6.2008, obs. B. Trčak (Database Flora Slovenije at CKFF).

0252/1 Slovenija: Notranjska, Cerknjško jezero, S of Dolenje Jezero, 31.5.2009, obs. B. FRAJMAN & P. SCHÖNSWETTER.

Four specimens revised as *G. palustre* agg.:

9464/4 Slovenija: Prekmurje, Petišovci, 27.7.1999, leg. N. JOGAN (LJU10131147; SL: 32,7 µm); determined as *G. elongatum*!

0054/3 Slovenija: Notranjska, Boštanj near Grosuplje, 17.6.1983, leg. C. CURK, M. LOVKA, M. PALMA & T. WRABER (LJU 10025169; SL: 31,3 µm); determined as *G. palustre*!

0252/1 Slovenija: Notranjska, Cerknjško jezero, near Martinjak, 31.7.1971, leg. M. WRABER (LJU10024923; SL: 31,6 µm); determined as *G. elongatum*!

0451/3 Slovenija: Primorska, along the stream Mola (!) near Mala Bukovica, 2.7.1905, leg. R. JUSTIN (LJU10025198; SL: 34 µm); determined as *G. palustre*!

3.5. *Isolepis setacea* (Cyperaceae)

*Isolepis setacea* is a caespitose member of *Cyperaceae*. Its slender culms (about 10 cm high) resemble *Eleocharis acicularis* in habit, but are distinct in having c. 5 mm long spikelets not on the top of the culms, as in *Eleocharis*, but about 1 cm below. *I. setacea* is a very rare species in Slovenia. It grows on wet, sandy grounds, together with *Juncus* spp. and *Eleocharis* spp. and can be easily overlooked. PAULIN's old herbarium specimen (LJU1003144) give evidence of the former occurrence at Cerknjško

jezero, so finding the species in DN was not surprising (see specimen visa).

There are some old literature records of *I. setacea* for Slovenia: MURMANN 1874 found it in the surroundings of Maribor (9459/2: Trije ribniki in Maribor; 9459/4: Betnava and Pohorski dvor; 9559/2: Slivniški ribniki) and FLEISCHMANN 1844 observed it in Dolenjska near Kočevje (0355/3) and Metlika (0357/4).

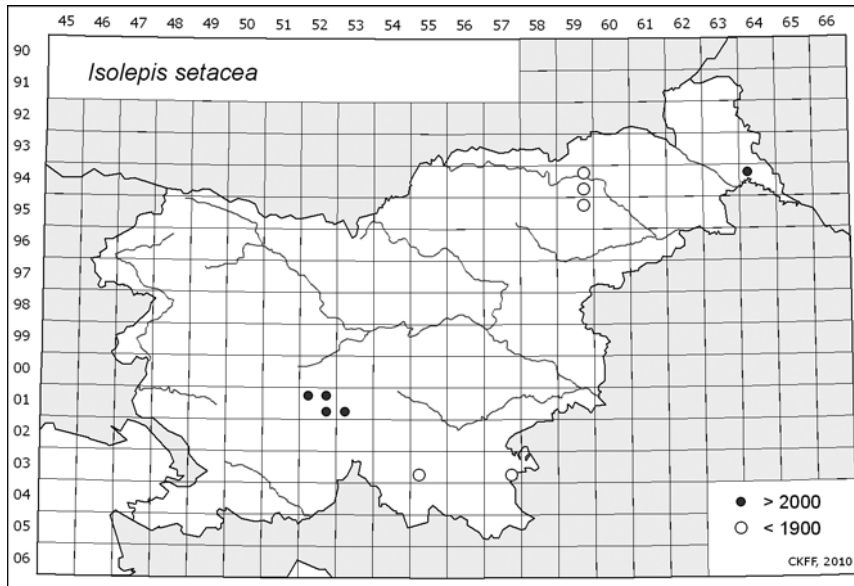


Fig. 6. Distribution of *Isolepis setacea* in Slovenia.

Besides our data, recent reports of the species are scarce. In Prekmurje *Isolepis* was found in a moist field near Brezovica at Mala Polana and on a cart-way between Hotiza and Velika Polana, near the Croatian border (9464/1, LJU; BAKAN & GORŠAK 2002). On the southern edge of Ljubljansko barje, *I. setacea* was found near Borovnica (0152/1) and in several localities on the Menišija plateau (0152/2; PETELIN & BAČIČ 2009).

According to the only published distribution map for Slovenia (JOGAN & al. 2001), *Isolepis* has a known locality also in Ljubljana (9953/3). This record, however, is based on cultivated material from the Botanical Garden of the University of Ljubljana (9953/3; leg & det. F. DOLŠAK, 7. 1929, LJU10031146; leg. & det. A. PAULIN, Fl. Exsiccata Carniol. 1450 II, LJU10031145) and we consequently omitted it in our updated distribution map (Fig. 6). There is also a record by MARTINČIČ (in MARTINČIČ & al. 2007) for occurrence of the species near Tolmin in AL, but since the primary source of the record and its author remain unknown (MARTINČIČ, pers.

com.) it is not included in Fig. 6. The record was also not included in the distribution map published by JOGAN & al. 2001.

