ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 65 156 Number 5, 2017
https://doi.org/10.11118/actaun201765051521

FAUNISTIC STUDY ON SPIDERS (ARANEAE) IN THE ŠPRANĚK NATIONAL NATURE RESERVE WITH SUGGESTION TO CONSERVATION MANAGEMENT OF THE LOCALITY

Ondřej Košulič[1]

[1]Department of Forest Protection and Wildlife Management, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czech Republic

Abstract

KOŠULIČ ONDŘEJ. 2017. Faunistic Study on Spiders (Araneae) in the Špraněk National Nature Reserve with Suggestion to Conservation Management of the Locality. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 65(5): 1521–1535.

Spiders (Araneae) are a classic indicator taxon for evaluating the health of natural environments. Here, spiders from the forest ecosystems in Špraněk National Nature Reserve (Olomoucký Region) were investigated. A total of 1195 specimens were collected by pitfall traps, individual collection, sweeping herb vegetation, beating shrubs and trees, and shifting leaf litters. Currently, 126 species from 23 families from April to October 2013 were recorded. The species diversity in the Špraněk area is rather high, representing approximately 14% of Czech araneofauna. The most abundant species were *Pardosa alacris* and *Xerolycosa nemoralis* from the family Lycosidae. Of the identified species, 15 species were found listed in the Red List of Threatened Species in the Czech Republic (EN – 1 species, VU – 5 species, LC – 9 species). Several findings represent the northernmost occurrences of rare thermophilic spiders in Moravia and even the Czech Republic. In addition, the author proposed management methods of the locality and suggests management efforts which can improve conditions for biodiversity within the studied area.

Keywords: forest, biodiversity, biomonitoring, woodlands, Arachnida, threatened species, Czech Republic

INTRODUCTION

Taxa that are suitable as ecological indicators are sensitive to environmental changes and therefore demonstrate negative effects of anthropogenic disturbance on the processes or functioning of an ecosystem (Marc *et al.*, 1999; Pearce and Venier, 2006). Although several animal taxa have been proposed as environmental indicators, spiders are widely used as indicator taxa. They are used due to their species and ecological diversity in various terrestrial habitats (Wise, 1993; Cardoso *et al.*, 2011). Many species of spiders are common over a wide area, but remain closely associated with their environment and are economically and logistically feasible to survey, being sampled simultaneously in large numbers using various sampling techniques (Pearce and Venier, 2006). Because of these attributes, they constitute a good indicator group among organisms that may be surveyed to help in the assessment of the natural conditions (Buchar, 1983; Buchar and Růžička, 2002; Kůrka *et al.*, 2015). Thus, establishing an inventory of these organisms in selected ecosystems such as deciduous forests is important for developing conservation and environmental management strategies.

The Špraněk National Nature Reservation (NNR) is located close to the border of Litovelské Pomoraví Protected Landscape Area (PLA). This area is characterized by the presence of various

forest ecosystems along the Drahany Highlands. The Špraněk NNR is located on the border of faunistic squares 6367 of the faunistical zoological grid mapping system (Buchar, 1982). The whole area is of limestone origin which determines the formation of unique communities of rare fauna and flora (Šafář, 2003). Several inventory surveys have been carried out within the area, mostly focused on insects (Jeniš, 2012; Stanovský, 2012), mammals (Losík, 2013), amphibians (Kočvara, 2014) and lichens (Halda, 2013). Spiders have never been studied within the area of the Špraněk NNR. To date, only unpublished findings are known. These samples were collected during ecological excursions organized by Palacký University in Olomouc (Machač, pers. comm.). In general, we know presence of nine spider species within studied location (ČAS, 2017). I can conclude that the araneofauna of the Špraněk NNR and surrounding area including Litovelské Pomoraví PLA is understudied with very few recent faunistical reports (e.g. Košulič, 2015).

The goal of the present paper was to make a faunistic contribution of spiders in various ecosystems in the Špraněk NNR. I anticipate that the recorded faunistic findings will significantly extend the knowledge of local araneofauna in the studied location and surrounding area. I also suggest that faunistic discoveries published in this paper will provide important contribution to biodiversity in the agriculturally intensified landscape of the Moravian region, therefore may be also used as practical information for conservation management of mentioned habitats.

MATERIALS AND METHODS

Study area

The Špraněk NNM is located in the district of Olomouc in the Luká cadastral area, about 2 km west from the village of Březina (Fig. 1). Špraněk was declared a protected area in 1949. With its area of 131 ha, it is a small protected site. This area predominantly consists of afforested karst hills with complex cave system and fragments of native oak, oak-hornbeam, and beech forests with minor presence of firs. The steppe-rocky habitats around Špláz Hill are very valuable, forming unique xerothermic communities. Unfortunately, some locations within protected area have been converted into uniform spruce monocultures. The territory lies climatically on the border between the Thermophyticum and Mesophyticum (Quitt, 1971). The protected area is situated at an altitude of 378–539 m a.s.l. The geologic substrate is Devonian limestone, sometimes covered by loess. The prevailing soil types are brown earths, rendzinas, and fluvisoils (Šafář, 2003). The surrounding landscape consists of small fragments of deciduous and mixed forests and agricultural fields dominated by cultivated cereals and oilseed rape.

Samples collection and study sites

Research on araneofauna was carried out in 2013 from 29 April to 25 October. Spiders were collected using different collecting methods: pitfall traps, individual collecting under stones and in grass, sweeping of herb vegetation, shifting leaf litters and beating shrubs and trees 50–200 cm in height. Herb vegetation was swept along each sampling plot (100 sweeps in each plot) at a maximum distance of 3 m from the pitfall traps. Each pitfall trap consisted of a plastic cup (500 ml, 9 cm in diameter, 15 cm long) sunk flush with the soil surface. Each trap was filled with a 3–4% solution of formaldehyde and detergent as a killing and fixative fluid. Pitfall traps were installed on 29 April 2013 with subsequent collections on 7 June 2013, 5 July 2013, 22 August 2013, 25 September 2013, and 25 October 2013. The traps were placed in sites 1–4 in lines of three traps ca. 5 m apart, with altogether 12 pitfall traps installed per the study location Špraněk. Individual collecting and beating of shrubs and trees with shifting leaf litters took place at randomly selected patches along each sampling plot. Samples were collected at monthly intervals. After collecting, the material was preserved in 70% alcohol. On sites 5–8, all of the aforementioned collection methods were used except for the pitfall traps. Individual sites used for collecting spiders are shown in Fig. 1. Maps with the occurrence of particular species were created by online application of BioLib (2017) website. Following publications were used for actual distribution data: Buchar and Růžička (2002); Bryja *et al.* (2005); Košulič (2014, 2015); Košulič and Hula (2012, 2013, 2014); Hula *et al.* (2012, 2014); ČAS (2017).

