

## Spiders and harvestmen on tree trunks obtained by three sampling methods

Ondřej Machač & Ivan H. Tuf



doi: 10.5431/aramit5110

**Abstract.** We studied spiders and harvestmen on tree trunks using three sampling methods. In 2013, spider and harvestman research was conducted on the trunks of selected species of deciduous trees (linden, oak, maple) in the town of Přerov and a surrounding floodplain forest near the Bečva River in the Czech Republic. Three methods were used to collect arachnids (pitfall traps with a conservation fluid, sticky traps and cardboard pocket traps). Overall, 1862 spiders and 864 harvestmen were trapped, represented by 56 spider species belonging to 15 families and seven harvestman species belonging to one family. The most effective method for collecting spider specimens was a modified pitfall trap method, and in autumn (September to October) a cardboard band method. The results suggest a high number of spiders overwintering on the tree bark. The highest species diversity of spiders was found in pitfall traps, evaluated as the most effective method for collecting harvestmen too.

**Keywords:** Araneae, arboreal, bark traps, Czech Republic, modified pitfall traps, Opiliones

Trees provide important microhabitats for arachnids including specific microclimatic and structural conditions in the bark cracks and hollows (Wunderlich 1982, Nikolai 1986). Some species lives on tree trunks throughout the year, whereas other spiders use trees only for a certain period, mainly during overwintering (Horváth et al. 2001, 2004). Facultative bark-dwelling spiders which usually live in the canopies are found on trees only in late autumn to early spring, i.e. in season when deciduous trees are without leaves (Horváth & Szinetár 2002).

Bark-dwelling spiders are relatively rarely studied. Information on bark-dwelling spiders are scattered in studies focused on the diversity of fauna of particular forest habitats (e.g. Weiss 1995, Horváth & Szinetár 2002, Blick 2011) or parks and towns (e.g. Hansen 1992, Horváth & Szinetár 1998). Applied research may study bark-dwelling spiders as pest-control agents in orchards (e.g., Bogyá et al. 1999, Pekár 1999). Some studies are focused specifically on spider biology, e.g. overwintering (Pekár 1999, Spitzer et al. 2010) or habitat stratification (e. g. Simon 1994). Several species find shelter on tree trunks during harsh conditions, e.g. floods (Zulka 1989, Marx et al. 2012). In Europe, several hundreds of spider species were reported on the bark of different tree species (Szinetár & Horváth 2006, Blick 2011).

Different methods can be used to collect arachnids living on tree trunks. The most popular ones are arboreal eclectors placed on trunks (e.g. Albrecht 1995, Kubcová & Schläghammerký 2002, Blick 2011) or branches in canopies (e.g. Koponen 2004, Moeed & Meads 1983, Simon 1995). Another method is the bark trap which can be made from wrapped cardboard (e.g. Bogyá et al. 1999, Horváth & Szinetár 1998, 2002, Horváth et al. 2001, 2004, 2005) or polyethylene bubble film (Isaia et al. 2006). Pitfall traps (i.e. Barber traps) were adopted to sample trunk inhabiting invertebrates too (e.g. Pinzon & Spence 2008). Canopy-inhabiting invertebrates can be sampled by fogging (e.g. Otto & Floren 2007), window traps, various types of eclectors or direct beating of branches (Bolzern & Hänggi 2005, Blick & Gossner 2006, Aguilar 2010), but these methods are expensive, time-consuming or difficult.

This study is focused on the comparison of the species spectrum of spiders and harvestmen obtained by three simple low-cost trap designs – modified pitfall traps, cardboard bands and sticky traps.

### Material and methods

The study was carried out in Přerov Town (49°26'58"N, 17°27'23"E) and a surrounding floodplain forest fragment (49°28'8"N, 17°29'7"E) in the Czech Republic. Both localities are situated at 220 m a.s.l. Spiders and harvestmen were sampled on the trunks of three different species of deciduous trees (Littleleaf linden – *Tilia cordata*, Norway maple – *Acer platanoides*, English oak – *Quercus robur*) using three different methods. Simple pitfall traps were made from the 1.5-litre plastic bottles (Fig. 1) filled with 0.25 litre of a saturated solution of salt (NaCl). Sticky traps were made from ordinary transparent sticky tape 20 cm wide and 40 cm long covered with a layer of glue 95-10-0220 used against tree pests (tape Stromset made by Propher, Fig. 2). Cardboard bands were made from corrugated cardboard 20 cm wide and 40 cm long (Fig. 3). Altogether, 90 traps were installed on 90 trees (each tree with one trap, 15 traps for each method in the forest as well as in the town, i.e. 45 trees in the forest and 45 trees in the town). The tree species were equally sampled by different traps in the forest and in the town (15 lindens, 15 maples and 15 oaks in both forest and town). Traps were placed on the tree trunks at a height of 4 m. Traps were exposed from May 5<sup>th</sup> to October 27<sup>th</sup> 2013 and sampled monthly. Spiders and harvestmen were identified to species level using common identification keys (Miller 1971, Šilhavý 1971, Nentwig et al. 2015). Nomenclature follows the World Spider Catalog (2015) and Martens (2013).