In the Slovene red data book, *I. setacea* is categorised as vulnerable species (V; Anonymous 2002). Because it is rare and its habitats are threatened because of human activity and natural succession, BAČIČ 2006 suggested that “endangered” (E) would be a more appropriate category. The species is rare and threatened also in neighbouring countries. In Austria its localities are scattered and rare (FISCHER & al. 2008) and it is considered critically endangered (NIKLFIELD & SCHRATT-EHRENDORFER 1999), for Italian Friuli Venezia Giulia there is only one recent confirmation of occurrence (POLDINI 2002), in Croatia the species is rare and treated as critically endangered (CR; NIKOLIĆ & TOPIĆ 2005), and in Hungary as vulnerable (VU; KIRÁLY 2007).

#### Specimina visa:

9464/1 Slovenia: Prekmurje, between Brezovica and Nedelica (Gosposko), cart track, 25.7.2001, leg. B. BAKAN (LJU).

0152/4 Slovenia: Notranjska, village Cajnarje, about 200 m north from Hruškarica, 22.7.2006, leg. B. FRAJMAN & M. TURJAK (LJU10134440)

0152/4 Slovenia: Notranjska, Hruškarje, wet, sandy road-side, 22.7.2006, leg. M. TURJAK (LJU10134438).

0153/3 Slovenia: Notranjska, Predgozd, near the bridge over Iška, 26.7.2006, leg. B. FRAJMAN (LJU10134439).

0252/1 Slovenia: Notranjska, on wet, sandy places at lake Cerknisko jezero, aluvium, leg. A. PAULIN (Flora exsiccata Carniolica 1450/I, LJU1003144)

### 3.6. *Laserpitium archangelica* (Apiaceae)

*Laserpitium archangelica* is a dinaric-carpathian species, reaching its northwestern distribution in Slovenia (THELLUNG 1926). In habit (and name!) it resembles *Angelica archangelica* L., which is not native in this part of Europe. Typical for *L. archangelica* is a dense hirsute indumentum, along with broadly winged fruits and swollen upper petioles (MARTINČIČ in MARTINČIČ & al. 2007, FISCHER & al. 2008). It can be found in forests and forest margins (MARTINČIČ in MARTINČIČ & al. 2007).

*L. archangelica* seems to be very rare in Slovenia. In the distribution map published by JOGAN & al. 2001 it is only found in four mapping grid cells in DN. MARTINČIČ (in MARTINČIČ & al. 2007) lists *L. archangelica* for DN and questions its occurrence in the vicinity of Ljubljana and Škofja Loka (both PA).

Review of the data published by JOGAN & al. 2001 reveals that all four dots are based on more than 100 years old observations (PLEMEL 1862: Brezje near Cerknica and Menišija – 0152/3; PAULIN 1904: Krim – 0052/4, vicinity of Ribnica – 0254/3, Mt. Slivnica near Brezje and foot of Goli vrh near Topol and Selšček – 0152/3, Stojna near Kočevje – 0355/3). Krim,

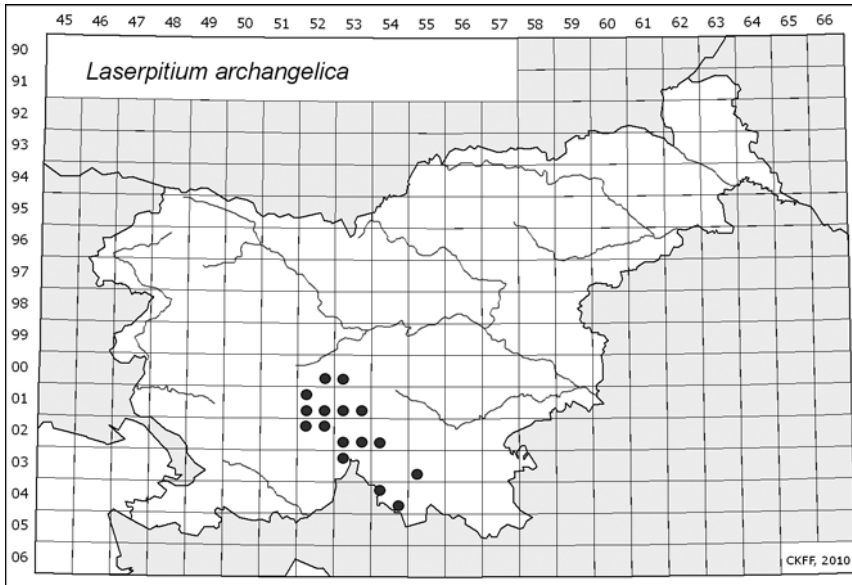


Fig. 7. Distribution of *Laserpitium archangelica* in Slovenia.

Ribnica, and Kočevje, as well as Polje near Ljubljana were already listed by FLEISCHMANN 1844, but *L. archangelica* was never again found at the last locality, which can thus be considered as doubtful (PAULIN 1904) as are many other localities published by FLEISCHMANN for other taxa (pers. obs.). We therefore disregard this occurrence in our distribution map (Fig. 7).