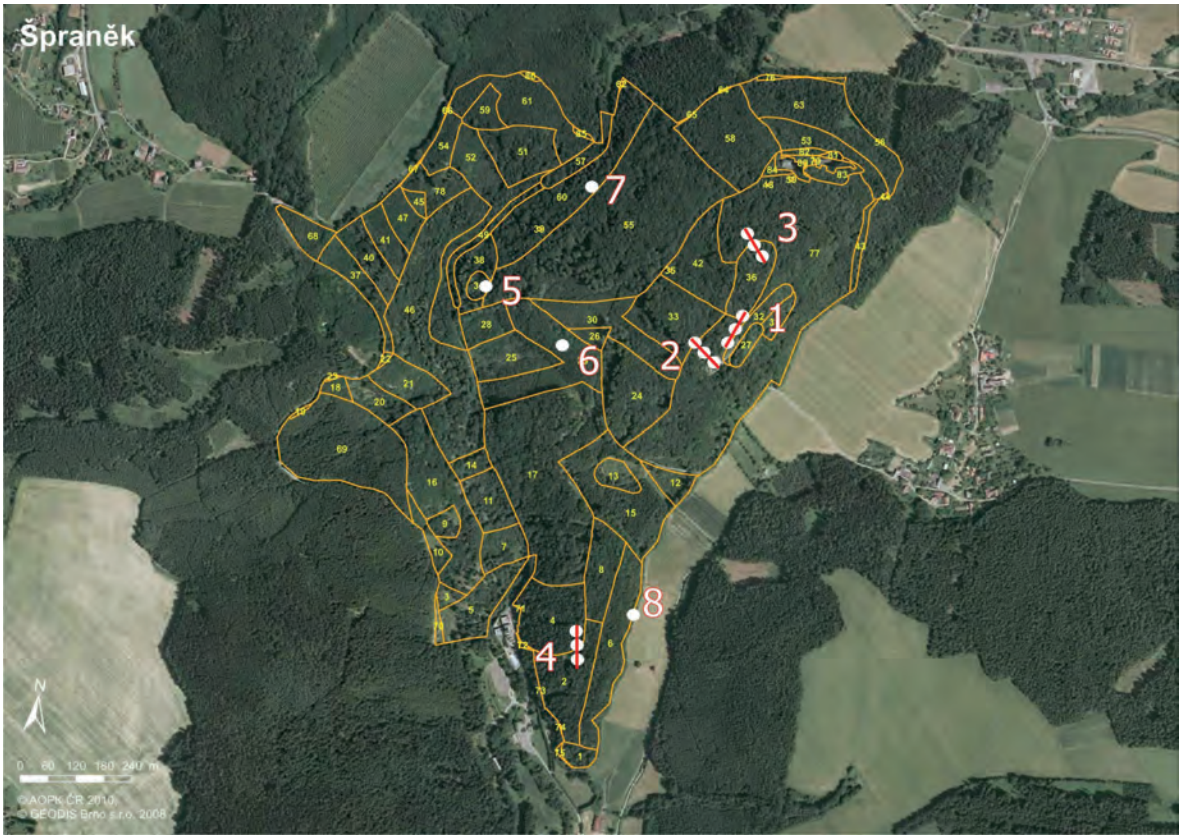
Site 1 – The peak of Špláz Hill which was characterized by south-western exposed steep rocky slopes with very sparse tree canopy and presence of sparse herbaceous vegetation. Spiders were collected using all collection methods except litter sieving (due low litter profile).

Site 2 – Oak forest stand (*Quercion pubescenti-petraeae* plant communities) with south exposure on the upper edge of Špláz Hill, sparse canopy, and diverse vegetation in the undergrowth. Spiders were collected using all sampling methods.

Site 3 – Beech forest stand with presence of limestone blocks, rich undergrowth and high presence of dead woods. Spiders were collected using all collection methods.

Site 4 – Oak-hornbeam forest with minor presence of beech and pine trees. Location was characteristic by presence of dense canopy coverage and low herbaceous undergrowth. Spiders were collected using all sampling methods.

Site 5 – Steep walls of rocky habitats around western part of locality. North exposure, humid and milder climate with dense coverage of lichens



1: *Design of sampling transects (for collecting methods used in every site see Material and Methods) (numbers 1–8 means studied transects, numbers 1–84 with small lettering means habitat types of locality, yellow line – borders of the locality, according to AOPK, Czech Republic)*

and moss. Spiders were collected by sweeping and individual sampling methods.

Site 6 – Spruce monoculture forest stand with presence of non-native trees (e.g. *Robinia pseudoacacia*). Location is characterized by very low canopy openness and vegetation coverage. Spiders were collected using all collection methods except for pitfall traps.

Site 7 – A steep slope with mixed beech and spruce growth over valley of Špraněk, minor presence of limestone blocks and rich herbaceous undergrowth. Spiders were collected using all collection methods except for pitfall traps.

Site 8 – The edge of beech and hornbeam forest stand with the southern part containing transition to periodically mowed meadow with southeast exposure. Spiders were collected using individual collection, sweeping of herb vegetation, and beating of shrubs along the edge of the meadow.

Species identification and classification

All adult spiders was determined to the species level using the identification keys of Heimer and Nentwig (1991), Roberts (1995), and Nentwig *et al.* (2017). Nomenclature and arrangement of families, genera, and species follow the most recent version of the World Spider Catalog (2017) and Catalogue of Spiders of the Czech Republic. Most species were determined by the author (OK). Some morphologically complicated taxa were revised and determined by Vladimír Hula (VH) and Milan Řezáč (MR). For each determined species, the following characteristics (according to Buchar and Růžička, 2002; Řezáč *et al.*, 2015) are recorded:

- originality of habitat: climax preferences (C), semi-natural habitats (SN), disturbed (D), artificial (A)
- occurrence level: very abundant (VA), abundant (A), scarce (S), rare (R), very rare (VR)
- conservation status: critically endangered (CR), endangered (EN), vulnerable (VU), LC (least concern).

The abbreviations of protected locations and collecting methods are as follows: PLA – Protected Landscape Area, NNR – National Nature Reserve, NNM – National Nature Monument, NR – Nature Reserve, NM – National Monument, pt – pitfall traps, sw – sweeping vegetation, bst – beating shrubs and trees, ic – individual collection under stones and in grass, ls – litter sieving.

All examined material was deposited in the collection of the Mendel University, Faculty of Forestry and Wood Technology in Brno. The numbers of collected species and specimens in each studied locality are shown in Tabs. I–II.

RESULTS AND DISCUSSION

Faunistic overview

A total of 1195 spiders (925 adults, 270 juveniles) were collected, representing 126 species in 77 genera of 23 families (Tables II and III). The most abundant species were *Pardosa alacris* and *Xerolycosa nemoralis* which belonged to the family Lycosidae. Among the other most abundant species (Tab. III), *Coelotes terrestris* and *Histopona torpida* were the common forest ground-dwelling species as well as *Haplodrassus silvestris*, which occur dominantly under stones and dead woods within various forest stands of studied locality. I also have found dominant representation of *Alopecosa sulzeri* which is interesting as this species is relatively rare in the Czech Republic (Buchar and Růžička, 2002). This species was found especially in the Site 2 which was the transect creating the transition between warm oak woods and rock habitats. Surprisingly, the second abundant representation was found in Site 3 that was more humid beech forest with presence of limestone blocks. Usually, this species of wolf spider is cited as a characteristic type of spider communities in thermophilic oak woodland and adjacent forest edges (Kůrka *et al*., 2010).

In terms of number of species, the Linyphiidae was clearly dominant with 31 species (Tab. I). However, most of these species were found only sporadically (represented by a few specimens). The exceptions were only two more common linyphiid species – *Linyphia hortensis* and *Linyphia triangularis*. Other eudominant families were the Lycosidae (11 species) and Gnaphosidae (13 species) including typically epigeic species, also Salticidae (12 species) including epigeic species as well as those occurring in herb vegetation and lower branches of trees. These families were also the most numerous ones, since from the Lycosidae, Gnaphosidae, and Salticidae families up to 501, 104, and 38 specimens, respectively, were collected.

Assemblages of spiders include mainly species typical for deciduous forest habitats (shaded, partly shaded), represented in this community by species of natural (C), semi-natural (SN), disturbed (D), and artificial (A) habitats (Buchar and Růžička, 2002), see Tab. II. Numerous species inhabiting open dry forest-steppe and rocky habitats (C and SN habitats) were also discovered. These species occurred mainly in south exposed rock formation around of Špláz (Site 1 and 2). Such species included mainly rare and threatened spiders, typical for such endangered habitats, categorized as rare to scarce in the Czech Republic (Buchar and Růžička, 2002), namely in R category: *Alopecosa sulzeri*, *Drassyllus pumilus, Dysdera moravica*, *Ipa keyserlingi*, *Nematogmus sanguinolentus*, *Phrurolithus pullatus*, *Synema globosum*, *Xysticus robustus*, *Zelotes longipes* and in S category: *Agroeca cuprea, Alopecosa trabalis, Enoplognatha ovata, Evarcha laetabunda, Pardosa alacris, Pardosa hortensis, Salticus cingulatus, Xerolycosa miniata, Zodarion germanicum* and *Zelotes electus*. For rare thermophilic species *A. sulzeri, D. moravica*, *P. pullatus, N. sanguinolentus* and *Z. electus,* the studied location represents the northernmost territory of their distribution in Moravia and/or in the whole Czech Republic, respectively (Řezáč *et al*., 2014; Košulič, 2015).