### Results

Overall, 1862 spiders and 864 harvestmen were trapped, representing 56 spider species from 15 families and seven harvestman species from one family (Tab. 1). One third of all spiders were immature specimens (*Clubiona* 57 %, *Theridion* 23 %, *Philodromus* 20 %). Juveniles of Linyphiidae, which could not be determined to genus level, were not counted. Although the number of recorded individuals was higher in the forest than in town, the number of species was similar between the localities (39 vs. 39 species of spiders and seven vs. five harvestman species respectively). The highest number of species and specimens of spiders and harvestmen were found on oak. A total of 1133 spiders belonging to 48 species and

This contribution was presented at the 29th European Congress of Arachnology, Brno, 2015 August 24-28.

Ondřej MACHAČ, Ivan H. TUF, Department of Ecology and Environmental Sciences, Faculty of Science, Palacký University Olomouc, Czech Republic; E-mail: machac.ondra@seznam.cz, ivan.tuf@upol.cz

submitted 30.10.2015, accepted 15.2.2016, online 6.3.2016



**Fig. 1:** Pitfall trap made from a plastic bottle

**Fig. 2:** Sticky trap

**Fig. 3:** Cardboard band trap

805 harvestmen belonging to seven species were captured in modified pitfall traps. In total 16 spider species were recorded by pitfall trapping exclusively (30 % of all species sampled by this method). The most abundant taxa obtained using this method were *Anyphaena accentuata*, *Clubiona pallidula* (*Clubiona* sp.), *Drapetisca socialis* and the harvestman *Rilaena triangularis*. A total of 560 spiders belonging to 31 species but only 27 (mainly immature) harvestmen were sampled by cardboard bands (Tab. 1). Four spider species were obtained by this method exclusively (13 % of all species recorded by this method). The most abundant taxa obtained using this method were *Clubiona pallidula* and *Nuctenea umbratica*. A total of 169 spiders belonging to 24 species and 32 harvestmen belonging to three species were stuck on sticky traps. Three spider species were sampled by sticky traps exclusively (11 % of all species captured by this method). The most abundant taxa obtained with this method were *Philodromus* sp. and *Drapetisca socialis*. The number of spider and harvestman

specimens trapped in pitfall traps was the highest in May at both localities (Fig. 4), whereas the number of species was the highest in July (Fig. 5). The effectivity of cardboard bands (both in the number of individuals and species) was highest in October (Figs 4, 5). Only 11 species of spiders were trapped by all methods, other species were recorded by one method exclusively, or by a combination of two methods (Tab. 1).

