

Additions to the spider fauna of Slovenia, with a comparison of spider species richness among European countries*

Matjaž Kuntner

Department of Biological Sciences, George Washington University, 2023 G Street, N.W., Washington, DC 20052, USA; and Institute of Biology, Centre for Scientific Research of the Slovenian Academy of Sciences and Arts, Novi Trg 5, SI-1000 Ljubljana, Slovenia

and

Irena Šereg

Environmental Studies, American University, 4400 Massachusetts Avenue, N.W., Washington, DC 20016–8007, USA

Summary

The history of araneology in Slovenia and the state of knowledge of the spider fauna at the turn of the millennium are discussed. Between 1994 and 2000, 76 species have been added to the known Slovenian fauna, giving a current total of 529 species. In effect, this paper represents a supplement to the previously published checklist of Nikolić & Polenec (1981) and later additions to the Slovenian spider fauna, with a complete bibliography of the relevant araneological literature. A graphical comparison of spider species richness against log-area for most European countries suggests that the spider fauna richness of Slovenia, as currently known, is typical for its area. Large positive deviations occur in medium-sized mountainous central European countries such as Switzerland, Slovakia and Austria. The Iberian peninsula, and especially Italy, are the richest European geographical units for their size. The largest negative deviations are found in the high latitude countries such as Iceland, Lithuania, Ireland and Norway.

Introduction

Slovenia, a Central European country, lies between 45°25' and 46°55'N, and covers an area of 20,273 km² (the size of the state of New Jersey, or approximately half the size of Switzerland). It shares borders with Italy (232 km), Austria (333 km), Croatia (670 km) and Hungary (102 km). Four major European natural landscape units meet in Slovenia: the Alps, the Dinaric area, the Pannonian plain, and the Mediterranean. Slovenia has 46.6 km of Adriatic coastline, 26,000 km of rivers and streams, and some 7,500 springs of drinking water. The highest peak is Mt. Triglav (2,864 m), the lowest point is at sea level, and the average height above sea level is 556.8 m. Forests cover half the territory, as much as 10,124 km²; in this respect Slovenia ranks third in Europe after Finland and Sweden. Slovenia mainly has a continental climate with cold winters (January mean 2°C) and warm summers (July mean 21°C). The average rainfall varies from a maximum of 3,500 mm in the Alps through 1,400 mm in central Slovenia and 1,000 mm at the coast, to 800 mm in the drier north-east. These features combined with the varied tectonic history of the

area make Slovenian landscapes and climates extremely diverse. Consequently, the biota in Slovenia is unusually diverse for such a small country (Mršič, 1997). In Slovenia, some 24,000 species of organisms have been identified so far (Mršič, 1997), but the true number is probably appreciably larger. Mršič (1997) estimated it to lie between 50,000 and 120,000.

This paper summarises recent contributions to the knowledge of Slovenian spiders. In effect, it is a supplement to the previously published checklist (Nikolić & Polenec, 1981) and later additions to the Slovenian spider fauna made by Polenec (1982–1989, 1992). Kuntner and colleagues published sporadically on the fauna from 1994 to 2000 (Kuntner, 1994, 1996, 1997a–d, 1998, 1999; Kuntner & Baxter, 1997; Kuntner *et al.*, 1999; Kuntner & Kostanjšek, 2000), but these papers are mostly in Slovenian or appeared in narrowly distributed publications that are difficult or impossible for the interested international arachnologist to obtain. In addition many species new to Slovenia remain unpublished. All these published and unpublished records are presented or summarised here with comments and omissions from the list as necessary. We also present a complete bibliography of the araneological literature relevant to Slovenia, which might prove useful for future faunistic or ecological work on the Slovenian spider fauna. A comprehensive checklist of the known Slovenian spider fauna is beyond the scope of this paper, but would be extremely useful as a basis for further investigations.

Brief history of araneology in Slovenia

The history of araneological research in Slovenia starts with Scopoli (1763, 1772). His *Entomologia Carniolica* (Scopoli, 1763) treated 44 spider species from the territory of Slovenia. Other pre-20th century works were Schiödte's (1847) description of *Stalita taenaria*, the first known cave spider, and Joseph's (1882) account on cave arthropods of Carniola, today central Slovenia. Sporadic papers in the early part of the 20th century treated cave spider fauna (Absolon & Kratochvíl, 1932a, b; Caporiacco, 1938). However, no serious advances in spider faunistics in Slovenia were made until the second half of the last century.

From 1954 to 1992 the late Dr Anton Polenec and co-authors published 63 papers on the spiders of Slovenia (Polenec, 1954–1992; Buchar & Polenec, 1974; Fuhn & Polenec, 1967; Miller & Polenec, 1975a, b; Nikolić & Polenec, 1981; Polenec & Thaler, 1975, 1980; Thaler & Polenec, 1974). We do not mention here his numerous popular science articles or books. Polenec's large collection of spiders is housed in the Slovene Museum of Natural History in Ljubljana. His work emphasised those epigeic spider groups caught mostly by pitfall trapping, and focused on north-western Slovenia, but his coverage of other areas was opportunistic. His career contribution and devotion to the study of the Slovenian fauna is unparalleled to date.