Concerning the Red List of Endangered Species in the Czech Republic (Řezáč *et al*., 2015), 15 species belonging to categories endangered (EN), vulnerable (VU) and least concern (LC) were found. These species include the following: EN – *Drassyllus pumilus*; VU – *Ipa keyserlingi*, *Nematogmus sanguinolentus*, *Alopecosa sulzeri*, *Phrurolithus pullatus*, *Xysticus robustus*; LC – *Dysdera moravica*, *Hahnia ononidum*, *Agroeca cuprea*, *Zelotes apricorum*, *Zelotes electus*, *Zelotes longipes*, *Ozyptila claveata*, *Synema globosum* and *Salticus cingulatus*. In general, these species are among the important bioindicators of open xeric and semi-dry habitats in forest-steppe and rocky steppe locations (Buchar & Růžička, 2002; Růžička & Buchar, 2008). Unfortunately, such habitats are diminishing in the constantly intensifying landscape of southern Moravia due to overgrowth of such suitable places as well as intensified agriculture and forestry (Spitzer *et al*., 2008; Košulič *et al*., 2016).

Total spider diversity (126 species – approximately 14% of araneofauna in the Czech Republic) was relatively high and significantly enriches the surveyed area with new findings. Collectively, 135 species of spiders are recently known from studied locations due to the presented faunistic study and previously mentioned unpublished data (ČAS, 2017). The rich occurrence of a wide spectrum of species also confirms the importance of various forest ecosystems (oak, hornbeams, beech stands) as well non-forest habitats (rocky and steppe formations) within the Špraněk NNR as refuges for spider communities in the intensified agriculture landscape of central Moravia. The locality also creates an important refuge for thermophilic spiders in the colder region on the border between the thermophytic and mesophytic areas. The findings of several mesophilic and psychrophilic species of spiders typical for the Mesophyticum and Oreophyticum (e.g. *Hahnia ononidum, Salticus cingulatus* and *Walckenaeria obtusa*) are also important. Faunistically remarkable species of spiders found in this study are described below.

I: *Family count with recorded species*

	Family	Species number
1.	Segestriidae	1
2.	Dysderidae	4
3.	Theridiidae	8
4.	Linyphiidae	31
5.	Tetragnathidae	2
6.	Araneidae	6

	Family	Species number
7.	Lycosidae	11
8.	Pisauridae	1
9.	Miturgidae	3
10.	Agelenidae	5
11.	Hahniidae	1
12.	Dictynidae	2
13.	Amaurobiidae	3
14.	Titanoecidae	1
15.	Anyphaenidae	1
16.	Liocranidae	2
17.	Clubionidae	2
18.	Phrurolithidae	2
19.	Zodariidae	1
20.	Gnaphosidae	13
21.	Philodromidae	5
22.	Thomisidae	9
23.	Salticidae	12
	SUM	126

Faunistically remarkable species

Dysderidae

***Dysdera moravica* (Řezáč, 2014) C, R, LC**

This species was previously named as *D. ninnii* Canestrini 1868, however, taxonomic revision showed that it is in fact a complex of several species (Řezáč *et al.*, 2014). Now, it was described as a separate species *D. moravica* occurring in the Pannonian region (Řezáč *et al.*, 2014). This is a thermophilic species whose occurrence in the Czech Republic represents the most northern location in whole Europe. In the Czech Republic, the species occurs in xeric habitats such as southern slopes in the lowland oak forests, vineyard terraces, forest steppes etc. (Řezáč, 2012). In the explored locality, the species was found only in one site which was characteristic by presence of beech and hornbeam forest stands and limestone blocks. The species is endangered by overgrowing of forest-steppe and steppe habitats due to absence of traditional management (coppice, mowing, pasture etc.). Košulič (2015) found this species in the Třesín NNM which is located in the same region with similar nature conditions. Therefore, these findings in Špraněk NNR and Třesín NNM (Košulič, 2015) are among the northernmost occurrences in the Czech Republic, even in the whole distribution area of this Pannonian spider species (Fig. 2).

Data: Site 3, 22. 8. 2013, ic, 1$; Site 3, 25. 9.–25. 10. 2013, pt, 1$, det. MR

Linyphiidae

***Nematogmus sanguinolentus* (Walckenaer, 1841) C, R, VU**

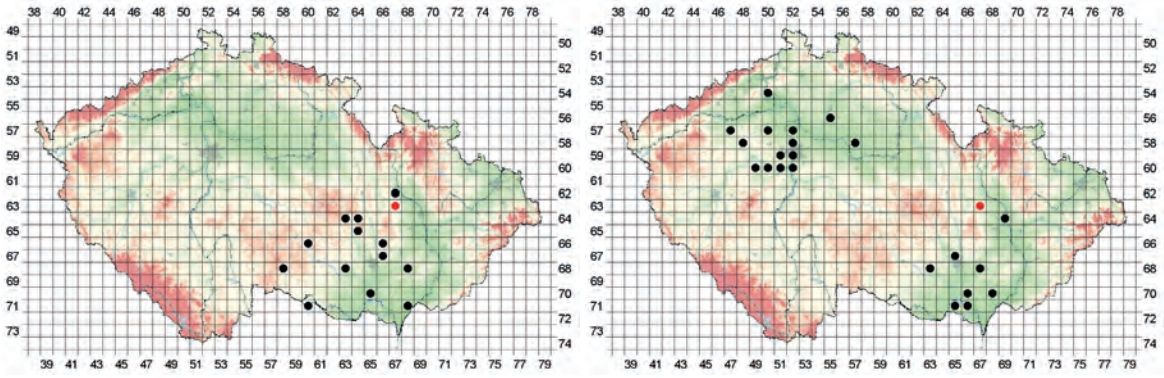
A rare species typical by orange colour of the body. In the Czech Republic, this species is known from steppe and forest steppe habitats in the warmest regions. According to Bryja *et al.* (2005), it is quite common in southern Moravia, on dry and sunny stands where it prefers localities on sandy or loess soils. Only one specimen was found in sunny and dry habitats of the peak of Špláz in the eastern part of locality. This finding is one of the northernmost occurrence of this rare species of spider from Moravia region (Fig. 3).

Data: Site 2, 29. 4.–7. 6. 2013, sw, 1$, det. OK.

Lycosidae

***Alopecosa sulzeri* (Pavesi, 1873) C, R, VU**

This species is restricted to steppe habitats, it is also a dominant species on calcareous habitats and open sandy pasture lands (Buchar and Růžička, 2002; Bryja *et al.*, 2005). This is a rare thermophilic species occurring from lowlands to middle altitudes (Kůrka *et al.*, 2015). The species was discovered in two sampling plots. Altogether, 11 specimens were found in sunny and dry habitats of sparse oak forest stands and, surprisingly, 10 specimens were caught in more humid beech forest stands with presence of limestone blocks. This finding is one of



2: *Distribution of Dysdera moravica Řezáč, 2014 in the Czech Republic (red dot – studied locality).*

3: *Distribution of Nematogmus sanguinolentus (Walckenaer, 1841) in the Czech Republic (red dot – studied locality).*

the northernmost occurrence of this rare species of spider in the Moravia region (Fig. 4).