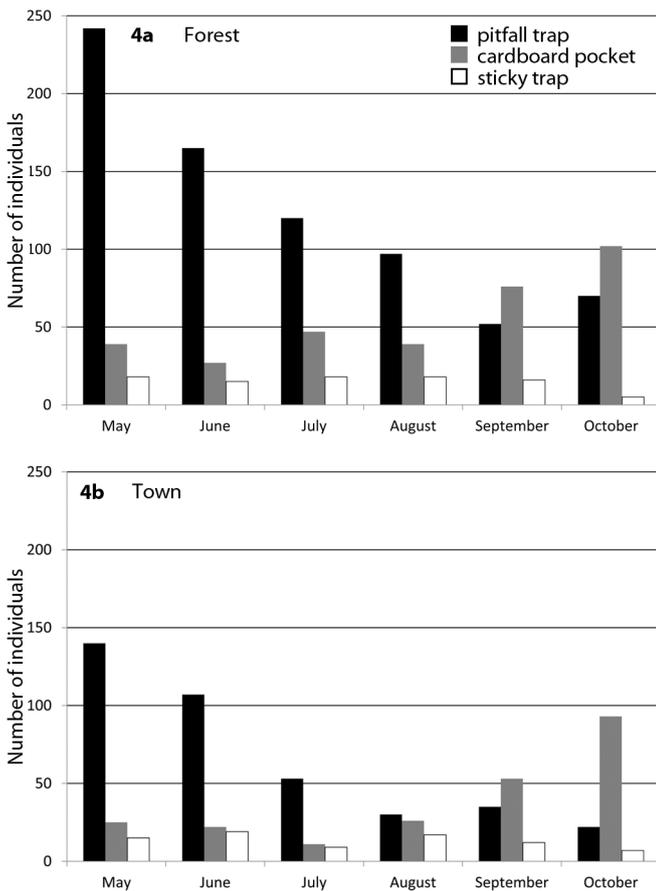
### Discussion

The 56 spider species collected during this study mostly represent common arboreal species. The number of spider species is low in comparison with some other methods like eclectors (e.g. Albert 1976, Platen 1985, Simon 1995, Koponen 1996, Blick 2009, 2012). Evidently, trunk eclectors are much more effective in sampling the whole spider species spectrum compared to our methods. Using trunk eclectors in different forests in Germany Blick (2011) found a total of 334 spider species between 1990 and 2003. In a different project (Blick

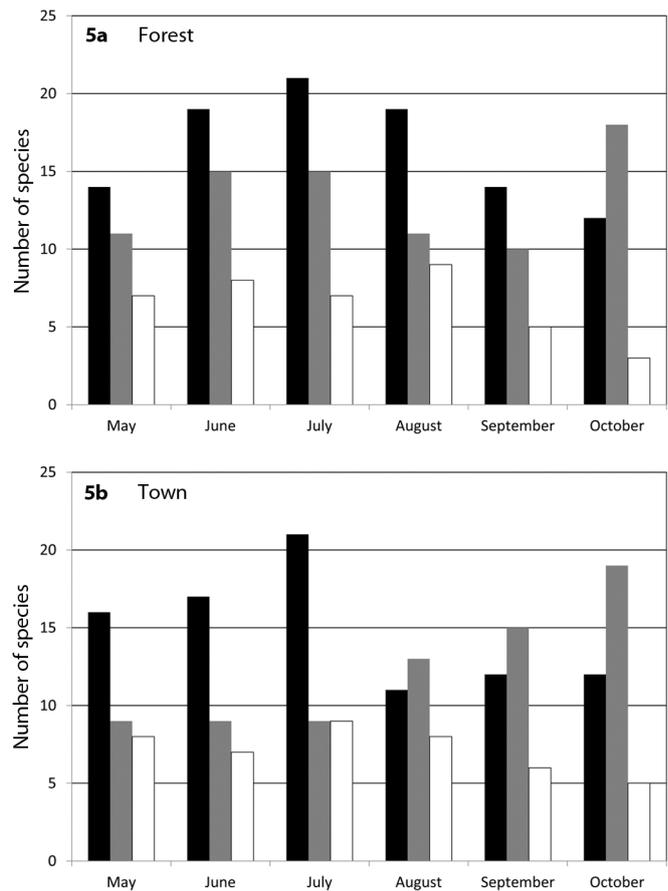
**Tab. 1:** List of all collected spiders and harvestmen species and the number of specimens collected at two localities and by three different methods. L – linden, O – oak, M – maple; PT – pitfall traps, CB – cardboard bands, ST – sticky traps. Bold numbers indicate trapping exclusively with one method.

Species/Family	Locality		Tree			Method		
	Forest	Town	L	O	M	PT	CB	ST
<b>Araneae</b>								
<b>Segestriidae</b>								
<i>Segestria senoculata</i> (Linnaeus, 1758)	1	3	.	3	1	3	1	.
<b>Mimetidae</b>								
<i>Ero furcata</i> (Villers, 1789)	1	.	.	1	.	<b>1</b>	.	.
<b>Theridiidae</b>								
<i>Anelosimus vittatus</i> (C. L. Koch, 1836)	2	12	9	.	5	13	1	.
<i>Dipoena melanogaster</i> (C. L. Koch, 1837)	4	4	.	8	.	4	3	1
<i>Enoplognatha ovata</i> (Clerck, 1757)	12	2	3	9	2	10	.	4
<i>Parasteatoda lunata</i> (Clerck, 1757)	8	7	6	3	6	12	3	.
<i>Parasteatoda simulans</i> (Thorell, 1875)	.	1	1	.	.	.	.	<b>1</b>
<i>Platnickina tincta</i> (Walckenaer, 1802)	24	23	10	31	6	10	24	13
<i>Steatoda bipunctata</i> (Linnaeus, 1758)	.	2	.	2	.	.	<b>2</b>	.
<i>Theridion mystaceum</i> L. Koch, 1870	22	14	9	21	6	.	29	7
<i>Theridion varians</i> Hahn, 1833	4	10	6	7	1	9	1	4
<i>Theridion</i> sp. (juv.)	61	42	40	46	17	50	17	36
<b>Linyphiidae</b>								
<i>Agyneta innotabilis</i> (O. P.-Cambridge, 1863)	.	11	.	7	4	9	.	2
<i>Agyneta rurestris</i> (C. L. Koch, 1836)	7	2	5	4	.	7	1	1
<i>Bathypantes</i> sp. (juv.)	1	.	.	1	.	<b>1</b>	.	.
<i>Drapetisca socialis</i> (Sundevall, 1833)	95	24	69	21	29	99	4	16
<i>Entelecara acuminata</i> (Wider, 1834)	13	12	7	2	16	22	.	3
<i>Erigone atra</i> Blackwall, 1833	.	1	1	.	.	.	.	<b>1</b>
<i>Hypomma cornutum</i> (Blackwall, 1833)	12	.	.	12	.	7	5	.
<i>Leptyphantes minutus</i> (Blackwall, 1833)	80	15	17	39	39	53	42	.
<i>Moebelia penicillata</i> (Westring, 1851)	24	20	20	12	12	10	34	.
<i>Neriere montana</i> (Clerck, 1757)	13	.	.	13	.	2	11	.