Foreign authors of the 20th century published important works relevant to the Slovenian spider

*This paper is dedicated to Dr Anton Polenec (1910–2000), the pioneer of Slovenian araneology, in recognition of his lifelong study of spiders in Slovenia.

fauna. Dr Christa Deeleman-Reinhold researched the subterranean spider fauna (Deeleman-Reinhold, 1971–1993), focusing primarily on the family Dysderidae (Deeleman-Reinhold, 1971, 1978a, 1993; Deeleman-Reinhold & Deeleman, 1988), and the linyphiid genus *Troglohyphantes* (Deeleman-Reinhold, 1978b). Other works on cave spiders were those of Brignoli (1971) and Kratochvíl (1934, 1970). The only paper on Thomisidae was by Šilhavy (1944). Wiehle (1961, 1964) published two taxonomic papers on spiders of Slovenia, and Wunderlich (1980) described new species of *Zodarion*. Many important taxonomic treatments of spiders relevant to Slovenia, especially those of the Alps, were published by Thaler (1972–1994), and one by Blick *et al.* (1995).

The only checklist of the Slovenian fauna appears in the *Catalogus Faunae Jugoslaviae* (part III/4: Aranea) of Nikolić & Polenec (1981). The catalogue lists the distribution of each species in the former Yugoslav republics, and lists relevant literature published before 1981. Since Slovenia's borders within the Yugoslav federation did not change with independence in 1991, the catalogue of Nikolić & Polenec remains geographically accurate. However, the nomenclature and systematics in the checklist are seriously out of date, and much new information has accumulated since its publication. Some identifications are almost certainly erroneous.

Polenec published nine contributions after the catalogue (Polenec, 1982–1989, 1992), among them a systematic overview of his findings in north-west Slovenia (Polenec, 1989), two reports on new records for Slovenia (Polenec, 1982, 1988) and the Red List of Slovenian spiders (Polenec, 1992). Kuntner and co-authors published eleven faunistic and ecological contributions to the knowledge of Slovenian spiders (Kuntner, 1994, 1996, 1997a–d, 1998, 1999; Kuntner & Baxter, 1997; Kuntner *et al.*, 1999; Kuntner & Kostanjšek, 2000). Deltšev (1999) recently reviewed spider faunistics in the Balkan peninsula. Besides misspelling the name of the country (p. 258: table 2), the claim that only 216 spider species are known from Slovenia is simply an error. Nikolić & Polenec (1981) alone recorded 416 species from Slovenia, and papers after 1981 add many more (see Discussion). An up-to-date checklist is badly needed that reviews the published literature before the Catalogue and checks the dubious identifications in Polenec's collection.

Species are listed here as “new” to Slovenia if they did not appear in the 1981 catalogue or any of Polenec's subsequent publications. For “new” records, we cite the original publication if previously published, provide comments on some of the more interesting findings, and give for the first time geographical co-ordinates for each new record, taken as decimal longitude and latitude from the digital map of Slovenia (Interaktivni Atlas Slovenije, 1998).

Nomenclature and systematic placements follow Platnick (2000). Families, genera and species are listed alphabetically. The first author's private collection is currently housed in the zoological collection of the

Institute of Biology of the Slovenian Academy of Sciences and Arts in Ljubljana.

New records by families

Family AGELENIDAE

Tegenaria campestris C. L. Koch, 1834

Kuntner (1999): Obrež, near Središče ob Dravi (16.25, 46.41), 3♀, first and so far only record in Slovenia.

Family ARANEIDAE

Araneus angulatus Clerck, 1757

Kuntner (1997a): Belvedere, near Izola (13.64, 45.53), 3♀, 1 juv.; Koče, near Kočevska Reka (14.81, 45.60), 1♂; Taborska stena, near Kočevska Reka (14.73, 45.58), 1♀; Dragonja river (exact locality unknown), 1♂; Marija Snežna (Zg. Velka: 15.78, 46.68), 1 juv.; Kozje (15.56, 46.08), 1 juv. Kuntner (1997d): Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 3♀, Podgrad, Stari grad (14.15, 45.53), 1♀; Velika Pleševica, near Golac (14.03, 45.52), 1♂ 2♀. Kuntner (1999): Obrež, near Središče ob Dravi (16.25, 46.41), 1♀; Hraščica, near Središče ob Dravi (16.29, 46.41), 2♀; Godeninci, near Središče ob Dravi (16.28, 46.41), 1♀.

Gibbaranea bituberculata (Walckenaer, 1802)

The first two localities in Slovenia are reported here: Dragonja river (exact locality unknown), 2 July 1989 (anonymous collector), 1♀; southern slope of Šmarnogorska Grmada (14.46, 46.13), 500–600 m, 3 May 1997, Kuntner & Šereg leg., 1♀.