Data: Site 2, 29. 4.–7. 6. 2013, pt, 5*, 7. 6.–5. 7. 2013, pt, 3$, 25. 9.–25. 10. 2013, pt, 3$; Site 3, 29. 4.–7. 6. 2013, pt, 4*2$, 25. 9.–25. 10. 2013, pt, 4$, det. OK.

Phrurolithidae

***Phrurolithus pullatus* (Kulczyński, 1897) C, R, VU**

A rare species of spider which usually occur among grass on rock steppes of suitable location within Moravia region (Buchar and Růžička, 2002). According Bryja *et al.* (2005), this species is relatively common in southern Moravia, but restricted solely to limestone and grass steppes and their close vicinity. In central Moravia, there is only one finding in the rock steppe habitat near Olomouc (ČAS, 2017). Thus, the finding in the Špraněk NNR is one of the northernmost occurrence of this rare spider species from the Czech Republic (Fig. 5).

Data: Site 3, 29. 4. 2013, ls, 1*, det. OK.

Gnaphosidae

***Drassyllus pumilus* (C. L. Koch, 1839) C, R, EN**

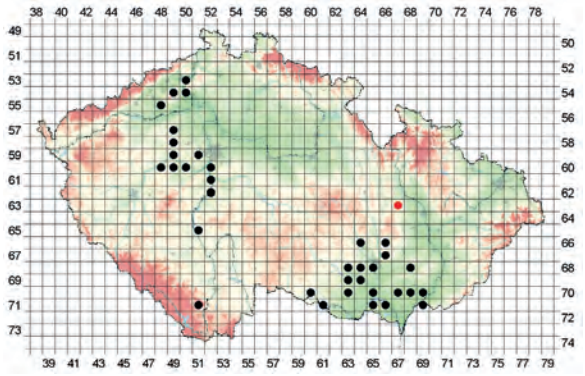
Xerothermophilic species of spider typical for rocky steppe habitats, forest steppes, very numerous on the slope of vineyard terraces (Košulič and Hula, 2013). Bryja *et al.* (2005) mentions relatively rich findings from south Moravia, however, only from those habitats situated on calcareous and limestone soil. The species is threatened by overgrowing of forest-steppe and steppe habitats due to absence of management. This finding is one of the northernmost occurrence of this rare species of spider from the Moravia region (Fig. 6).

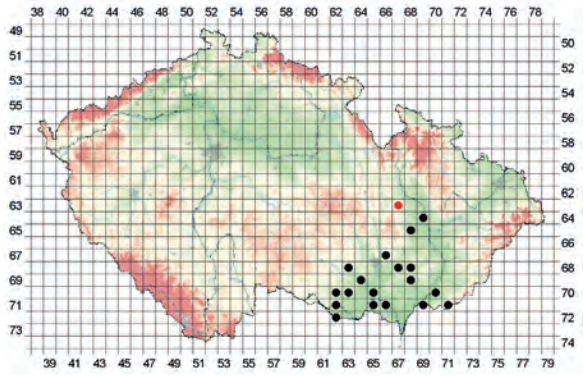
Data: Site 2, 29. 4.–7. 6. 2013, pt, 1*; Site 3, 25. 9.–25. 10. 2013, pt, 1$, det. OK.

***Zelotes electus* (C. L. Koch, 1839) C, SN, S, LC**

An epigeic rare species living under stones on rocky steppes and forest-steppes habitats like thermophilic oak forest stands (Buchar and Růžička, 2002). The presence of sufficient number of loose stones which are used by these spiders as their shelter is an important factor. According Bryja *et al.* (2005), quite common in southern Moravia, on dry and sunny stands where it prefers localities on sandy or loess soils. Both of the rare gnaphosid spiders (*D. pumilus* and *Z. electus*) were found in sunny and dry habitats of sparse oak forest around the peak of Špláz. This finding is one of the northernmost occurrence of this rare species of spider from the Moravia region (Fig. 7).

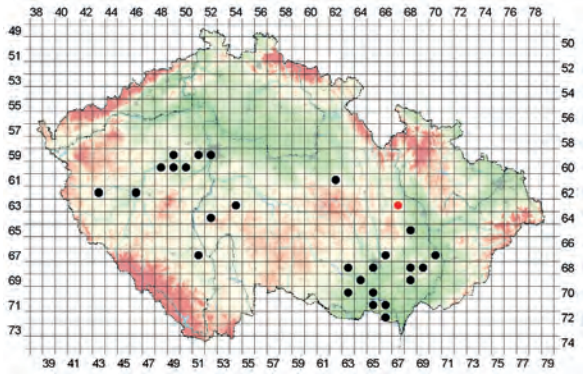
Data: Site 2, 7. 6.–5. 7. 2013, pt, 1*, det. OK.

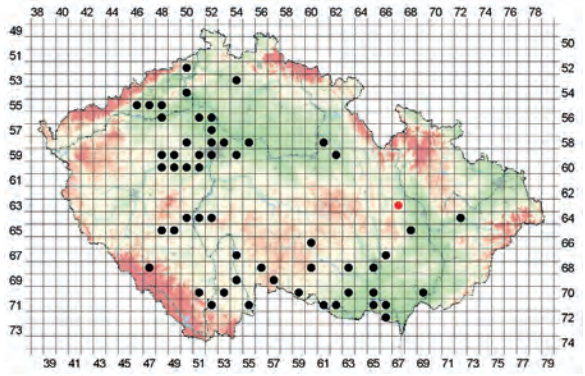




4: *Distribution of Alopecosa sulzeri (Pavesi, 1873) in the Czech Republic (red dot – studied locality).*

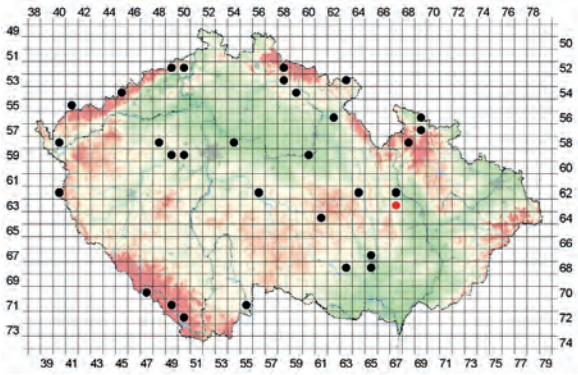
5: *Distribution of Phrurolithus pullatus (Kulczyński, 1897) in the Czech Republic (red dot – studied locality).*





6: *Distribution of Drassyllus pumilus (C. L. Koch, 1839) in the Czech Republic (red dot – studied locality).*

7: *Distribution of Zelotes electus (C. L. Koch, 1839) in the Czech Republic (red dot – studied locality).*



8: *Distribution of Salticus cingulatus (Panzer, 1797) in the Czech Republic (red dot – studied locality).*

Salticidae

***Salticus cingulatus* (Panzer, 1797) C, SN, S, LC**

A scarce species of jumping spider occurring on trunks of solitary trees in forest edges, clearings and forest-steppe habitats (Buchar and Růžička, 2002; Bryja *et al.*, 2005). This spider prefers open habitats with the presence of mature trees and sparse canopy along thermo to mesophyticum. It is likely that the species occurs mainly in oak forests along the edge of Špláz Hill. Here, only one specimen has been found by beating of lower branches. This species was also found in near location (Třesín, see Fig. 8) which is located in Litovelské Pomoraví PLA (Košulič, 2015).

Data: Site 2, 29. 4. 2013, bst, 1*, det. VH.