Species/Family	Locality		Tree			Method		
	Forest	Town	L	O	M	PT	CB	ST
<i>Tenuiphantes flavipes</i> (Blackwall, 1854)	2	2	.	2	2	3	.	1
<i>Trematocephalus cristatus</i> (Wider, 1834)	8	6	4	2	8	11	1	2
<b>Tetragnathidae</b>								
<i>Pachygnatha listeri</i> Sundevall, 1830	1	.	.	1	.	1	.	.
<i>Tetragnatha pinicola</i> L. Koch, 1870	4	2	1	5	.	2	.	4
<b>Araneidae</b>								
<i>Araneus</i> sp. (juv.)	.	8	.	.	8	6	.	2
<i>Gibbaranea gibbosa</i> (Walckenaer, 1802)	.	3	3	.	.	3	.	.
<i>Larinioides scolopetarius</i> (Clerck, 1757)	.	4	4	.	.	4	.	.
<i>Nuctenea umbratica</i> (Clerck, 1757)	24	45	8	30	31	20	49	.
<i>Zygiella atrica</i> (C. L. Koch, 1845)	.	1	.	.	1	1	.	.
<b>Agelenidae</b>								
<i>Agelena labyrinthica</i> (Clerck, 1757)	.	1	.	.	1	.	1	.
<i>Eratigena atrica</i> (C. L. Koch, 1843)	.	1	1	.	.	1	.	.
<i>Tegenaria silvestris</i> (L. Koch, 1872)	5	.	.	3	2	4	.	1
<b>Dictynidae</b>								
<i>Brigittea civica</i> (Lucas, 1850)	.	2	2	.	.	1	.	1
<i>Dictyna uncinata</i> Thorell, 1856	1	.	1	.	.	.	.	1
<i>Emblyna annulipes</i> (Blackwall, 1846)	.	2	.	.	2	.	2	.
<i>Lathys humilis</i> (Blackwall, 1855)	4	.	.	3	1	3	1	.
<i>Nigma flavescens</i> (Walckenaer, 1830)	2	.	.	2	.	1	.	1
<i>Nigma walckenaeri</i> (Roewer, 1951)	.	10	.	.	10	2	8	.
<b>Eutichuridae</b>								
<i>Cheiracanthium mildei</i> L. Koch, 1864	.	10	1	.	9	5	5	.
<b>Anyphaenidae</b>								
<i>Anyphaena accentuata</i> (Walckenaer, 1802)	241	114	78	214	73	316	33	6
<b>Clubionidae</b>								
<i>Clubiona brevipes</i> Blackwall, 1841	8	.	.	8	.	8	.	.
<i>Clubiona comta</i> C. L. Koch, 1839	3	.	1	2	.	2	1	.
<i>Clubiona lutescens</i> Westring, 1851	.	3	2	.	1	2	1	.
<i>Clubiona pallidula</i> (Clerck, 1757)	175	124	62	184	53	105	191	3
<i>Clubiona</i> sp. (juv.)	202	54	68	114	74	175	51	30
<b>Gnaphosidae</b>								
<i>Micaria subopaca</i> Westring, 1861	3	.	.	3	.	2	1	.
<b>Philodromidae</b>								
<i>Philodromus albidus</i> Kulczyński, 1911	1	13	10	.	4	10	1	3
<i>Philodromus</i> sp. (juv.)	23	47	17	31	22	53	.	17
<b>Thomisidae</b>								
<i>Ozyptila praticola</i> (C. L. Koch, 1837)	36	4	.	40	.	11	29	.
<i>Pistius truncatus</i> (Pallas, 1772)	5	.	1	4	.	.	5	.
<i>Synema globosum</i> (Fabricius, 1775)	1	.	.	1	.	1	.	.
<i>Xysticus lanio</i> C. L. Koch, 1835	18	.	2	12	4	18	.	.
<b>Salticidae</b>								
<i>Ballus chalybeius</i> (Walckenaer, 1802)	8	5	3	10	.	13	.	.
<i>Evarcha falcata</i> (Clerck, 1757)	1	.	.	1	.	1	.	.
<i>Salticus scenicus</i> (Clerck, 1757)	.	8	5	.	3	8	.	.
<i>Salticus zebraneus</i> (C. L. Koch, 1837)	9	19	7	17	4	18	4	6
<b>Opiliones</b>								
<b>Phalangiidae</b>								
<i>Lacinius dentiger</i> (C. L. Koch, 1847)	3	1	.	2	2	4	.	.
<i>Lacinius ephippiatus</i> (C. L. Koch, 1935)	17	6	.	11	12	23	.	.
<i>Mitopus morio</i> (Fabricius, 1799)	1	.	.	.	1	1	.	.
<i>Opilio canestrinii</i> (Thorell, 1876)	7	20	5	12	10	26	1	.
<i>Opilio saxatilis</i> C. L. Koch, 1839	3	.	3	.	.	1	.	2
Phalangiidae spp. (juv.)	26	.	.	26	.	.	26	.
<i>Phalangium opilio</i> Linnaeus, 1761	12	1	4	7	2	9	.	3
<i>Rilaena triangularis</i> (Herbst, 1799)	566	202	203	471	94	741	.	27