Hypsosinga heri (Hahn, 1831)

Kuntner (1997c): Drtiščica river, central Slovenia (14.72, 46.16), 1♀. Kuntner (1999): Mursko Središče, Petišovci (16.45, 46.53), 1♀.

Larinioides cornutus (Clerck, 1757)

This widespread Holarctic species is recorded in Slovenia for the first time here, which demonstrates how poorly the spider fauna of Slovenia is known: Sečovlje, soline (13.61, 45.50), M. Kuntner & I. Baxter leg., 16 May 1997, 4♀.

Larinioides sclopetarius (Clerck, 1757)

Abundant in the centre of Ljubljana city (14.51, 46.05; Kuntner, 1997a). Later records from Hum pri Ormožu (16.20, 46.42) and Središče ob Dravi (16.21, 46.40) (Kuntner, 1999).

Larinioides suspicax (O. P.-Cambridge, 1876)

Kuntner (1997a) reported the finding of 1♂ 2♀ of *Larinioides folium* (Schrank, 1803) at Jovsi, Kapele (15.68, 45.91). Platnick (2000) follows Levy (1998) in treating *L. folium* as a nomen dubium. The correct name *sensu* Levy (1998) is *L. suspicax*.

Neoscona adianta (Walckenaer, 1802)

Kuntner (1997d): Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 1♀. Kuntner & Kostanjšek (2000): Reber, Brestovica pri Komnu (13.62, 45.82), 4♀. Since this is a widespread Palearctic species, we believe it has been overlooked in Slovenia previously and is not rare.

Neoscona subfusca (C. L. Koch, 1837)

Kuntner (1997d): Osp (13.86, 45.57), 2♀. Kuntner & Kostanjšek (2000): Reber, Brestovica pri Komnu (13.62, 45.82), 1♀; Šempas (13.75, 45.93), 2♂ 3♀. We believe the species is confined to Submediterranean Slovenia, where it is not rare.

Zygiella stroemi (Thorell, 1870)

Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 3♀, first and so far only record in Slovenia.

Zygiella thorelli (Ausserer, 1871)

Kuntner (1999): Hum pri Ormožu (16.20, 46.42), 2♀; Godeninci, Središče ob Dravi (16.28, 46.41), 6♀; Središče ob Dravi (16.21, 46.40), 1♀.

Zygiella x-notata (Clerck, 1757)

Surprisingly, the first Slovenian record of this common Holarctic species is as recent as 2000. Kuntner & Kostanjšek (2000): Šempas (13.75, 45.93), 1♂, 2 juvs. This illustrates the poor state of

knowledge of the Slovenian spider fauna, and there is no reason to believe that the species is rare.

Family CLUBIONIDAE

Clubiona germanica Thorell, 1871

Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 1♂. Kuntner (1999): Središče ob Dravi (16.21, 46.40), 1♀.

Clubiona phragmitis C. L. Koch, 1843

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 3♂ 1♀, first and so far only record in Slovenia.

Clubiona pseudoneglecta Wunderlich, 1994

Known from Switzerland and Germany (Platnick, 2000), as well as from Belgium, Netherlands, Great Britain, France, Hungary and Greece (Merrett, 2001). The first record in Slovenia was that of Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 1♀. Another ♀ was found at Zajelšje, Brkini (14.16, 45.56), after the publication.

Family CORINNIDAE

Trachelas maculatus Thorell, 1875

Kuntner (1997a) reported the finding of 1♀ inside a house in Ljubljana (14.51, 46.05), the westernmost record of the species.

Family DICTYNIDAE

Dictyna pusilla Thorell, 1856

Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 1♀, first and so far only record in Slovenia.

Dictyna uncinata Thorell, 1856

Kuntner (1997a): Dobrava, Kapele (15.66, 45.94), 2♀. Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 1♀.

Family FILISTATIDAE

Filistata insidiatrix (Forskål, 1775)

The first and so far only record of the family Filistatidae in Slovenia was that of Kuntner (1997d): Osp (13.86, 45.57), 2 immatures. The site is known as one of the very few places in Slovenia harbouring Mediterranean flora and fauna.

Family GNAPHOSIDAE

Aphantaulax sp.

Kuntner (1997d) reported the finding of two juvenile individuals of an unidentified species at Klivnik, Brkini (14.19, 45.55). This was the first record of the genus in Slovenia.

Drassodes cupreus (Blackwall, 1834)

Kuntner (1997d): Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 1♀, so far only record in Slovenia.

Micaria formicaria (Sundevall, 1831)

Kuntner (1997d): Polje, near Golac (14.06, 45.52), 1♀, so far only record in Slovenia.

Scotophaeus sp.

Kuntner (1999) recorded a juvenile of an unidentified species in Hum pri Ormožu (16.20, 46.42), so far the only record of the genus in Slovenia.

Family LINYPHIIDAE

Bathyphantes nigrinus (Westring, 1851)

Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 5♀. Kuntner (1999): Obrež, near Središče ob Dravi (16.25, 46.41), 2♀.