Also the doubtful occurrence in the vicinity of Škofja Loka (MARTINČIČ in MARTINČIČ & al. 2007) can be disregarded, as shown by a literature review: according to SCOPOLI 1772, this species (as *Laserpitium chironium*) was observed in the mountains near Škofja Loka by WULFEN: “Habitat in montibus Lokopolitanis. P. WULFEN.” However, WULFEN 1786, in his work *Plantae rariores Carinthiae*, argues against this published locality: “Since long time I am absolutely sure about Scopoli’s synonym [*Laserpitium chironium*], as he could get [this plant] only from me. But not from the mountains around Škofja Loka, where I have never seen it, but from the others, as stated [above]: from the very high mountain Slivnica [1114 m] near that utmost famous lake Cerkniško jezero – or should I [rather] say a yearly gathering of the waters from surrounding hills/mountains? – then from the densely wooded mountain Fridrichstein [Stojna], named after the count [Friderick II from Celje], in Kočevje county not far from the town [Kočevje]. Here, on the rocky, shady, woody and very inhospitable mountains of the Mediterranean Noricum, from where both river Sava and Drava are flowing to Pannonia, in this area, as I say, where that cultivated

*Angelica* [*A. archangelica*] is missing, I have discovered this plant [*L. archangelica*], not found after CLUSIUS by nobody else." It is thus obvious, that *L. archangelica* has never been observed in the vicinity of Škofja Loka. Besides on Slivnica and Stojna, WULFEN 1858 recorded *L. archangelica* also on Mt. Krim ("towards Ig"), a locality published in Flora Norica more than half a century after WULFEN's death.

Only two additional localities were published in the past 100 years: Iški Vintgar (0053/3; ZOR 1959; DRUŠKOVIČ & LOVKA 1995) and Mestni vrh near Kočevje (0355/3, STRGAR 1966), even if the plant was found at several other places, as evident from the herbarium revision (see specimina visa). In the recent past, we have encountered this species at several localities during field excursions to the Slovenian Dinaric area.

*L. archangelica* is thus, as evident from all available data (Fig. 7), much more common in the Slovenian Dinaric area than shown by JOGAN & al. 2001. However, it occurs fairly scattered in the area with only one to few individuals found per locality (pers. obs.) and we thus recommend its inclusion into the red data book of Slovenian flora as a rare species (R) following the criteria listed by BAČIČ 2006.

#### Specimina visa:

0053/3 Slovenija: Notranjska, Iški Vintgar, 16.6.1936, leg. M. ZALOKAR (LJU10032488); 19.8.1954 & 2.7.1955, leg. E. MAYER (LJU10032482, LJU10032484).

0152/3 Slovenija: Notranjska, along the Cerknjščica stream near the village Begunje, 21.7.2006, leg. B. FRAJMAN (LJU10134464).

0152/4 Slovenija: Notranjska, near Slugovo above Cerknjščica, 22.7.2006, leg. M. TURJAK (LJU10134465).

0153/4 Slovenija: Notranjska, Mišja dolina near Velike Lašče, 14.6.1996, leg. M. KAČIČNIK (LJU10032485).

0252/1 Slovenija: Notranjska, Mt. Slivnica, beneath the summit, 20.8.1909, leg. R. JUSTIN (LJU10032486).

0252/2 Slovenija: Notranjska, Mt. Slivnica, above Grahovo, 12.8.1967, leg. E. MAYER (LJU10032483).

0253/4 Slovenija: Kočevsko, Travná gora near Nova Štifta, 22.6.1930, leg. F. DOLŠAK (LJU10032489).

0355/3 Slovenija: Kočevsko, Mt. Stojna, 13.7.1965, leg. M. WRABER (LJU10032480).

0454/1 Slovenija: Kočevsko, Pasje jame near Medvedjak, 29.6.1963, leg. M. WRABER (LJU10032481).

0454/4 Slovenija: Notranjska, along Kolpa near Mirtoviči, 14.6.1982, leg. I. ŠTIMEC (LJU10032479).

#### Mapping data without vouchers:

0152/1 Slovenija: Notranjska, at the entry to the gorge Pekel near Borovnica, 15.6.2009, obs. B. FRAJMAN & P. SCHÖNSWETTER.

0153/3 Slovenija: Notranjska, along the stream Iška, 26.7.2006, obs. B. FRAJMAN.

0252/1 Slovenija: Notranjska, along the path from Cerknica to Mt. Slivnica, 31.5.2009, obs. B. FRAJMAN & P. SCHÖNSWETTER.

0253/3 Slovenija: Notranjska, Kočevska dolina, near Lož, 23.7.2006, obs. M. TURJAK.

0353/1 Slovenija: Notranjska, Babno polje SE from Doline, 23.7.2006, obs. B. FRAJMAN.