**Fig. 4:** Number of spider specimens obtained by three sampling methods during one year (total number); above (4a) – forest, below (4b) – town



**Fig. 5:** Number of spider species obtained from three sampling methods during one year (total number); above (5a) – forest, below (5b) – town

2010), 105–151 spider species was sampled using just 8 eclectors in different forest reserves in Hesse (Germany). Similarly, Platen (1985) sampled 69 species using just one eclector.

Nevertheless, in comparison with other studies using modified pitfall traps, its efficiency was similar: Weiss (1995) found 57 species and Machač (2014) found 33 spider species and 3 harvestman species from 18 traps contrary to 48 species recorded by pitfall traps in this study. We trapped relatively more harvestman species than has been published (Sührig & Rothländer 2006), but without some typical bark-dwelling species, e.g. from the genus *Leiobunum*. The number of species can also be influenced by the type of locality, both localities are relatively disturbed and without protected nature status.

Most of the collected spider species in the forest are widespread, silvicolous spiders with a known arboreal occurrence (Szinétár & Horváth 2006). In the town, synanthropic species of spiders were collected too, e.g. *Brigittea civica*, *Cheiracanthium mildei* and *Nigma walckenaeri* (Buchar & Růžička 2002). The most dominant species found in the town and the forest are the common spider species *Anyphaena accentuata*, *Clubiona pallidula* and the harvestman *Rilaena triangularis*, known from previous studies (e.g. Horváth et al. 2001, Horváth & Szinetár 2002). The greatest number of spider specimens collected using cardboard bands were obtained during September and October (almost 60% of them). The exclusive species recorded in cardboard bands were *Agelena labyrinthica*, *Emblina annulipes*, *Pistius truncatus* and *Steatoda bipunctata*. Tree trunks provide important shelters for the overwintering of spiders (Pekár 1999, Horváth & Szinetár 2002, Szinetár

& Horváth 2006). Corrugated cardboard bands simulate tree bark asperities and spiders used them preferably (Isaia et al. 2006). During summer months, these cardboard bands are inhabited mostly by females with egg sacs, e.g. *Clubiona pallidula*, *Nuctenea umbratica* or *Ozyptila praticola*, which provide calm and warm shelters. Similarly, the spider *Oreonetides quadridentatus* is known to migrate onto tree trunks from soil during spring (Kopecký & Tuf 2013). Cardboard bands seem to be effective for sampling species living under bark or overwintering on trunks. On the contrary, this method is not suitable for harvestmen as only one aggregation of unidentified juveniles was found.

The pitfall traps made from PET bottles obtained the most spider specimens and the largest number of spider species (48) as well as harvestmen species (seven). Also, the highest portion of exclusive species was recorded by this method, including a majority of specimens belonging to Araneidae and Salticidae as well as harvestmen. The highest number of spider and harvestman specimens was obtained by this method during May, including the harvestman *Rilaena triangularis* which is most active in this month (Klimeš 1990). Pinzon & Spence (2008) found only 33 species on trunks using trunk pitfall traps in the forests of Canada. Trunk pitfall traps are, however, very effective for sampling of spiders and harvestmen living on tree trunks (Weiss 1995).