Diplocentria bidentata (Emerton, 1882)

Kuntner & Kostanjšek (2000): Paradana, Trnovski Gozd (13.85, 45.99), 1♀, first and so far only record in Slovenia.

Diplocephalus cristatus (Blackwall, 1833)

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 1♀, first and so far only record in Slovenia.

Kaestneria dorsalis (Wider, 1834)

Kuntner (1999): Središče ob Dravi (16.21, 46.40), 1♀, first and so far only record of the genus in Slovenia.

Lepthyphantes alutacius Simon, 1884

Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 1♀, first and so far only record in Slovenia.

Linyphia hortensis Sundevall, 1830

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 1♀; Zajelšje, Brkini (14.16, 45.56), 1♀.

Minicia marginella (Wider, 1834)

Kuntner (1997d): Velika Pleševica, near Golac (14.03, 45.52), 1♀.

Neriere furtiva (O. P.-Cambridge, 1871)

Kuntner (1997d): Velika Pleševica, near Golac (14.03, 45.52), 1♀.

Oedothorax retusus (Westring, 1851)

Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 1♀.

Oryphantes angulatus (O. P.-Cambridge, 1881)

The finding of *Lepthyphantes angulatus* (O. P.-Cambridge, 1881) was reported by Kuntner & Kostanjšek (2000): Paradana, Trnovski Gozd (13.85, 45.99), 1♀, first and so far only record in Slovenia.

Pocadicnemis carpatica (Chyzer, 1894)

Kuntner (1999): Obrež near Središče ob Dravi (16.25, 46.41), 2♀, first and so far only record in Slovenia.

Family LYCOSIDAE

Alopecosa fabrilis (Clerck, 1757)

Kuntner & Kostanjšek (2000): Ravne, western Slovenia (13.79, 45.92), 1♀, first and so far only record in Slovenia.

Pardosa saturator Simon, 1937

Kuntner (1999): Petišovci (16.45, 46.53), 1♀, first and so far only record in Slovenia.

Pirata piraticus (Clerck, 1757)

Kuntner (1999): Petišovci (16.45, 46.53), 1♀, first and so far only record in Slovenia.

Pirata tenuitarsis Simon, 1876

Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 1♀, first and so far only record in Slovenia.

Pirata uliginosus (Thorell, 1856)

Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 1♀. Kuntner (1999): Obrež near Središče ob Dravi (16.25, 46.41), 2♀.

Family MIMETIDAE

Ero aphana (Walckenaer, 1802)

Kuntner (1997d): Polje, near Golac (14.06, 45.52), 1♀, first and so far only record in Slovenia.

Family OXYOPIDAE

Oxyopes heterophthalmus (Latreille, 1804)

Kuntner (1997a): Koper (13.73, 45.55), 2♀.

Oxyopes lineatus Latreille, 1806

Kuntner (1997d): Velika Pleševica, near Golac (14.03, 45.52), 1♀. Kuntner & Kostanjšek (2000): Reber, near Brestovica pri Komnu (13.62, 45.82), 3♀. Unpublished records: Stena, Dragonja (13.67, 45.46), 6 July 1997, 3♂ 3♀; Rokava river, Škrline (13.76, 45.47), 6 July 1997, 1♂; Osp (13.86, 45.57), 7 July 1997, 2♀. The species appears to be present in warm localities of Submediterranean Slovenia where it can be locally abundant on vegetation.

Family PHILODROMIDAE

Philodromus albidus Kulczynski, 1911

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 2♀. Kuntner (1997c): Drtjiščica river, central Slovenia (14.72, 46.16), 2♀.

Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 3♀.
Kuntner & Kostanjšek (2000): Črniče (13.78, 45.91), 2♀.

***Philodromus cespitum* (Walckenaer, 1802)**

Kuntner & Kostanjšek (2000): Šempas (13.75, 45.93), 1♀; Črniče (13.78, 45.91), 2♀.

***Philodromus rufus* Walckenaer, 1826**

Kuntner (1997d): Glavica, Mt. Slavnik (14.00, 45.56), 1♀, first and so far only record in Slovenia.

Family PHOLCIDAE

***Holocnemus pluchei* (Scopoli, 1763)**

This species, originally described from the area, was presumed extinct in Slovenia by Polenec (1992). This is refuted by the record of a female in Šempas (13.75, 45.93) (Kuntner & Kostanjšek, 2000). This is the only record of the genus in Slovenia.

***Spermophora senoculata* (Dugès, 1836)**

Kuntner (1997d): Osp (13.86, 45.57), 2♀, 2 juvs, in abandoned stone house. The only record of the genus in Slovenia.

Family SALTICIDAE

***Carrhotus xanthogramma* (Latreille, 1819)**

Kuntner (1997b): Zajelšje, Brkini (14.16, 45.56), 1♀, first record in Slovenia. Kuntner & Kostanjšek (2000): Reber, near Brestovica pri Komnu (13.62, 45.82), 1♀.

***Dendryphantès rudis* (Sundevall, 1833)**

Kuntner (1997b): Preserje, near Lukovica (14.71, 46.16), 2♀.
Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 1♀.