Suggestions on conservation management

According to the results, the most valuable parts of the Špraněk NNR include the sparse oak forest stands adjacent to the rocky habitats of Špláz Hill which are characterized by sparse canopies and high volumes of light conditions. These sites hosted the most endangered species which require specific microhabitat conditions formed by disturbed grass turf and non-continuous vegetation structure with exposed soil. These important conditions, crucial for a wide spectrum of rare invertebrates, are a result of blocked and partially suspended succession of rock habitats (Tropek *et al.*, 2010). Further, surrounding habitats such as thermophilic oak and oak-hornbeam forest stands were historically managed by old management methods such as coppicing, litter harvesting, thinning etc. (Šafář, 2003). These management activities blocked overgrowing of these habitats for several centuries which positively influences the diversity, abundance, and presence of important bioindicator species of invertebrates (e.g. Konvička *et al.*, 2006; Čížek *et al.*, 2013; Košulič *et al.*, 2014). It is very important to continue within these old silvicultural practices. It is also necessary to keep old, dead, and fallen trees as important shelters and microhabitats for various arthropods, e.g. cerambycid beetles (Vodka *et al.*, 2009), or spiders from the families Thomisidae, Philodromidae or Salticidae. Similar interventions would support species diversity and microhabitat conditions, especially for xeric and semixeric spiders and other arthropods (e.g. Spitzer *et al.*, 2008; Košulič *et al.*, 2016). Also, canopy opening in beech forest stands would certainly be very positive in otherwise dense forest stands within protected area (Košulič *et al.*, 2016). The opening of forest in the northern, western and southern part of the territory may create migratory corridors from warmer habitats of the eastern part (Špláz) to the western part (Zkamenělý zámek).

According the forest management of studied location, I evaluate non-native spruce monoculture stands (with minor admixture of pine and larch) very negatively. The coniferous monocultures which are located mainly in the fragmented parts of central and western part of locality, contained very low spider diversity. This community of spiders mainly contains euryvalent species without any specific requirements as is typical for monoculture spruce and larch stands (Buchar and Růžička, 2002; Kůrka *et al.*, 2015). As a part of the proposed management, it would be useful to propose the gradual replacement of secondary spruce stands by deciduous forest stands (*Quercus* spp., *Carpinus* spp., *Fagus* spp. *Ulmus* spp.), therefore supporting the natural species composition of trees (e.g. *Quercion pubescenti-petraeae* plant communities) within the protected area. I expect that similar management efforts may help to improve conditions for overall biodiversity within studied area.

II: *Checklist of collected species with ecological indicators, in taxonomical order. Explanations: Occurrence level: VA (very abundant), A (abundant), S (scarce), R (rare), VR (very rare); Habitat preference: C (climax), SN (seminatural), D (disturbed), A (artificial); Conservation status: CR (critically endangered), EN (endangered), VU (vulnerable), LC (least concern)*

Family	Species	Occurrence level	Habitat preference	Conservation status
Segestriidae	*Segestria senoculata* (Linné, 1758)	VA	C, SN	
Dysderidae	*Dysdera moravica* (Řezáč, 2014)	R	C	LC
	Harpactea hombergi (Scopoli, 1763)	A	C, SN	
	Harpactea lepida (C. L. Koch, 1838)	VA	C, SN	
	Harpactea rubicunda (C. L. Koch, 1838)	VA	C, SN, A	
Theridiidae	*Cryptachaea riparia* (Blackwall, 1834)	A	C, SN	
	Enoplognatha ovata (Clerck, 1757)	S	SN, D	
	Enoplognatha thoracica (Hahn, 1833)	A	C, SN, D	
	Neottiura bimaculata (Linné, 1767)	VA	C, SN, D	
	Phylloneta impressa (L. Koch, 1881)	VA	C, SN, D	
	Robertus arundineti (O. P.-Cambridge, 1871)	VA	C, SN	
	Robertus lividus (Blackwall, 1836)	VA	C, SN	
	Theridion varians (Hahn, 1833)	VA	C, SN, D	
Linyphiidae	*Agyneta saxatilis* (Blackwall, 1844)	A	C, SN, D	
	Bathyphantes gracilis (Blackwall, 1841)	VA	C, SN, D	
	Bathyphantes nigrinus (Westring, 1851)	VA	C, SN	
	Bathyphantes parvulus (Westring, 1851)	VA	C, SN	
	Centromerus sylvaticus (Blackwall, 1841)	VA	C, SN, D	
	Ceratinella brevipes (Westring, 1851)	S	C, SN	
	Diplocephalus picinus (Blacwall, 1841)	VA	C, SN	
	Diplostyla concolor (Wider, 1834)	VA	C, SN, D	
	Gonatium rubellum (Blackwall, 1841)	VA	C, SN	
	Ipa keyserlingi (Ausserer, 1867	R	C	VU
	Linyphia hortensis Sundevall, 1830	A	C, SN	
	Linyphia triangularis (Clerck, 1757)	VA	C, SN, D	
	Maso sundevalli (Westring, 1851)	VA	C, SN	
	Micrargus herbigradus (Blackwall, 1854)	VA	C, SN	
	Micrargus subaequalis (Westring, 1851)	VA	C, SN	
	Microneta viaria (Blackwall, 1841)	VA	C, SN	
	Nematogmus sanguinolentus (Walckenaer, 1841)	R	C	VU
	Oedothorax gibbosus (Blackwell, 1841)	VA	C, SN	
	Stemonyphantes lineatus (Linne, 1758)	A	C, SN, D	
	Tapinocyba affinis (Lessert, 1907)	A	C, SN	
	Tapinocyba insecta (L. Koch, 1869)	A	C, SN	
	Tenuiphantes alacris (Blackwall, 1853)	A	C, SN	
	Tenuiphantes cristatus (Menge, 1866)	VA	C, SN	
	Tenuiphantes flavipes (Blackwall, 1854)	VA	C, SN	
	Tenuiphantes tenebricola (Wider, 1834)	VA	C, SN	
	Tiso vagans (Blackwall, 1834)	A	C, SN, D	
	Trematocephalus cristatus (Wider, 1834)	A	C, SN	
	Walckenaeria atrotibialis (O. P.-Cambridge, 1878)	VA	C, SN	
	Walckenaeria corniculans (O. P.-Cambridge, 1875)	S	C, SN	
	Walckenaeria furcillata (Menge, 1869)	VA	C, SN	
	Walckenaeria obtusa Blackwall, 1836	A	C, SN	
Tetragnathidae	*Metellina mengei* (Blackwall, 1870)	VA	C, SN	
	Metellina segmentata (Clerck, 1757)	VA	C, SN, D	