The sticky trap method was not effective for arachnids at all. Twenty-four spider (mostly juveniles and small species) and three harvestman species were obtained using this method only. Moreover, harvestmen were usually damaged when

releasing them from the glue. This method is not usually used for sampling arachnids, but is suitable for monitoring ballooning spiders (e.g. Greenstone et al. 1985). Sticky traps are more suitable for flying insects, e.g. Coleoptera, Diptera or Hymenoptera (Horváth et al. 2005, Bar-Ness et al. 2012).

Based on our results, we can recommend pitfall trapping for sampling spiders and harvestmen from tree trunks. In autumn and during winter, this method can be combined (or replaced) with cardboard bands (bark traps) as an effective method to collect arachnids searching for overwintering shelters.

### Acknowledgements

We are thankful for financial support of the research to the project No. PrF\_2013\_016 of the Faculty of Science, Palacky University Olomouc.

### References

- Aguilar JC 2010 Methods for catching beetles. *Naturalia Scientifica Collection, Montevideo-Asuncion*. 303 pp.
- Albert R 1976 Zusammensetzung und Vertikalverteilung der Spinnfauna in Buchenwäldern des Solling. – *Faunistisch-ökologische Mitteilungen* 5: 65-80
- Albrecht H 1995 Stammeklektorenfänge von Spinnen (Araneae) in Laubwaldgesellschaften des ehemaligen Militärgeländes "Hohe Schrecke-Finne" (Nordthüringen). – *Veröffentlichungen des Naturkundemuseums Erfurt* 14: 67-79
- Bar-Ness YD, McQuillan PB, Whitman M, Junker MR, Cracknell M & Barrows A 2012 Sampling forest canopy arthropod biodiversity with three novel minimal-cost trap designs. – *Australian Journal of Entomology* 51: 12-21 – doi: [10.1111/j.1440-6055.2011.00836.x](https://doi.org/10.1111/j.1440-6055.2011.00836.x)
- Blick T & Gossner M 2006 Spinnen aus Baumkronen-Klopfproben (Arachnida: Araneae), mit Anmerkungen zu *Cinetata gradata* (Linyphiidae) und *Theridion boesenbergi* (Theridiidae). – *Arachnologische Mitteilungen* 31: 23-39 – doi: [10.5431/aramit3104](https://doi.org/10.5431/aramit3104)
- Blick T 2009 Die Spinnen (Araneae) des Naturwaldreservats Goldbachs- und Ziebachsrück (Hessen). Untersuchungszeitraum 1994-1996. In: Dorow WHO, Blick T & Kopelke J-P (eds) *Naturwaldreservate in Hessen. Band 11/2.1. Goldbachs- und Ziebachsrück. Zoologische Untersuchungen 1994-1996, Teil 1.* – *Mitteilungen der Hessischen Landesforstverwaltung* 45: 57-138
- Blick T 2010 Spiders coenoses in strict forest reserves in Hesse (Germany). In: Nentwig W, Entling M & Kropf C (eds) *European Arachnology 2008. Proceedings of the 24th European Congress of Arachnology*. Bern, Natural History Museum. pp. 11-29
- Blick T 2011 Abundant and rare spiders on tree trunks in German forests (Arachnida: Araneae). – *Arachnologische Mitteilungen* 40: 5-14 – doi: [10.5431/aramit4002](https://doi.org/10.5431/aramit4002)
- Blick T 2012 Die Spinnen (Araneae) des Naturwaldreservates Kinzigau (Hessen). Untersuchungszeitraum 1999-2001. In: Blick T, Dorow WHO & Kopelke J-P (eds) *Kinzigau. Zoologische Untersuchungen 1999-2001, Teil 1.* – *Naturwaldreservate in Hessen* 12: 53-124
- Bogya S, Szinetár C & Markó V 1999 Species composition of spider (Araneae) assemblages in apple and pear orchards in Central Basin. – *Acta Phytopathologica et Entomologica Hungarica* 34: 99-121
- Bolzern A & Hänggi A 2005 Spinnenfänge (Arachnida, Araneae) auf subalpinen Fichten der Alp Flix (GR, Schweiz) – ein Methodenvergleich. – *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 78: 125-141 – doi: [10.5169/seals-402886](https://doi.org/10.5169/seals-402886)
- Buchar J & Růžička V 2002 Catalogue of spiders of Czech Republic. Peres, Praha. 351 pp.
- Greenstone MH, Morgan CE & Hultsch AL 1985 Spider ballooning: development and evaluation of field trapping methods (Araneae). – *Journal of Arachnology* 13: 337-345
- Hansen H 1992 Über die Arachniden-Fauna von urbanen Lebensräumen in Venedig II. Die Rinde-bewohnenden Arten des Stammbereiches von *Platanus hybrida*. – *Bollettino del Museo civico di Storia naturale di Venezia* 41: 91-108
- Horváth R & Szinetár C 1998 Study of the bark-dwelling spiders (Araneae) on black pine (*Pinus nigra*) I. – *Miscellanea Zoologica Hungarica* 12: 77-83