***Evarcha jucunda* (Lucas, 1846)**

Kuntner (1997b): Osp (13.86, 45.57), 1♀, see comment on locality under *Filistata insidiatrix*.

***Heliophanus cupreus* (Walckenaer, 1802)**

Kuntner (1997b): Zajelšje (14.16, 45.56), 1♀; Javorje (14.15, 45.58), 1♂ (adjacent localities in Brkini hills); Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 1♀. Kuntner (1999): Godeninci, Središče ob Dravi (16.28, 46.41), 1♂. Kuntner & Kostanjšek (2000): Reber, near Brestovica pri Komnu (13.62, 45.82), 1♀; Ravne, western Slovenia (13.79, 45.92), 2♀. Widespread and common in Slovenia.

***Leptorchestes berolinensis* (C. L. Koch, 1846)**

Kuntner (1997a): four synanthropic localities in Ljubljana city (14.51, 46.05).

***Macaroeris nidicolens* (Walckenaer, 1802)**

Kuntner (1997b) recorded *Eris nidicolens* (Walckenaer) at Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 1♀. Additional records: Kuntner & Kostanjšek (2000): Črniče (13.78, 45.91), 3♀; Ravne, western Slovenia (13.79, 45.92), 2♀. Apparently confined to Submediterranean Slovenia.

***Marpissa nivoyi* (Lucas, 1846)**

Kuntner (1997b): Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 1 juv. There is an ambiguous record of the species from Strunjan by Polenec (1992).

***Menemerus semilimbatus* (Hahn, 1829)**

Kuntner (1997b): Osp (13.86, 45.57), 1♀.

***Pseudeuophrys lanigera* (Simon, 1871)**

Kuntner & Kostanjšek (2000) recorded *Euophrys lanigera* (Simon) in Paradana, Trnovski Gozd (13.85, 45.99), 1♂, first and so far only record in Slovenia.

***Sitticus floricola* (C. L. Koch, 1837)**

Kuntner (1999): Sp. Velovlek (15.92, 46.47), 1♀, first and so far only record in Slovenia.

Family SEGESTRIIDAE

***Segestria florentina* (Rossi, 1790)**

Kuntner (1997a): many individuals at following localities on Slovenian Adriatic coast: Piran, Bernardin (13.57, 45.52); Sečovlje, Soline (13.61, 45.47); Padna (13.69, 45.49); also observations on the

spider's diet. Kuntner & Kostanjšek (2000): Šempas (13.75, 45.93), 5♀, 4 juvs. This Mediterranean species is confined to the Slovenian coast and a few warm inland localities, where it is believed to be indigenous (Kuntner, 1997a).

Family TETRAGNATHIDAE

***Pachygnatha terilis* Thaler, 1991**

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 1♂ 1♀, 1 juv., first and so far only record in Slovenia. Previously known only from the Southern Alps in Austria and Italy (Thaler, 1991).

***Tetragnatha nigrita* Lendl, 1886**

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 8♂ 5♀, first and so far only record in Slovenia.

***Tetragnatha obtusa* C. L. Koch, 1837**

Kuntner (1997c): Drtiščica river, central Slovenia (14.72, 46.16), 3♀, first and so far only record in Slovenia.

Family THERIDIIDAE

***Achaearanea simulans* (Thorell, 1875)**

Kuntner (1997d): Zajelšje, Brkini (14.16, 45.56), 1♀; Klivnik, Brkini (14.19, 45.55), 5♂ 7♀. Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 1♂ 7♀; Hum pri Ormožu (16.20, 46.42), 1♀; Godeninci, Središče ob Dravi (16.28, 46.41), 1♀. Widespread and abundant in Slovenia.

***Anelosimus vittatus* (C. L. Koch, 1836)**

Kuntner & Kostanjšek (2000): Črniče (13.78, 45.91), 1♀, first and so far only record in Slovenia.

***Dipoena torva* (Thorell, 1875)**

Kuntner & Kostanjšek (2000): Črniče (13.78, 45.91), 1♀; Ravne, west Slovenia (13.79, 45.92), 1♂.

***Enoplognatha latimana* Hippa & Oksala, 1982**

Kuntner (1997d): Podgorje, SW slope of Mt. Slavnik (13.96, 45.53), 1♀. Kuntner (1999): large numbers at following sites in NE Slovenia, near Središče ob Dravi: Hraščica forest (16.29, 46.41), Godeninci (16.28, 46.41). Kuntner & Kostanjšek (2000): Ravne, west Slovenia (13.79, 45.92), 1♀. Widespread but previously confused with the equally common sister species, *E. ovata*.

***Episinus maculipes* Cavanna, 1876**

Kuntner (1997a): Kozje (15.56, 46.08), 11♀. Kuntner & Kostanjšek (2000): 2.5 km N of Črniče (13.78, 45.93), 1♀; Črniče (13.78, 45.91), large numbers. Found to be a dominant species on aerial webs during intensive spider sampling in the forest of Črniče (Kuntner & Kostanjšek, 2000).