Family	Species	Occurrence level	Habitat preference	Conservation status
Araneidae	*Aculepeira ceropegia* (Walckenaer, 1802)	VA	C, SN, D	
	Araneus diadematus Clerck, 1757	VA	C, SN, A	
	Araniella cucurbitina (Clerck, 1757)	VA	C, SN, D	
	Araniella opisthographa (Kulczynski, 1905)	S	C, SN	
	Cyclosa conica (Pallas, 1872)	VA	C, SN	
	Nuctenea umbratica (Clerck, 1757)	A	C, SN, A	
Lycosidae	*Alopecosa cuneata* (Clerck, 1757)	VA	C, SN, D	
	Alopecosa pulverulenta (Clerck, 1757)	VA	C, SN, D	
	Alopecosa sulzeri (Pavesi, 1873)	R	C	VU
	Alopecosa taeniata (C. L. Koch, 1835)	A	C, SN	
	Alopecosa trabalis (Clerck, 1757)	S	C, SN	
	Pardosa alacris (C. L. Koch, 1833)	S	C, SN	
	Pardosa hortensis (Thorell, 1872)	S	C, SN, D	
	Pardosa lugubris (Walckenaer, 1802)	VA	C, SN, D	
	Trochosa terricola Thorell, 1856	VA	C, SN, D	
	Xerolycosa miniata (C. L. Koch, 1834)	S	C, SN	
	Xerolycosa nemoralis (Westring, 1861)	VA	C, SN	
Pisauridae	*Pisaura mirabilis* (Clerck, 1757)	VA	C, SN, D	
Miturgidae	*Zora nemoralis* (Blackwall, 1861)	A	C, SN	
	Zora silvestris Kulczyński, 1897	A	C, SN	
	Zora spinimana (Sundevall, 1833)	VA	C, SN, D	
Agelenidae	*Coelotes terrestris* (Wider, 1834)	VA	C, SN	
	Histopona torpida (C. L. Koch, 1834)	VA	C, SN	
	Inermocoelotes inermis (L. Koch, 1855)	VA	C, SN	
	Tegenaria campestris (C. L. Koch, 1834)	S	C, SN	
	Tegenaria ferruginea (Panzer, 1804)	VA	C, SN, A	
Hahniidae	*Hahnia ononidum* Simon, 1875	S	C, SN	LC
Dictynidae	*Cicurina cicur* (Fabricius, 1793)	VA	C, SN, D	
	Nigma flavescens (Walckenaer, 1830)	A	C, SN	
Amaurobiidae	*Amaurobius fenestralis* (Ström, 1768)	VA	C, SN	
	Amaurobius ferox (Walckenaer, 1830)	S	A	
	Callobius claustrarius (Hahn, 1833)	A	C, SN	
Titanoecidae	*Titanoeca quadriguttata* (Hahn, 1833)	A	C, SN	
Anyphaenidae	*Anyphaena accentuata* (Walckenaer, 1802)	S	C, SN	
Liocranidae	*Agroeca brunnea* (Blackwall, 1833)	VA	C, SN	
	Agroeca cuprea Menge, 1873	S	C	LC
Clubionidae	*Clubiona neglecta* O. P.-Cambridge, 1862	VA	C, SN	
	Clubiona terrestris Westring, 1851	VA	C, SN	
Phrurolithidae	*Phrurolithus festivus* (C. L. Koch, 1835)	VA	C, SN	
	Phrurolithus pullatus (Kulczyński, 1897)	R	C	VU
Zodariidae	*Zodarion germanicum* (C. L. Koch, 1837)	S	C, SN	
Gnaphosidae	*Drassodes lapidosus* (Walckenaer, 1802)	VA	C, SN	
	Drassodes pubescens (Thorell, 1856)	VA	C, SN	
	Drassyllus praeficus (L. Koch, 1866)	A	C, SN	
	Drassyllus pumilus (C. L. Koch, 1839)	R	C	EN
	Drassyllus pusillus (C. L. Koch, 1833)	A	C, SN, D	
	Haplodrassus signifer (C. L. Koch, 1839)	VA	C, SN, D	
	Haplodrassus silvestris (Blackwall, 1833)	A	C, SN	

Family	Species	Occurrence level	Habitat preference	Conservation status
	Trachyzelotes pedestris (C. L. Koch, 1837)	S	C, SN	
	Zelotes apricorum (L. Koch, 1876)	S	C, SN	LC
	Zelotes electus (C. L. Koch, 1839)	S	C, SN	LC
	Zelotes latreillei (Simon, 1878)	VA	C, SN, D	
	Zelotes longipes (L. Koch, 1866)	R	C	LC
	Zelotes petrensis (C. L. Koch, 1839)	A	C, SN	
Philodromidae	*Philodromus albidus* Kulczyński, 1911	A	C, SN, D	
	Philodromus aureolus (Clerck, 1757)	VA	C, SN, D	
	Philodromus cespitum (Walckenaer, 1802)	VA	C, SN, D	
	Philodromus dispar Walckenaer, 1826	S	C, SN	
	Tibellus oblongus (Walckenaer, 1802)	S	CN	
Thomisidae	*Diaea dorsata* (Fabricius, 1777)	VA	C, SN	
	Ebrechtella tricuspidata (Fabricius, 1775)	S	C, SN	
	Ozyptila claveata (Walckenaer, 1837)	S	C	LC
	Ozyptila praticola (C. L. Koch, 1837)	S	C, SN	
	Synema globosum (Fabricius, 1775)	R	C, SN	LC
	Xysticus cristatus (Clerck, 1757)	VA	C, SN, D	
	Xysticus kochi Thorell, 1872	A	C, SN	
	Xysticus luctuosus (Blackwall, 1836)	A	C, SN	
	Xysticus robustus (Hahn, 1832)	R	C	VU
Salticidae	*Aelurillus v-insignitus* (Clerck, 1757)	VA	C, SN	
	Ballus chylabeius (Walckenaer, 1802)	A	C, SN	
	Euophrys frontalis (Walckenaer, 1802)	A	C, SN	
	Evarcha arcuata (Clerck, 1757)	VA	C, SN	
	Evarcha falcata (Clerck, 1757)	VA	C, SN	
	Evarcha laetabunda (C. L. Koch, 1846)	S	C	
	Heliophanus cupreus (Walckenaer, 1802)	A	C, SN	
	Heliophanus flavipes (Hahn, 1832)	A	C	
	Neon reticulatus (Blackwall, 1853)	VA	C, SN	
	Phlegra fasciata (Hahn, 1826)	A	C, SN	
	Pseudeuophrys erratica (Walckenaer, 1826)	A	C, SN	
	Salticus cingulatus (Panzer, 1797)	S	C, SN	LC

III: *The total abundances of specimens of spiders at individual sampling sites (in alphabetical order, for characterization of sites, see Material and Methods)*

	Species	Sum	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
1.	*Aculepeira ceropegia*	2		1						1
2.	*Aelurillus v-insignitus*	3		2	1					
3.	*Agroeca brunnea*	3	2						1	
4.	*Agroeca cuprea*	2		1	1					
5.	*Agyneta saxatilis*	2				1	1			
6.	*Alopecosa cuneata*	2			1	1				
7.	*Alopecosa pulverulenta*	7		1	3					3
8.	*Alopecosa sulzeri*	21		11	10					
9.	*Alopecosa taeniata*	3				1			2	
10.	*Alopecosa trabalis*	1		1						
11.	*Amaurobius fenestralis*	15	2		1	10	1	1		
12.	*Amaurobius ferox*	11	1		5	3	1	1		

	Species	Sum	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
13.	*Anyphaena accentuata*	2				2				
14.	*Araneus diadematus*	2	1			1				
15.	*Araniella cucurbitina*	1			1					
16.	*Araniella opisthographa*	1	1							
17.	*Ballus chalybeius*	2				1	1			
18.	*Bathyphantes gracilis*	4			2			2		
19.	*Bathyphantes nigrinus*	4				2			2	
20.	*Bathyphantes parvulus*	1	1							
21.	*Callobius claustrarius*	6			2	2	1		1	
22.	*Centromerus sylvaticus*	2	1							1
23.	*Ceratinella brevipes*	2	2							
24.	*Cicurina cicur*	3		1		1				1
25.	*Clubiona neglecta*	2		1			1			
26.	*Clubiona terestris*	9	1		4	1		2	1	
27.	*Coelotes terrestris*	170	102		20	47			1	
28.	*Cryptachaea riparia*	1	1							
29.	*Cyclosa conica*	3			1		1		1	
30.	*Diaea dorsata*	5	1			1	1			2
21.	*Diplocephalus picinus*	4	1			1		1	1	
32.	*Diplostyla concolor*	3	1		1	1				
33.	*Drassodes lapidosus*	11		11						
34.	*Drassodes pubescens*	15		5	10					
35.	*Drassyllus praeficus*	2			2					
36.	*Drassyllus pumilus*	2		1	1					
37.	*Drassyllus pusillus*	1		1						
38.	*Dysdera moravica*	2			2					
39.	*Ebrechtella tricuspidata*	1			1					
40.	*Enoplognatha ovata*	6			2	3			1	
41.	*Enoplognatha thoracica*	1			1					
42.	*Euophrys frontalis*	2			1		1			
43.	*Evarcha arcuata*	1				1				
44.	*Evarcha falcata*	2			1				1	
45.	*Evarcha laetabunda*	2			1	1				
46.	*Gonatium rubellum*	1			1					
47.	*Hahnia ononidum*	4		1	2				1	
48.	*Haplodrassus signifer*	2		2						
49.	*Haplodrassus silvestris*	39	7		11	20			1	
50.	*Harpactea hombergi*	2			2					
51.	*Harpactea lepida*	30	5		4	18	1	2		
52.	*Harpactea rubicunda*	6	2		1	1		1		1
53.	*Heliophanus cupreus*	13	3	4	4	2				
54.	*Heliophanus flavipes*	4		1	2				1	
55.	*Histopona torpida*	66	16	1	24	25				
56.	*Inermocoelotes inermis*	5	1			1	1	2		
57.	*Ipa keyserlingi*	1			1					
58.	*Linyphia hortensis*	10	5		3	2				
59.	*Linyphia triangluaris*	10	5		1	4				
60.	*Maso sundevalli*	2			1			1		
61.	*Metellina mengei*	7		2		2	2			1