### 3.7. *Phacelia tanacetifolia* (Hydrophyllaceae)

*Phacelia tanacetifolia* is native to California; outside its native range it is commonly cultivated as nectariferous plant or as an ornamental in gardens. It sometimes escapes from cultivation and can be found in nature (FISCHER & al. 2008). In neighbouring areas its occurrence in the wild was recorded in Austria (FISCHER & al. 2008), Hungary (KIRÁLY 2009), Friuli-Venezia Giulia (POLDINI 2002) and Croatia (NIKOLIĆ 2010). ESSL & RABITSCH 2002 state that it shows no invasive character in Austria.

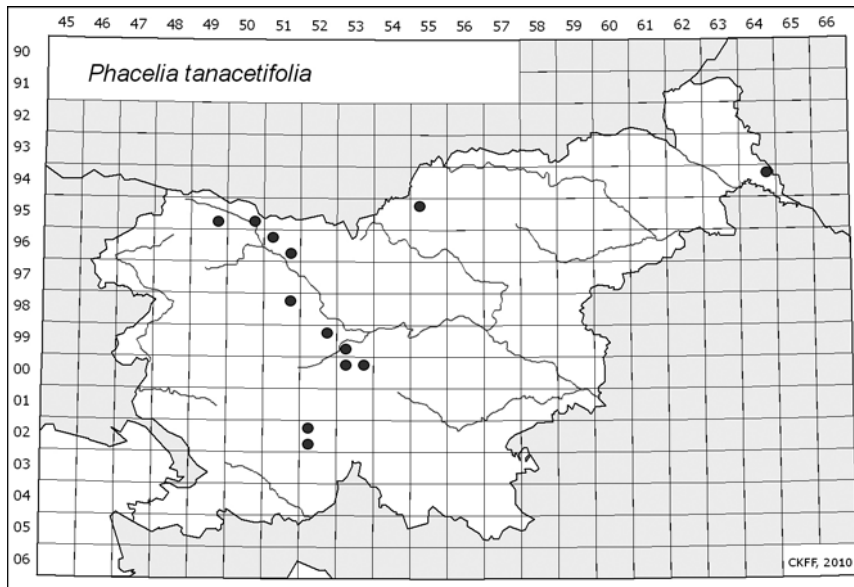


Fig. 8. Distribution of *Phacelia tanacetifolia* in Slovenia.

*P. tanacetifolia* occurs subspontaneously also in Slovenia (JOGAN in MARTINČIČ & al. 2007) where it was first collected in Ljubljana by JUSTIN as early as in 1911 (LJU10041428) as well as by PAULIN (LJU10041423; DOLŠAK 1936). Its occurrence in the wild is mentioned also by MAYER 1952. It was confirmed in Ljubljana in recent times (LJU10133845; 0053/1: PRAPROTNIK 1994) and observed also in Koroška (9555/1; JOGAN 1993), Gorenjska (9651/1: PRAPROTNIK 1994, LJU10041426; 9550/4, 9549/4: JOGAN 1997; 9651/4: PRAPROTNIK 1994; LJU10133946), Prekmurje (LJU10041424), and Notranjska (LJU10041427; 0253/2: PRAPROTNIK 1994). We recorded the

species east of the village Otok near Cerknica (0252/3; leg. T. BAČIČ, B. FRAJMAN & M. TURJAK, 19.7.2006).

As the number of new localities has doubled since a distribution map for Slovenia was published by JOGAN & al. 2001, we here present the updated map (Fig. 8), showing that *P. tanacetifolia* was observed in all phytogeographic regions with exception of PD. At present, it does not seem to be invasive in Slovenia as it occurs predominantly in fields, along roads, houses and in other ruderal places.

Specimina visa:

9464/2 Slovenia: Prekmurje, Lendava, 18.6.2002, leg. D. HUZIMEC (LJU10041424).

9651/1 Slovenia: Gorenjska, Smokuč, 16.6.1990, leg. N. PRAPROTNIK (LJU10041426).

9952/2 Slovenia: Ljubljana, Jamikarjeva ul, 16.6.2003, leg. T. BAČIČ (LJU10133845).

9953/3 Slovenia: Ljubljana, 14. 9. 1911, leg R. JUSTIN (LJU10041428).

9953/3 Slovenia: Ljubljana, leg. A. PAULIN (Flora exsiccata Carniolica 1732, LJU10041423).

0252/1 Slovenia: Notranjska, Cerknica, Dolenja vas, 16.6.1994, leg. K. KOLARIČ (LJU10041427).

### 3.8. *Ranunculus polyanthemus* Group, with Emphasis on *R. polyanthemophyllus* (Ranunculaceae)

*Ranunculus polyanthemophyllus* belongs to the *R. polyanthemus* group, which is in Slovenia and neighbouring regions represented also by *R. nemorosus*, *R. polyanthemus* and *R. polyanthemoides* BOREAU (JALAS & SUOMINEN 1989). For Slovenia, only *R. nemorosus* and *R. polyanthemus* have been listed until recently, when *R. polyanthemophyllus* was discovered by JOGAN (in POBOLJŠAJ & al. 1999b) in Žejna dolina near Hotedrščica (0050/4); this is also the only locality given by PODOBNIK (in MARTINČIČ & al. 2007). In contrast, *R. nemorosus* is a common species of the Slovenian flora, whereas *R. polyanthemus* is more scattered (JOGAN & al. 2001, PODOBNIK in MARTINČIČ & al. 2007).