- Horváth R & Szinetár C 2002 Ecofaunistic study of bark-dwelling spiders (Araneae) on black pine (*Pinus nigra*) in urban and forest habitats. – *Acta Biologica Debrecina* 24: 87-101
- Horváth R, Lengyel S, Szinetár C & Honti S 2004 The effect of exposition time and temperature on spiders (Araneae) overwintering on the bark of black pine (*Pinus nigra*). In: Samu F & Szinetár C (eds) *European Arachnology 2002*. Plant Protection Institute and Berzsenyi College, Budapest. pp. 95-102
- Horváth R, Lengyel S, Szinetár C & Jakab L 2005 The effect of prey availability on spider assemblages on Black Pine (*Pinus nigra*) bark: spatial patterns and guild structure. – *Canadian Journal of Zoology* 83: 324-335 – doi: [10.1139/z05-009](https://doi.org/10.1139/z05-009)
- Horváth R, Magura T & Szinetár C 2001 Effects of immission load on spiders living on black pine. – *Biodiversity and Conservation* 10: 1531-1542 – doi: [10.1023/A:1011819427941](https://doi.org/10.1023/A:1011819427941)
- Isaia M, Bona F & Badino G 2006 Comparison of polyethylene bubble wrap and corrugated cardboard traps for sampling tree-inhabiting spiders. – *Environmental Entomology* 35: 1654-1660 – doi: [10.1603/0046-225X\(2006\)35\[1654:COPBWA\]2.0.CO;2](https://doi.org/10.1603/0046-225X(2006)35[1654:COPBWA]2.0.CO;2)
- Klímeš L 1990 Vliv záplav na životní cyklus *Rilaena triangularis* (Herbst) (Opiliones). [Impact of floodings on the life cycle in *Rilaena triangularis* (Herbst) (Opiliones).] – *Sborník Jihočeského muzea v Českých Budějovicích, přírodní vědy* 30: 37-45 [in Czech]
- Kopecký O & Tuf IH 2013 Podzemní populace pavouka plachetnatky čtyřzubé (*Oreonetides quadridentatus* (Wunderlich, 1972)). [Subterranean population of spider *Oreonetides quadridentatus* (Wunderlich, 1972) (Araneae).] – *Západočeské entomologické listy* 4: 106-109 [in Czech]
- Koponen S 1996 Spiders (Araneae) on trunks and large branches in SW Finland, collected by a new trap type. – *Revue suisse de Zoologie*, hors série 1: 335-340
- Koponen S 2004 Arthropods from high oak branches – comparison of two trap types, with a special reference to spiders. – *Latvijas Entomologs* 41: 71-75
- Kubcová L & Schlaghamerský J 2002 Zur Spinnfauna der Stammregion stehenden Totholzes in süd-mährischen Auwäldern. – *Arachnologische Mitteilungen* 24: 35-61 – doi: [10.5431/aramit2403](https://doi.org/10.5431/aramit2403)
- Machač O 2014 Pavouci a sekáči na kmenech stromů Hostýnsko-vsetínské hornatiny. [Spiders and harvestmen on tree trunks in Hostýnsko-vsetínská highlands.] – *Acta Carpathica Occidentalis* 5: 64-67 [in Czech]
- Martens J 2013 Opiliones. Fauna Europaea, version 2.6. – Internet: <http://www.fauna-eu.org> (September 30, 2015)
- Miller F 1971 Rád Pavouci – Araneida. In: Daniel M & Černý V (eds) *Klíč zvířeny ČSSR IV.* [Key to the fauna of Czechoslovakia IV.] ČSAV, Praha. pp. 51-306 [in Czech]
- Moeed A & Meads MJ 1983 Invertebrate fauna of four tree species in Orongorongo valley, New Zealand, as revealed by trunk traps. – *New Zealand Journal of Ecology* 6: 39-53
- Nentwig W, Blick T, Gloor D, Hänggi A & Kropf C 2015 Spiders of Europe, version 09.2015. – Internet: <http://www.araneae.unibe.ch> (September 30, 2015)
- Nikolai V 1986 The bark of trees: thermal properties, microclimate and fauna. – *Oecologia* 69: 148-160 – doi: [10.1007/BF00399052](https://doi.org/10.1007/BF00399052)
- Otto S & Floren A 2007 The spider fauna (Araneae) of tree canopies in the Bialowieza Forest. – *Fragmenta Faunistica* 50: 57-70 – doi: [10.3161/00159301FF2007.50.1.057](https://doi.org/10.3161/00159301FF2007.50.1.057)
- Pekár S 1999 Some observations on overwintering of spiders (Araneae) in two contrasting orchards in the Czech Republic. – *Agriculture, Ecosystems & Environment* 73: 205-210 – doi: [10.1016/S0167-8809\(99\)00052-3](https://doi.org/10.1016/S0167-8809(99)00052-3)
- Pinzon J & Spence JR 2008 Performance of two arboreal pitfall trap designs in sampling cursorial spiders from tree trunks. – *Journal of Arachnology* 32: 280-286 – doi: [10.1636/CH07-97.1](https://doi.org/10.1636/CH07-97.1)
- Platen R 1985 Die Spinnentierfauna (Araneae, Opiliones) aus Boden und Baumelektoren des Staatswaldes Burgholz (MB 4708). –