	Species	Sum	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
62.	*Metellina segmentata*	4	2							2
63.	*Micrargus herbigradus*	5	3			1	1			
64.	*Micrargus subaequalis*	1			1					
65.	*Microneta viaria*	4		1		2			1	
66.	*Nematogmus sanguinolentus*	1		1						
67.	*Neon reticulatus*	2	1			1				
68.	*Neottiura bimaculata*	1				1				
69.	*Nigma flavescens*	1	1							
70.	*Nuctenea umbratica*	2			1				1	
71.	*Oedothorax gibbosus*	1	1							
72.	*Ozyptila claveata*	2		1	1					
73.	*Ozyptila praticola*	4				1	2		1	
74.	*Pardosa alacris*	210		50	160					
75.	*Pardosa hortensis*	28		12	16					
76.	*Pardosa lugubris*	53		10	24	19				
77.	*Philodromus albidus*	5	1		2				2	
78.	*Philodromus aureolus*	2	1						1	
79.	*Philodromus collinus*	3				1	1	1		
80.	*Philodromus dispar*	5	2			1			2	
81.	*Phlegra fasciata*	4			3				1	
82.	*Phrurolithus festivus*	2		1				1		
83.	*Phrurolithus pullatus*	1			1					
84.	*Phylloneta impressa*	4		1	2				1	
85.	*Pisaura mirabilis*	5		1	3	1				
86.	*Pseudeuophrys erratica*	2			1	1				
87.	*Robertus arundineti*	1							1	
88.	*Robertus lividus*	1				1				
89.	*Salticus cingulatus*	1		1						
90.	*Segestria senoculata*	3	1			1			1	
91.	*Stemonyphantes lineatus*	1			1					
92.	*Synema globosum*	2		1	1					
93.	*Tapinocyba affinis*	2			1	1				
94.	*Tapinocyba insecta*	1						1		
95.	*Tegenaria campestris*	3	1			2				
96.	*Tegenaria ferruginea*	2				2				
97.	*Tenuiphantes alacris*	3	1			1			1	
98.	*Tenuiphantes cristatus*	1	1							
99.	*Tenuiphantes flavipes*	7	3			4				
100.	*Tenuiphantes tenebricola*	1	1							
101.	*Theridion varians*	2		1			1			
102.	*Tibellus oblongus*	3	1							2
103.	*Tiso vagans*	3				2		1		
104.	*Titanoeca quadriguttata*	17		13	2		1		1	
105.	*Trachyzelotes pedestris*	5		1	1				2	1
106.	*Trematocephalus cristatus*	2					1	1		
107.	*Trochosa terricola*	8		2	3	3				
108.	*Walckenaeria atrotibialis*	3	1			1			1	
109.	*Walckenaeria corniculans*	1	1							
110.	*Walckenaeria furcillata*	4			3				1	

	Species	Sum	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
111.	*Walckenaeria obtusa*	1	1							
112.	*Xerolycosa miniata*	4		1	3					
113.	*Xerolycosa nemoralis*	164		84	77				3	
114.	*Xysticus cristatus*	3		2					1	
115.	*Xysticus kochi*	5		1	1	1				2
116.	*Xysticus luctuosus*	2	1			1				
117.	*Xysticus robustus*	1		1						
118.	*Zelotes apricorum*	13	1		2	8	2			
119.	*Zelotes electus*	1		1						
120.	*Zelotes latreillei*	3			1	1			1	
121.	*Zelotes longipes*	1			1					
122.	*Zelotes petrensis*	3		3						
123.	*Zodarion germanicum*	8		4	4					
124.	*Zora nemoralis*	2				1	1			
125.	*Zora silvestris*	1	1							
126.	*Zora spinimana*	5	1		1		1		1	1

CONCLUSION

In this study, araneocenosis of Špraněk NNR were investigated by various sampling methods during the year 2013. Altogether, 1195 specimens belonging to 126 species from 23 families were recorded. The most abundant species were representatives of the family Lycosidae – *Pardosa alacris* and *Xerolycosa nemoralis*. Species diversity within the Špraněk NNR is rather high, with representatives of approximately 14% of araneofauna in the Czech Republic. Of the entire araneocenosis, 12% species belonged to the Red List of Endangered Species of the Czech Republic. Among these rare and endangered species, e.g. *Agroeca cuprea, Alopecosa sulzeri, Drassyllus pumilus, Dysdera moravica, Ipa keyserlingi, Nematogmus sanguinolentus, Phrurolithus pullatus, Salticus cingulatus* and *Xysticus robustus* were included. Several findings represent the northernmost occurrences of these rare spiders in Moravia and even the Czech Republic. To conclude, I discovered diversified spider communities with a large occurrence of rare species of spiders typical for open and xeric habitats as well as for non-disturbed forest ecosystems. The results of this study confirm high biotic value of various forest and open habitats of Špraněk NNR in Czech Republic's otherwise rather homogeneous landscape.

Acknowledgment

The author would like to thank to Milan Řezáč and Vladimír Hula for determination and revision of difficult-to-identify spider taxa. I must also thank to Šárka Mašová for her help with spider sampling during arachnological research in Špraněk and two reviewers for their useful suggestions and corrections of the manuscript during peer-review. This research was performed within the Operational Programme Environment project "Implementace soustavy NATURA 2000 na územích v péči AOPK ČR a jejich monitoring", supported by the European Regional Development Fund. The author was also financially supported by the Specific University Research Fund of the FFWT Mendel University in Brno [Reg. number: LDF_PSV_2017004/2017]).

REFERENCES

BIOLIB. 2017. *Biological Library*. [Online]. Available at: http://biolib.cz [Accessed: 2017, August 02].

BRYJA, V., SVATOŇ, J., CHYTIL, J. et al. 2005. Spiders (Araneae) of the Lower Morava Biosphere Reserve and closely adjacent localities (Czech Republic). *Acta Mus. Moraviae, Sci. Biol. (Brno)*, 90(1): 13–184.

BUCHAR, J. 1982. Publication of faunistic data from Czechoslovakia. *Věst. Čs. Společ. Zool.*, 46: 317–318.

BUCHAR., J. 1983. The classification of spider species in Bohemia, as an aid for bioindication of environmental quality [in Czech: Klasifikace druhů pavoučí zvířeny Čech, jako pomůcka k bioindikaci kvality životního prostředí]. *Fauna Bohem. Septentr.*, 8: 119–135.

BUCHAR, J. and RŮŽIČKA, V. 2002. *Catalogue of Spiders of the Czech Republic*. Praha: Peres.

CARDOSO, P., PEKÁR, S., JOCQUE, R. et al. 2011. Global patterns of guild composition and functional diversity of spiders. *PLoS ONE*, 6(6): e21710.

