OPERA CORCONTICA 38: 219–233, 2001

SPIDERS (ARANEAE) OF SHADED AND NON-SHADED SITES IN THE TUNDRA OF THE WESTERN GIANT MOUNTAINS (CZECH REPUBLIC)

Pavouci (*Araneae*) zastíněných a nezastíněných ploch v tundře západních Krkonoš (Česká republika)

ANTONÍN KŮRKA[1], JAN VANĚK[2]

[1] Department of Zoology, National Museum, Václavské náměstí 68, 115 79 Praha 1, Czech Republic

[2] Krkonoše National Park Administration, Dobrovského 3, 543 11 Vrchlabí, Czech Republic, e-mail: jvanek@krnap.cz

Arachnofauna of the topmost area of the western Giant Mts. was observed in the period 1997–1999. Species composition and abundance of particular populations have been assessed in spider communities of (1) sites shaded by shrubs or krummholz of dwarf pine and shrubby Norway spruce, and (2) open sites lacking any closed-canopy screening. The results confirm marked difference in species composition and size of population of spider communities in the above named habitats. Spider fauna of microrelief elevations and depressions induced by cryogenic processes (patterned grounds) within the non-shaded sites does not essentially differ between each other.

Keywords: spider fauna, *Pardosa saltuaria, Hilaira tatrica,* spider communities, closed-canopy effects, patterned grounds

INTRODUCTION

A number of data about spider fauna of the Giant Mountains were published in the second half of the 19th century (FICKERT 1876, ZIMMERMANN 1871, KOCH 1875, LEBERT 1875, NOSEK 1895). In the last century, arachnological research continued and was published by DAHL (1902, 1903), SCHENKEL (1929, 1930, 1939), PILAWSKI (1962, 1965) and BUCHAR (1967).Recent results of arachnological research in the Giant Mts. have been summarized by BUCHAR (1983). The following analysis follows Buchar´s earlier study of similar problems in treeless area of the Pančavská louka plateau.

Spiders in the surroundings of Stráž hill, situated below the treeline of the Giant Mts., were collected by ANTUŠ (1982) and BÍLEK (1985). Arachnofauna of the tundra above the treeline was studied on Studniční hora, Úpské rašeliniště and several plots in scree and stone debris by Růžička and associates (RŮŽIČKA et VANĚK 1997, RŮŽIČKA et ZACHARDA 1994).

Main goal of the following research was to assess differences in species composition and abundance of particular populations of spider communities inhabiting shaded and non-shaded habitats sites in the topmost areas of the Giant Mts. Moreover, observations executed in the course of this study should provide comparative data and deepening of zoogeographical knowledge available, so far, from the past studies of the spider communities.

MATERIAL AND METHODS

Study sites

Between 1997 and 1999, our research was carried out in the summit region of the western Giant Mts., between 1350 and 1400 m a.s.l. In the tundra area between the Hanč & Vrbata monument and Labská bouda, three sampling localities (A, B, C) were selected in the mat grassland classified by phytosociologists as the association *Carici fyllae-Nardetum* (within the alliance *Nardo-Caricion rigidae* Nordhagen1937), a community distributed in the subalpine zone of the topmost Giant Mts, often covering the patterned (polygonal) grounds created by cryogenic processes. In this area, open sites alternate with patches of closed-canopy krummholz of *Pinus mugo* ssp. *pumilio* and shrubby *Picea excelsa.*

Within the three sampling localities, several sites were chosen for the quantitative assessment of spider communities:

A. Labská louka plateau locality (**Ll**): 5259, 1 350 m a.s.l.
   a) Non-shaded habitats:
      1. top of an elevation within the polygonal grounds I (**EI**)
      2. top of an elevation within the polygonal grounds II (**EII**)
      3. stony depression between two elevated polygons (**SD**)
      4. top of an elevation within the polygonal grounds, covered by heath *Calluna vulgaris* (**C**)
   b) Shaded habitats:
      5. native krummholz I (**PI**)
      6. native krummholz II (**PII**)
      7. planted krummholz (**Pp**)
      8. spruce canopy I (**SI**)
      9. spruce canopy II (**SII**)

B. Harrachovy kameny (**Hk**): 5259, 1380 m a.s.l.
   a) Non-shaded habitat:
      10. moss cushion of *Polytrichum* sp. (**M**)
   b) Shaded habitat:
      11. native krummholz (**PIII**)

C. Locality near the Hanč & Vrbata monument (**HV**): 5259, 1400 m a.s.l.
      12. native krummholz (shaded habitat) (**PIV**)

Sampling methods

Samples for the assessments of population abundance were obtained by means of formalin pitfall traps (altogether 24 plastic pots, each 0.5 l in volume, one third of which was filled by 4 % formaldehyde), placed in pairs in each in the abovementioned habitat. These traps were installed on June 17, 1998, exposed through winter, and removed on October 23, 1999. Species composition of spider communities was assessed, between 1997 to 1999, in the herb and shrub layer of the pertinent sites by means of sweeping of herbs and beating of woody branches of dwarf pine and spruce.