A common characteristic of *R. polyanthemophyllus* and *R. polyanthemus* is the division type of basal leaves, as they both have the central lobe narrowed into a 4–8 mm long petiole-like base. Contrary, the central lobe of the leaves of *R. nemorosus* is without a petiole-like base, and the lobes are not so deeply divided. A common characteristic of *R. polyanthemophyllus* and *R. nemorosus* is the shape of the nutlets with curved stylar beak (straight in *R. polyanthemus*; BALTISBERGER 1980, PODOBNIK in MARTINČIČ & al. 2007, FISCHER & al. 2008). *R. polyanthemus* and *R. polyanthemophyllus* have similar habitat preferences. They are thermophilous species growing on warm meadows, pastures, as well as in shrubland and forests; *R. polyanthemophyllus* often occurs in dry pine forests, but also in

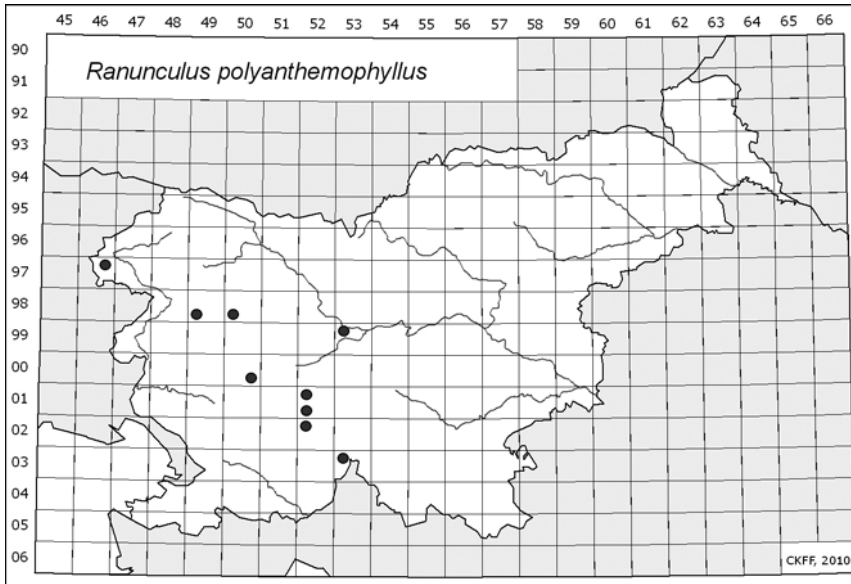


Fig. 9. Distribution of *Ranunculus polyanthemophyllus* in Slovenia.

slightly damp grasslands and forests. *R. nemorosus* is a mesophilous species growing mostly in forests (ZIMMERMANN 1974, BALTISBERGER 1980).

In 2006 we have found plants resembling *R. polyanthemophyllus* near Zgornje Poljane and Bezuljak in DN (see specimina visa). After our determination was confirmed by E. HÖRANDL (Vienna), we revised the herbarium specimens belonging to the *R. polyanthemus* group at LJU. As *R. polyanthemophyllus* was not included in the Slovenian excursion flora until recently (MARTINČIČ & al. 2007), we expected some erroneous determinations, a situation reported also by BALTISBERGER 1980 and ZIMMERMANN 1974 for other herbaria. In Fig. 9 we present the currently known distribution of *R. polyanthemophyllus* in Slovenia: it is scattered in the western part of Slovenia, in AL, PA and DN regions. As this taxon is known from adjacent regions in the north (HARTL & al. 1992) and west (POLDINI 2002), we may expect it to be more common in the NW part of Slovenia.

Another result of the herbarium revision was that none of the specimens could be unambiguously determined as *R. polyanthemus*. Only a single specimen from the surroundings of the railway station Dravljje in Ljubljana (leg. F. DOLŠAK, 14.6.1925, LJU10047044) has straight nutlet beaks, but we saw also a specimen of *R. polyanthemophyllus* (LJU10130962) with straight beaks of ripe nutlets (curved tips were obviously broken), whereas the beaks of unripe nutlets were clearly curved.

This might be the case also for the specimen from Dravljje, and it thus remains unclear whether *R. polyanthemus* occurs in Slovenia at all.

From the neighbouring regions Friuli Venezia Giulia (Italy) as well as Kärnten and Steiermark (Austria), only *R. polyanthemophyllus* is known (POLDINI 2002, FISCHER & al. 2008), whereas only *R. polyanthemus* is listed for Hungary, also from the bordering region to Slovenia (KIRÁLY 2009, pers. com.) and Croatia (NIKOLIĆ 2010). *R. polyanthemus* is an eastern European species (JALAS & SUOMINEN 1989; the distribution presented for Slovenia is likely based on erroneous determinations), in Austria it is common only in the Pannonian region (FISCHER & al. 2008). It can thus be expected to occur also in eastern-most parts of Slovenia (Prekmurje), as well as in adjacent parts of Austria (Steiermark, Burgenland). The distribution in the Goričko region of easternmost Slovenia presented in several MTB squares by JOGAN & al. 2001 might thus be correct, but further investigations are needed to confirm this.