***Neottiura bimaculata* (Linnaeus, 1767)**

Kuntner (1997d): *Theridion bimaculatum* (Linn.) at Klivnik, Brkini (14.19, 45.55), 1♀. Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 1♀. Kuntner & Kostanjšek (2000): Črniče (13.78, 45.91), 2♀; Ravne, western Slovenia (13.79, 45.92), 2♀.

***Neottiura suaveolens* (Simon, 1879)**

Kuntner & Kostanjšek (2000): 2.5 km N of Črniče (13.78, 45.93), 1♀, first and so far only record in Slovenia.

***Steatoda triangulosa* (Walckenaer, 1802)**

Kuntner (1999): Središče ob Dravi (16.21, 46.40), 1♂ 1♀, 5 juvs. Kuntner & Kostanjšek (2000): Šempas (13.75, 45.93), 1♀.

***Theridion mystaceum* L. Koch, 1870**

Kuntner (1997d): Podgrad, Stari grad (14.15, 45.53), 1♀, first and so far only record in Slovenia.

***Theridion pinastri* L. Koch, 1872**

Kuntner (1997c): Drtiščica river, central Slovenia (14.72, 46.16), 3♀. Kuntner & Kostanjšek (2000): Reber, near Brestovica pri Komnu (13.62, 45.82), 4♀; Črniče (13.78, 45.91), 1♂ 6♀.

Family THERIDIOSOMATIDAE

***Theridiosoma gemmosum* (L. Koch, 1877)**

Kuntner (1999): Drava river, near Središče ob Dravi (16.28, 46.38), 1♀, first and so far only record of the genus in Slovenia.

Family THOMISIDAE

Heriaeus sp.

Kuntner (1997d) reported the finding of an immature individual of an unidentified species in Osp (13.86, 45.57), which was the first record of the genus in Slovenia. We have collected more material from other warm localities in Submediterranean Slovenia, but have so far failed to find adults identifiable to species.

Misumenops tricuspidatus (Fabricius, 1775)

Kuntner (1997a): Sotelsko jezero, near Podčetrtek, subadult ♀, first published record in Slovenia. Kuntner (1997d): Zajelšje, Brkini (14.16, 45.56), 1♀; Polje, Golac (14.06, 45.52), 1♀; Klivnik, Brkini (14.19, 45.55), 4♀. Kuntner (1997c): Drtiščica river, central Slovenia (14.72, 46.16), 2♀.

Pistius truncatus (Pallas, 1772)

Kuntner (1997a): Olimski Log, near Podčetrtek (15.56, 46.14), 1♀; incorrectly listed as Olimski Rog. Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 2 juvs. Kuntner & Kostanjšek (2000): Črniče (13.78, 45.91), 1♀, 2 juvs. Not uncommon, but overlooked by previous researchers.

Tmarus stellio Simon, 1875

Kuntner (1997d): Klivnik, Brkini (14.19, 45.55), 1♀. Kuntner (1999): Obrež, Središče ob Dravi (16.25, 46.41), 1♀.

Xysticus ulmi (Hahn, 1831)

Kuntner (1999): Sp. Velovlek (15.92, 46.47), 1♀, first and so far only record in Slovenia.

Family ULOBORIDAE

Uloborus plumipes Lucas, 1846

Kuntner (1994) reported the finding of an introduced species in large numbers in various greenhouses in Ljubljana (14.51, 46.05), which he believed to be the North American species *Uloborus glomosus* (Walckenaer, 1841). It was later established that this was the similar Mediterranean species, *Uloborus plumipes*.

Uloborus walckenaerius Latreille, 1806

Unpublished records: Osp (13.86, 45.57), 7 July 1997, 1♀; Stena, Dragonja (13.67, 45.46), 6 July 1997, 1♂. These are the first accurate records of the species in Slovenia, although Polenec (1992) lists the species as present north of Kobarid in the Posoče region of Slovenia with no exact locality data.

Omissions from the Slovenian species list

Family CYBAEIDAE

Cybaeus raymondi (Simon, 1916)

Kuntner & Kostanjšek (2000) recorded 4♂ from Trnovski Gozd, western Slovenia, in the karst (limestone) depression Paradana (13.85, 45.99). The tentative identification of Kuntner & Kostanjšek (2000) is now considered doubtful (C. Fišer, in litt.); possibly, the material belongs to *C. tetricus* (C. L. Koch, 1839). Therefore, the species *C. raymondi*, known only from the French Pyrenees (Maurer, 1992), is omitted from the Slovenian checklist.

Family THOMISIDAE

Ozyptila praticola (C. L. Koch, 1837)

The record of this species by Kuntner (1997d), who failed to list the exact locality, was printed by the author's error. The species is not known from Slovenia.