ČAS. 2017. *Czech Arachnological Society* [in Czech: Česká arachnologická společnost]. [Online]. Available at: http://www.arachnology.cz. [Accessed: 2017, July 02].
ČÍŽEK, O., VRBA, P, BENEŠ, J. et al. 2013. Conservation potential of abandoned military areas matches that of established reserves: plants and butterflies in the Czech Republic. *PLoS ONE*, **8(1)**: e53124.
HALDA, J. 2013. *Inventory Survey of Lichens in Špraněk NNR* [in Czech: *Závěrečná zpráva z lichenologického inventarizačního průzkumu NPR Špraněk*]. Deposited in: Agentura ochrany přírody a krajiny ČR, Litovel, 54 p.
HEIMER, S. and NENTWIG, W. 1991. *Spinnen Mitteleuropas: ein Bestimmungbusch*. Berlin und Hamburg: Verlag Paul Parey.
HULA, V., KOŠULIČ, O. and ŠŤASTNÁ, P. 2012. Spiders (Araneae) of selected sinkholes of Moravský kras Protected Landscape Area (Czech Republic). *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 60(1): 57–70.
HULA, V., NIEDOBOVÁ, J. and ŠEFROVÁ, H. 2014. Remarkable Spiders of Artificial Sandy Grassland Near Town Hodonín (Czech Republic). *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 62(1): 99–115.
JENIŠ, I. 2012. *Inventory Survey of Saproxylic Coleoptera in Špraněk NNR* [in Czech: *Inventarizační průzkum NPR Špraněk – saproxyličtí brouci (Coleoptera)*]. Deposited in: Agentura ochrany přírody a krajiny ČR, Litovel, 23 p.
KOČVARA, R. 2014. *Inventory Survey of Amphibians in Špraněk NNR* [in Czech: *Inventarizační průzkum NPR Špraněk – obojživelníci (Amphibia)*]. Deposited in: Agentura ochrany přírody a krajiny ČR, Litovel, 20 pp.
KONVIČKA, M., ČÍŽEK, L. and BENEŠ, J. 2006. *Ohrožený hmyz nížinných lesů: ochrana a management*. Olomouc: Sagittaria.
KOŠULIČ, O. 2014. Araneofauna of the Křéby National Nature Monument (Eastern Moravia, Czech Republic) with some notes to conservation management of the locality. *Acta Univ. Agric. Silvic. Mendelianae Brun.* 62(5): 991–1005.
KOŠULIČ, O. 2015. Spiders (arachnida: Araneae) from forest ecosystems of Třesín national nature monument (Litovelské pomoraví, Czech Republic) with suggestions to conservation management of the locality. *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 63(3): 751–767.
KOŠULIČ, O. and HULA, V. 2012. Investigation of spiders (Araneae) of the Nature Monument Jesličky (South Moravia, Czech Republic). *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 60(5): 125–136.
KOŠULIČ, O. and HULA, V. 2013. Rare and remarkable spiders (Araneae) from vineyard terraces in Pálava region (South Moravia, Czech Republic). *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 61(3): 663–676.
KOŠULIČ, O. and HULA, V. 2014. A Faunistic Study on Spiders (Araneae) from Vineyard Terraces in the Municipalities of Morkůvky and Mutěnice (South Moravia, Czech Republic). *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 62(1): 137–154.
KOŠULIČ, O., MICHALKO, R. and HULA, V. 2014. Recent artificial vineyard terraces as a refuge for rare and endangered spiders in a modern agricultural landscape. *Ecol. Eng.*, 68: 137–154.
KOŠULIČ, O., MICHALKO, R. and HULA, V. 2016. Impact of canopy openness on spider communities: Implications for conservation management of formerly coppiced oak forests. *PLoS ONE*, 11(2): e0148585.
KŮRKA, A., BUCHAR, J., KUBCOVÁ, L. et al. 2010. Pavouci (Araneae) chráněné krajinné oblasti Český kras. Spiders (Araneae) of the Bohemian Karst Protected Landscape Area (Czech Republic). *Bohem. cent., Praha*, 30: 5–100.
KŮRKA, A., ŘEZÁČ, M., MACEK, R. et al. 2015. *Spiders of the Czech Republic*. [in Czech: *Pavouci České republiky*]. Praha: Academia.
LOSÍK, J. 2013. *Inventory Survey of Mammals in Špraněk NNR* [in Czech: *Inventarizační průzkum NPR Špraněk – savci (Mammalia)*]. Deposited in: Agentura ochrany přírody a krajiny ČR, Litovel, 21 p.
MARC, P., CANARD, A. and YSNEL, F. 1999. Spiders (Araneae) useful for pest limitation and bioindication. *Agr. Ecosyst. Environ.*, 74(1–3): 229–273.
NENTWIG W., BLICK T., GLOOR D. et al. 2017. *Spiders of Europe*. Version 03.2017. [Online]. Available at: http://www.araneae.unibe.ch [Accessed: 2017, July 10].
PEARCE, J. L. and VENIER, L. A. 2006. The use of ground beetles (Coleoptera: Carabidae) and spiders (Araneae) as bioindicators of sustainable forest management: a review. *Ecol. Indic.*, 6(4): 780–793.
QUITT, E. 1971. *Climatic regions of Czechoslovakia* [in Czech: *Klimatické oblasti Československa*]. Studia Geographica 16. Brno: GÚ ČSAV Brno, 73 p.
ROBERTS, M. 1995. *Spiders of Britain & Northern Europe*. London: Harper Collins Publishers.
ŘEZÁČ, M. 2012. Distribution and spider's habitat for genus *Dysdera* in the Czech Republic [in Czech: Rozšíření a stanovištní nároky pavouků šestioček rodu *Dysdera* (Araneae: Dysderidae) v Česku]. *Příroda*, 30: 117–162.
ŘEZÁČ, M., GASPARO, F., KRÁL, J. et al. 2014. Integrative taxonomy and evolutionary history of a newly revealed spider *Dysdera ninnii* complex (Araneae: Dysderidae). *Zool. J. Linn. Soc.*, 172(2): 451–474.
ŘEZÁČ, M., KŮRKA, A., RŮŽIČKA, V. et al. 2015. Red List of Czech spiders: 3rd edition, adjusted according to evidence-based national conservation priorities, *Biologia*, 70(5): 645–666.
SPITZER, L., KONVIČKA, M., BENEŠ, J. et al. 2008. Does closure of traditionally managed open woodlands threaten epigeic invertebrates? Effects of coppicing and high deer densities. *Biol. Conserv.*, 141(3): 827–837.

STANOVSKÝ, J. 2012. *Inventory Survey of Phytophagous Coleoptera in Špraněk NNR*. [in Czech: *Inventarizační průzkum NPR Špraněk – fytofágní brouci (Coleoptera)*]. Deposited in: Agentura ochrany přírody a krajiny ČR, Litovel, 24 p.
ŠAFÁŘ, J. 2003. Olomoucko. In: MACKOVČIN, P. and SEDLÁČEK, M. (Eds.) *Protected Area of the Czech Republic* [in Czech: *Chráněná území ČR*]. Svazek VI. Praha: AOPK ČR a EkoCentrum Brno, 456 p.
TROPEK, R., KADLEC, T., KAREŠOVÁ, P. et al. 2010. Spontaneous succession in limestone quarries as an effective restoration tool for endangered arthropods and plants. *J. App. Ecol*., 47: 139–147.
VODKA, S., KONVIČKA, M. and ČÍŽEK, L. 2009. Habitat preferences of oak-feeding xylophagous beetles in a temperate woodland: implications for forest history and management. *J. Ins. Conserv*., 13: 553–562.
WISE, D. H. 1993. *Spiders in ecological webs*. Cambridge: Cambridge University Press.
WORLD SPIDER CATALOG. 2017. *World Spider Catalog*. Version 18.0. [Online]. Available at: http://wsc.nmbe.ch [Accessed: 2017, July 31].

Contact information
Ing. Ondřej Košulič, Ph.D.:: ondra.kosulic@seznam.cz