Based on the limited number of records of *R. polyanthemophyllus*, we suggest its inclusion as a rare (R) species in the Slovenian red data list. On the other hand, the doubtful occurrence of *R. polyanthemus* in Slovenia merits its inclusion as an insufficiently known taxon (K). Both taxa need further attention in Slovenia as well as the neighbouring regions, especially in the south and east.

#### Specimina visa:

9746/2 Slovenija: Julijske Alpe, Kobariški Stol, 14.7.1971, leg. T. WRABER & M. LOVKA (LJU10046947).

9849/3 Slovenija: Primorska, Prapetno Brdo near Cerkno, 31.7.2000, leg. B. TRČAK & P. SPRYNAR (LJU10130962), and leg. B. TRČAK (LJU 10130964); NE of Stopnik near Cerkno, 30.7.2000, leg. N. JOGAN & B. TRČAK (LJU10130980).

9850/3 Slovenija: Gorenjska: Vrh ulice near the stream Podpleščica, 30.5.1979, leg. A. PODOBNIK (LJU10046945).

9953/1 Slovenija: Sneberje near Ljubljana, leg. A. DOLŠAK, Fl. exsic. Carniol. 1913 (LJU10046965).

0152/1 Slovenija: Notranjska, Pokojišče near Borovnica, 19.5.1968, leg. A. MARTINČIČ (LJU10046962).

0152/3 Slovenija: Notranjska, near Bezuljak, *Pinus sylvestris* forest, 23.7.2006, leg. B. FRAJMAN, rev. E. HÖRANDL (LJU 10136298).

0252/1 Slovenija: Notranjska, Mt. Slivnica above Cerknica, 13.9.1966, leg. A. MARTINČIČ (LJU10046959). Note: on the label "Bela Krajina" is written, but this is wrong (A. MARTINČIČ, pers. com.)

0353/1 Slovenija: Notranjska, Babno polje, S of Zg. Poljane, forest, 22.7.2006, leg. B. FRAJMAN, rev. E. HÖRANDL (LJU 10136297).

### 3.9. *Ranunculus reptans* (Ranunculaceae)

*Ranunculus reptans*, a species closely related to *R. flammula* (EMAD-ZADE & al., in press), has a circumpolar distribution (ZIMMERMANN 1974). In

Europe it is most common in Scandinavia and in the Alps (JALAS & SUOMINEN 1989), where it mostly grows in oligotrophic habitats mostly occurring on gravelly mineral grounds on lakeshores and periodically flooded areas (ZIMMERMANN 1974).

It was therefore surprising that MARTINČIČ 2001 reported this species for Cerknjsko jezero (0252/3), which can certainly not be regarded as oligotroph (see GABERŠČIK & URBANC-BERČIČ 2003). Accordingly, the distribution map was published by JOGAN & al. 2001, where also the occurrence in MTB square 0457/3 is presented, based on the data published by IVANOVIČ & al. 1983. This is likely a mistake, and *R. repens* was meant (P. SKOBERNE, pers. com.). The same mistake in spelling was done by SELIŠKAR & al. 1993 and KALIGARIČ & ŠKORNIK 1998 – in both cases *R. repens* is meant (B. VREŠ, pers. com.; S. ŠKORNIK, pers. com.)!

During field work on Cerknjsko jezero SE of the village Otok in 2006, we have discovered plants resembling the specimen collected by A. MARTINČIČ and determined by him as *R. reptans* (LJU10047048), but we could not determine them unambiguously. One of the characters to distinguish *R. reptans* from *R. flammula* is the shape of the nutlet stylar beak which is straight in *R. flammula* but curved in *R. reptans* (ZIMMERMANN 1974, PODOBNIK in MARTINČIČ & al. 2007, FISCHER & al. 2008). However, after checking this character on several specimens of *R. flammula* at LJU it became clear, that also *R. flammula* may have curved stylar beaks. Consultation of E. HÖRANDL (Vienna) confirmed that our specimen, as well as the one collected by A. MARTINČIČ in 2001 (MARTINČIČ 2001), belongs to *R. flammula*. B. VREŠ, A. SELIŠKAR and D. TRPIN in the 1990ies initially determined specimens from Cerknjsko jezero as *R. reptans*, but with more detailed revision they came to the conclusion that the plants are merely a form of *R. flammula* (*R. flammula* f. *gracilis* G. MEY.; B. VREŠ, pers. com.). We can thus conclude that *R. reptans* was erroneously listed for Slovenia; taking its distribution and ecology into account, it is also not very likely, that it could be found at another location in the future.