Discussion

Species counts

Adjusted for changes in nomenclature (Platnick, 2000), Nikolić & Polenec (1981) cited 416 spider

species from Slovenia. Polenec subsequently added an additional 37 species. The 76 species (excluding *Cybaeus raymondi* and *Ozyptila praticola*, see Omissions above) added here bring the current Slovenian total to 529 species. This count excludes the three unidentified representatives of the genera *Aphantaulax*, *Scotophaeus* and *Heriaeus* (this paper), and exotics that have not established breeding populations, such as *Phoneutria* sp. (Ctenidae) and *Heteropoda* sp. (Sparassidae) (M. Kuntner, original data).

Comparisons with other European countries

Table 1 lists the numbers of spider species recorded from European countries for which recent data exist, the areas of the countries, and the sources. The numbers for the Iberian peninsula (including Spain, Portugal, Andorra and Gibraltar) exceptionally treat a geographical unit instead of a country. In this case, the Portugal figures are redundant. Although the checklist of British spiders (Merrett & Murphy, 2000) covers the area of Britain and Ireland, all of the species listed there occur also in Great Britain, which includes England, Wales and Scotland, and excludes Northern Ireland. The area of Great Britain is compared for richness here to avoid redundancy of the area of Northern Ireland; in Table 1, Ireland includes the whole island. Beyond Europe, such numbers are less readily available. Ohio (USA) has 525 species (Harris & Bradley, 2000), and the Canadian province Manitoba has 483 (Benell-Aitchison & Dondale, 1990). Mexico, as an example of a large (sub)tropical country has only 2506 species recorded (Jiménez, 1996), which is certainly an underestimate.

Knowledge of the spider fauna of these countries is in most cases more complete than is the case for Slovenia (with the exception of Mexico and, perhaps, some Balkan and Mediterranean countries).

In addition, all the mentioned countries are considerably or much larger than Slovenia, so direct species richness comparisons are misleading. Mršič (1997) attempted to place the biotic richness of Slovenia in a global context by simply dividing species richness by the area of the country concerned. Such an index inflates the relative richness of very small countries because the species–area curve at all geographical scales is logarithmic. Mršič (1997) concluded that Slovenia is biotically richer than most other countries on Earth, even including many tropical ones, but this result is just an artifact of the index. Had he included much smaller European countries, such as Monaco, San Marino, or Andorra, their indices would have dwarfed that of Slovenia, despite their low diversities.

Although usually the log (richness) is plotted against log (area), we plot untransformed richness against log (land area) in Fig. 1 to highlight deviations from the best-fit least-squares line. Regression explains relatively little of the variation in richness ($r^2=0.17$; a log–log plot is no better). Slovenia falls almost exactly on the line itself, meaning that its currently known spider faunal richness is typical for its area, contra the generalisations of Mršič (1997). The largest positive deviations occur in

Country	Area (km ²)	Log area	Richness	Source
Austria	83,858	4.92	934	Blick & Hänggi (2000)
Belgium	30,528	4.48	690	Vanuytven (2000)
Bulgaria	110,550	5.04	775	Deltshev (1999)
Czech Rep.	77,280	4.89	781	Buchar (1997)
Croatia	55,920	4.75	615	Deltshev (1999)
Denmark	42,430	4.63	500	N. Scharff (pers. comm.)
Estonia	42,270	4.63	512	Vilbaste (1987)
Germany	356,970	5.55	984	Blick & Hänggi (2000)
Great Britain	229,957	5.36	645	Merrett & Murphy (2000)
Greece	128,900	5.11	642	Deltshev (1999)
Hungary	92,340	4.97	725	Samu & Szinetár (1999)
Iberian pen.*	591,412	5.77	1,171	Morano (2001)
Iceland	100,250	5.00	89	Agnarsson (1996)
Ireland	84,427	4.93	378	Helsdingen (1996)
Italy	294,060	5.47	1,406	Pesarini (1995)
Lithuania	64,800	4.81	277	Relys (1996)
Netherlands	33,920	4.53	608	Helsdingen (1999)
Norway	385,639	5.59	559	Aakra & Hauge (2000)
Poland	304,420	5.48	796	Kupryjanowicz (2000)
Portugal	91,500	4.96	642	Cardoso (1999)
Romania	230,340	5.36	972	Weiss & Urák (2000)
Serbia	102,000	5.01	508	Deltshev (1999)
Slovakia	48,080	4.68	920	Gajdoš & Sloboda (1996)
Slovenia	20,120	4.30	529	This paper
Sweden	411,620	5.61	705	L. J. Jonsson (pers. comm.)
Switzerland	41,285	4.62	930	Blick & Hänggi (2000)

Table 1: Comparison of area and spider species richness of European countries for which recent data are available. *Iberian peninsula includes Spain, Portugal, Andorra and Gibraltar (see text).

medium-sized mountainous central European countries such as Switzerland, Slovakia and Austria. While the Iberian peninsula shows high diversity, Italy, for its size, is by far the richest European country, probably reflecting its relatively southern position, high landscape diversity, and latitudinal range. The largest negative deviations are found in the relatively depauperate northern countries such as Iceland, Lithuania, Ireland and Norway, reflecting the extreme drop-off in diversity at high latitudes. The faunas of northern Europe have been impoverished by Pleistocene glaciation events. The consequences are especially obvious in island faunas such as those of Iceland, Ireland and Britain. The fauna of Iceland, for example, was completely wiped out during the last glaciation (Buckland *et al.*, 1986). Consequently, the particularly depauperate spider fauna of Iceland today is a result of immigration events during the last 10,000 years (Agnarsson, 1996).