- Jahresberichte des Naturwissenschaftlichen Vereins Wuppertal 38: 75-86
- Simon U 1994 Spider and harvestmen fauna (Arachnida: Araneae, Opiliones) of pine trees (*Pinus silvestris* L.) and its stratification. – *Bolletino dell'Accademia Gioenia di Scienze Naturali, Catania* 26 (345) (1993): 323-334
- Simon U 1995 Untersuchung der Stratozöosen von Spinnen und Weberknechten (Arachnoidea: Araneae, Opilionida) an der Waldkiefer (*Pinus sylvestris*). *Wissenschaft und Technik Verlag, Berlin*. 142 pp.
- Spitzer L, Konvička O, Tropek R, Roháčová M, Tuf IH & Nedvěd O 2010 Společenstvo členovců (Arthropoda) zimujících na jedli bělokoré na Valašsku (okr. Vsetín, Česká republika). [Assemblage of overwintering arthropods on white fir (*Abies alba*) in the Moravian Wallachia region (West Carpathians, Czech Republic).] – *Časopis Slezského Muzea Opava (A)* 59: 217-232 [in Czech]
- Sühlig A & Rothländer A 2006 Stammbewohnende Weberknechte (Arachnida: Opiliones) in einem Fichten-, einem Misch- und einem Buchenbestand im Solling. – *Arachnologische Mitteilungen* 32: 38-42 – doi: [10.5431/aramit3207](https://doi.org/10.5431/aramit3207)
- Szinetár C & Horváth R 2006 A review of spiders on tree trunks in Europe (Araneae). – *Acta zoologica bulgarica, Supplement* 1: 221-257
- Šilhavý V 1971 Sekáči – Opilionidea. In: Daniel M & Černý V (eds) *Klíč zvířeny ČSSR IV.* [Key to the fauna of Czechoslovakia IV.] ČSAV, Praha. pp. 33-49 [in Czech]
- Weiss I 1995 Spinnen und Weberknechte auf Baumstämmen im Nationalpark Bayerischer Wald. In: Růžička V (ed) *Proceedings of the 15th European Colloquium of Arachnology*. Czech Academy of Sciences, Institute of Entomology, České Budějovice. pp. 184-192
- World Spider Catalog 2015 World spider catalog, version 16.5. Natural History Museum Bern. – Internet: <http://wsc.nmbe.ch> (September 30, 2015)
- Wunderlich J 1982 Mitteleuropäische Spinnen (Araneae) der Baumrinde. – *Zeitschrift für angewandte Entomologie* 94: 9-21 – doi: [10.1111/j.1439-0418.1982.tb02540.x](https://doi.org/10.1111/j.1439-0418.1982.tb02540.x)
- Zulka KP 1989 Einfluß der Hochwässer auf die epigäische Arthropodenfauna im Überschwemmungsbereich der March (Niederösterreich). – *Mitteilungen der Deutschen Gesellschaft für allgemeine und angewandte Entomologie* 7: 74-75

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Arachnologische Mitteilungen](#)

Jahr/Year: 2016

Band/Volume: [51](#)

Autor(en)/Author(s): Machac Ondrej, Tuf Ivan H.

Artikel/Article: [Spiders and harvestmen on tree trunks obtained by three sampling methods 67-72](#)