### 3.10. *Thalictrum simplex* (Ranunculaceae)

*Thalictrum simplex* is an Eurasian species, which occurs scattered to rare in major parts of continental Europe, extending eastwards to China, Korea and Japan (ZIMMERMANN 1974). Until recently, two infraspecific taxa were listed for Slovenia by PODOBNIK (in MARTINČIČ & al. 1999): subsp. *simplex* and subsp. *galioides*. HAND 2001 and STARMÜHLER 2005 published records of a third taxon, subsp. *tenuifolium*, for the Slovenian territory and subsequently PODOBNIK (in MARTINČIČ & al. 2007) stated that all three subspecies might be present in Slovenia. The distinction among them is difficult as the taxa form a polyploid series: subsp. *galioides* is tetra-, subsp. *tenuifolium* hexa-, and subsp. *simplex* octoploid (HAND 2001).

PODOBNIK (in MARTINČIČ & al. 2007) lists *T. simplex* for wetlands, wet meadows and forests from all over Slovenia, which is not in agreement with the actual situation as we will show below.

For the nominate subspecies there is only one old record for Slovenia by PETRASCH (HAYEK 1908–1914) from the valley of river Drava in the vicinity of Ptuj (9651/3). All other records were until recently determined as subsp. *galioides* and this was also our preliminary determination of the

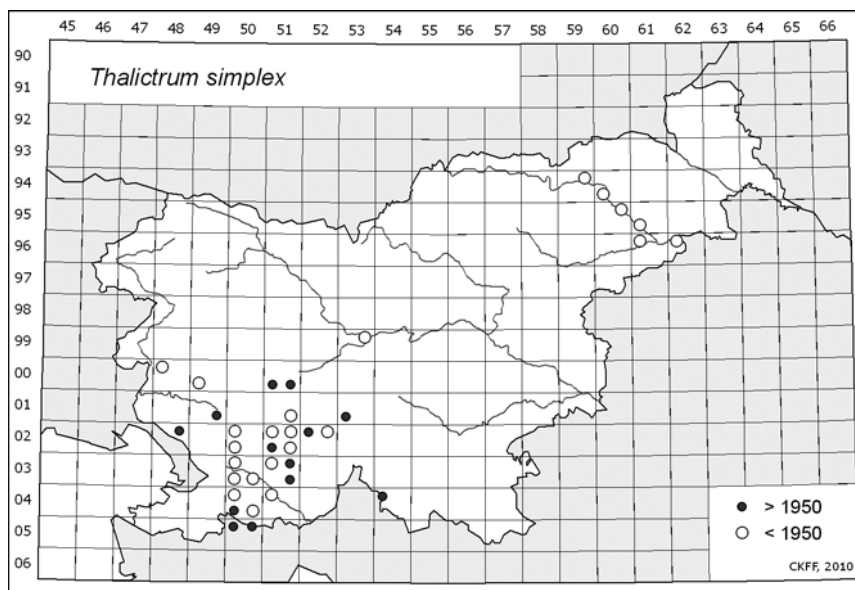


Fig. 10. Distribution of *Thalictum simplex* in Slovenia, recorded before and after 1950.

specimen found near Zavrh on Bloke plateau (LJU10134016). Based on the distribution map published by JOGAN & al. 2001 we concluded, that this is the first record for the central part of DN, but the revision of the herbarium material at LJU showed that there are several other localities known from the central DN (see specimina visa, and Fig. 10).

*T. simplex* is much more common in SM and adjacent parts of DN (W and SW slopes of Javorniki and southern margins of Trnovski gozd; JOGAN & al. 2001, Fig. 10). Many localities from this region were published more than 100 years ago by MARCHESETTI 1896–97 and POSPICHAL 1899, some additional later by PAULIN 1915, PISKERNIK 1988 (recorded in 1959), and POBOLJŠAJ & al. 2005. Here we present some additional localities and provide a list of revised specimens from LJU (see specimina visa). Dry grasslands and scrublands on calcareous ground are the most common habitats given on herbarium labels, which is in disagreement with the ecology de-

scribed by PODOBNIK (in MARTINČIČ & al. 2007). Also ZIMMERMANN 1974 and HAND 2001 besides more humid habitats list dry nutrient-poor meadows and pastures with prevailing *Molinia caerulea* as a typical habitat of *T. simplex*.

*T. simplex* was recorded outside DN and SM (as subsp. *galioides*) only along the rivers Drava southeast of Maribor (HAYEK 1908–1914) and Sava near Ljubljana (LJU10055738). The record in the surroundings of the village Potok (obs. B. ROZMAN, MTB square 0356/2 in JOGAN & al. 2001) is erroneous (B. ROZMAN, pers. com.). Also the records in UTM squares 0048/3 and 0148/1 (in JOGAN & al. 2001) are erroneous because they are based on a technical mistake (pers. obs.).

The question remains to which subspecies the plants from Slovenia belong. All specimens in LJU morphologically and ecologically resemble the specimen from Žabnik in Istria (LJU10135069) determined by R. HAND as subsp. *tenuifolium* and can thus be assigned to this taxon. This is in agreement with HAND 2001, pers. com., who states that in western parts of Slovenia only subsp. *tenuifolium* occurs. It is possible that subsp. *galioides* occurs in the Soča valley (Posočje), as it has been recorded in adjacent Friuli Venezia Giulia in the neighbourhood of Udine (HAND 2001), but there are no records of *T. simplex* from the Soča valley north of Most na Soči.