The data points for some countries in Fig. 1 are seriously biased by undersampling at the national level, but the known faunas of most central and northern European countries are unlikely to grow substantially. For these countries the differences reflected in Fig. 1 are probably real. Great Britain, for example, is possibly the most exhaustively studied of all the countries, and nearly all new additions to the national spider list are probably recent immigrants (P. Merrett, pers. comm.). On the other hand, the picture is likely to change in less researched areas of Europe. (Sub)Mediterranean countries such as Slovenia, Croatia, Greece, Spain and Portugal will undoubtedly prove to be much richer.

Future prospects

The Slovenian spider fauna is still poorly known. Many species discussed in this paper are widespread in Europe and as such should have been found in Slovenia long ago. Still more relatively common species have yet to be collected and recorded. However, many species are confined to certain areas, are endemic to Slovenia, or are rare but widespread. These include Alpine, Mediterranean, Dinaric (especially underground), and Pannonic faunal elements. Serious sampling in unexplored areas should be undertaken in the future to record these species. Southern, south-eastern and north-eastern Slovenia remain largely unexplored. Even moderate sampling in these areas reveals previously unrecorded spiders. Undescribed species can still be expected from the Alps, the Submediterranean Karst of the south-west, and the Dinaric Karst of the south and south-east. No doubt the current total of 529 spider species will rise dramatically as new data are gathered.

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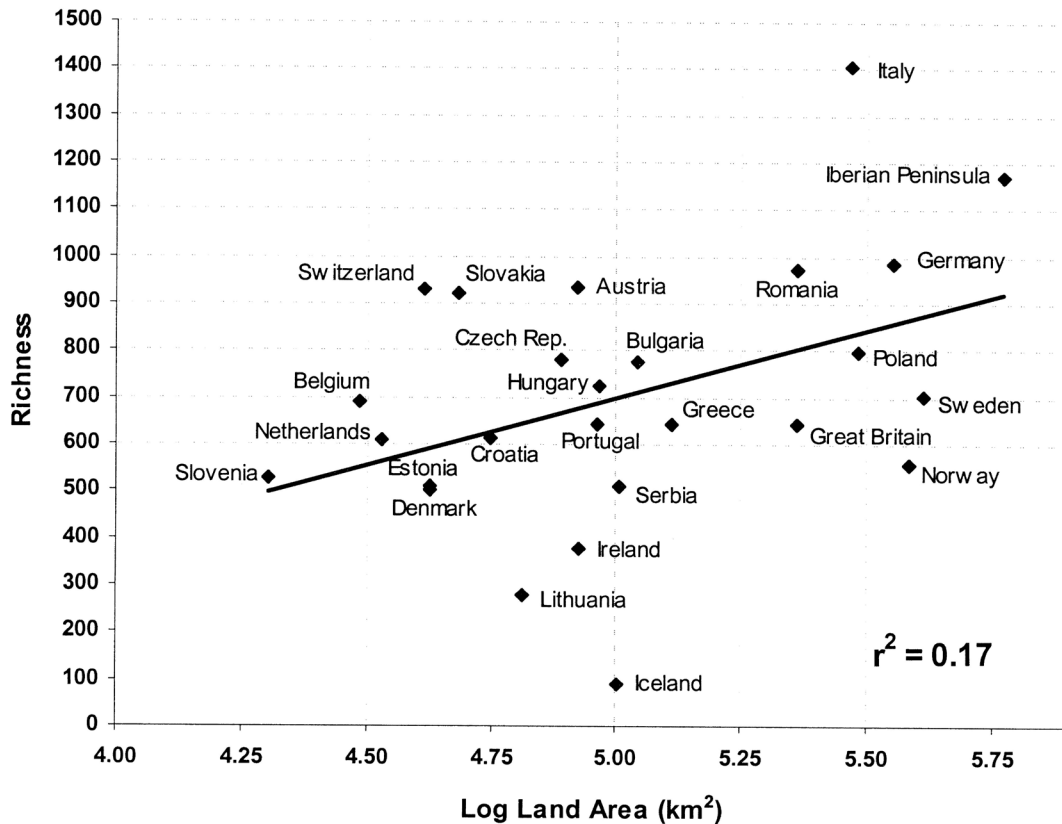


Fig. 1: Semi-log plot of spider species richness versus area for the European countries in Table 1, with a fitted least-squares line ($r^2=0.17$).

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Note added in proof

After submitting the manuscript, further references relevant to the Slovenian spider fauna (listed below) were brought to our attention. We thank Dr Fulvio Gasparo for his kind help.

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