As we did not see any herbarium specimens, it was difficult to conclude to which subspecies the plants found along the Drava river (HAYEK 1908–1914) belonged. Based on the distribution of the three subspecies in Austria (HAND 2001, FISCHER & al. 2008), it is likely, that they belonged to subsp. *tenuifolium*. However, as all records from this part of Slovenia are older than 100 years, we may consider it as probably extinct (Ex?) in this region, as well as in the vicinity of Ljubljana, where it was recorded 90 years ago for the last time.

*T. simplex* is in the Slovenian red data list (Anonymous 2002) treated as vulnerable (V). As it is not common and its distribution has narrowed in the last decades in Slovenia, and the species is potentially endangered due to overgrowing of grasslands with forest, as well as high negative human influence on wet habitats, we suggest its treatment as endangered (E). It is included only in the Austrian red data lists of all neighbouring countries, as critically endangered (“stark gefährdet”; NIKLFELD & SCHRATT-EHRENDORFER 1999, FISCHER & al. 2008).

#### Specimina visa:

9953/2 Slovenija: left Sava bank in Šentjakob near Ljubljana, leg. A. PAULIN (LJU10055738, Fl. exsic. Carniol. 1921).

0051/3 Slovenija: Notranjska, hill Grintavec near Logatec, 20.7.1995, leg. S. ŽIBERT (LJU10055739).

0051/4 Slovenija: Notranjska, Štampetov most SW from Verd, 22.6.1953, leg. A. MARTINČIČ (LJU10055742).

0151/4 Slovenija: Notranjska, Rakek – Rakova dolina, July 1949, leg. E. MAYER (LJU10055743).

0153/3 Slovenija: Notranjska, Bloška planota, Zavrh, 25.7.2006, leg. B. FRAJMAN (LJU10134016).

0251/1 Slovenija: Primorska, near Postojna, 1899, leg. A. GSPAN (LJU10055747); Postojna – Veliki Otok, 18.7.1954, leg. E. MAYER (LJU10055746).

0251/2 Slovenija: Notranjska, foot of Javorniki above Cerkniško jezero, 22.8.1906, leg. R. JUSTIN (LJU10055741).

0251/4 Slovenija: Primorska, Sv. Trojica near Sv. Peter, 7.7.1918, leg. R. JUSTIN (LJU10055748).

0350/1 Slovenija: Primorska, Dolnje Vreme, 1900, leg. R. JUSTIN (LJU10055740); Gornje Ležeče, 12.7.1905, leg. R. JUSTIN (LJU10055744).

0351/1 Slovenija: Primorska, Klenik near Sv. Peter, 9.7.1911, leg. R. JUSTIN (LJU10055745).

0454/1 Slovenija: Kočevsko, Draga, 16.7.1981, leg. I. ŠIMEC (LJU10055737).

0550/2 Slovenija: Primorska, Žabnik in Istria, 13.8.2002, leg. U. & W. STARMÜHLER, rev. R. HAND, 2003 (LJU10135069).

#### Mapping data without vouchers:

0251/3 Slovenija: Primorska, Poček, 9.9.2008, obs. T. BAČIČ & B. FRAJMAN.

0351/2 Slovenija: Primorska, NE from Jurišče, 10.10.2007 & 9.9.2008, obs. T. BAČIČ & B. FRAJMAN.

0550/1 Slovenija: Primorska, hill Ostrič, 31.7.1996, obs. V. BABIJ (Database Flora Slovenije at CKFF).

0550/2 Slovenija: Primorska, Goli vrh near Poljane, 29.7.1996, obs. V. BABIJ (Database Flora Slovenije at CKFF).

#### Published data:

HAND 2001: hills near Postojna (0251/1; 1880), Dolenje Jezero (0252/1; 1977, 1995), Grahovo (0252/2; 1891, 1893).

HAYEK 1908–1911: along Drava near Maribor (9459/2), Zrkovci (9460/3), Starše and Vurberk (9560/2), Ptuj (9561/3), Videm pri Ptuj (9661/1), Borl and Zavrč (9662/1).

MARCHESETTI 1896–97: Razdrto (0250/1), Postojna (0251/1)

PAULIN 1915: Skrajni vrh pri Postojni (0251/1).

PISKERNIK 1988 (records from 1959): Veliki dol near Sežana (0248/2), Skadanščina and Velika Pleševica (0450/3), hill Tuščak near Bač (0351/4), Klenik (0351/1), hills Debela gora, Sovič and Sveta Trojica (0251/4).

POBOLJŠAJ & al. 2005: Gradišče pri Vipavi (0149/4).

POSPICHAL 1899: Trnovo (0048/1), Otlica (0049/3), Razdrto (0250/1), Senožee (0250/3), Barka, Kozjane and Vatovlje pri Divači (0350/3), Prelože (0350/4), Odolina, Hotična and Markovščina (0450/1), Obrov (0450/4), Ilirska Bistrica – Gabrje (0451/1).

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Autor(en)/Author(s): Frajman Bozo, Bacic Tinka

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