Analysis of abundance in epigeic arachnofauna in the studied area was based on the set of 2970 adult specimen sampled by means of formalin pitfall traps from the complete annual course between June 17, 1998 and July 26, 1999 (the samples taken between July 26 and October 23, 1999 thus were not included). During the investigations altogether 5145 specimens of spiders were collected and determined. The material is stored in collections of the Zoological Department, National Museum, Prague.

Evaluation procedure

The following categories have been distinguished in the classification of collected spiders:
Species abundance **a** (BUCHAR 1993): I – abundant, II – frequent, III – rare

Thermic affinity **t** (BUCHAR 1993): P – psychrophilous species occurring only in the Oreophyticum, M – mesothermic species prevailing in the Mesophyticum, N – indifferent species with probable occurrence in the Thermophyticum, Mesophyticum and Oreophyticum, T – thermophilous species occurring only in Thermophyticum

Degree of indigenousness **i** (BUCHAR 1992, RŮŽIČKA et HEJKAL 1997): 1 – species of natural habitats, 2 – species of semi-natural habitats, 3 – species of man-made habitats. (All above-mentioned symbols are used in the following text as well.)
(Taxonomic nomenclature in the study follows that of BUCHAR, RŮŽIČKA et KŮRKA 1995).

RESULTS

1. Spider fauna of the studied area

Among the 73 species, found in the studied area, the indifferent category (31 species, 42.5 %) and psychrophilous category (29 species, 39.7 %) prevailed; only 6 species (8.2 %) were mesothermic (Tab. 1.). In accordance with the expectations, no specimen belonged to the thermophilous category (Tab. 1.).

Most species show the affinity to natural and semi-natural habitats (44 species, i.e., 60.3 %). Among them 17 species occur in habitats closely related to the respective climatic and edaphic climax, and can be considered as rare species (except for two species). Most of the collected spiders belong to psychrophilous category. Altogether 23 species (31.5 %) occupy man-induced habitats.

2. Spiders of the herb and shrub layer

The spider fauna of the vegetation layers is poor in numbers. By means of sweeping of herbs and beating of woody plants (dwarf pine and spruce) altogether 137 specimens belonging to 37 species of spiders were obtained, among which 10 species occurred only in herbs and 14 species only on shrubs (Tab. 2.). Representatives of *Lepthyphantes mughi*, *Dicymbium tibiale*, *Gongylidiellum murcidum*, *Lepthyphantes obscurus*, *Meioneta milleri*, *Porrhomma oblitum* and *Entelecara congenera* were most important. Occasionally, some epigeic species were found on the surface of plants (*Dicymbium tibiale*, *Maro sublestus* and even *Pardosa saltuaria*, the dominant species of epigeon).

3. Abundance analysis of samples collected in pitfall traps

Comparison of individual sites is given in Tables 3. to 6., data referring to the degree of indigenousness are given in Table 1. The following conclusions can be derived from the analysis:

- Epigeic species indicating natural habitats substantially prevail in all sites.
- Decisive proportion (33.3 to 93.8 %) in this remarkable prevalence refers to the occurrence of *Pardosa saltuaria*, a relic wolf spider observed as eudominant species in virtually all habitats investigated.
- In the non-shaded sites, the dominance of *P. saltuaria* is striking, while in the majority of shaded sites the portion of this species is much lower. In the non-shaded sites of Labská louka, this wolf

spider *P. saltuaria* was even the only dominant species of the local epigeon. In samples from the open sites, the percentage of this species was similar. Composition of epigeic spider fauna did not show any substantial difference between elevations and depressions of polygonal grounds, and between graminoid and heath cover. Slight differences are in recedent spider fauna.

- Remarkable differences were found between the epigeic spider fauna of shaded and non-shaded sites. In the sites shaded by dwarf pine or spruce, the proportion of *P. saltuaria* is much lower, except for the site SI on the Labská louka where representation of this animal (72.9 %) is even higher that on the open site of the Harrachovy kameny. Its least occurrence (30.1 %) was in site LI (Labská louka), which is also the only site where the percentage (38.8 %) of one eudominant species (*Centromerus pabulator*) was higher than that of *P. saltuaria.*

- In the shaded sites, concentration of dominant species is lower and several dominant species (3 to 7) coexist. Apart from *P. saltuaria* the following dominant species were observed: *Centromerus pabulator* (six sites), *Hilaira tatrica* (five sites), *Dicymbium tibiale* (three sites), *Centromerus arcanus, Haplodrassus signifer* (two sites) and *Coelotes terrestris, Oreonetides vaginatus* and *Ozyptila trux* on one site only.

- Higher proportion of dominant species in the shaded sites as compared with non-shaded sites coincides with much lower specimen abundance of *P. saltuaria* in former habitats than with a higher equitability and degree of diversity. Though *P. saltuaria* individuals disperse from the non-shaded habitats, its abundance in shaded sites (138, 76, 74, 59, 53, 27, 27) is many times lower than that in non-shaded ones (563, 558, 458, 379, 179). The limit of 5 %, or even of 10 % representation, may be thus overcome due to relatively low abundance of *P. saltuaria,* although the absolute number of specimens of the both sites does not differ significantly (e.g., *Centromerus pabulator* with 28, 21, 17 and 11 specimens in samples from non-shaded sites of Labská louka does not reach the dominance of 5 %, while in the samples from shaded sites with 27, 17, 17, 15, 14, and 8 specimens this species reached a dominance between 5.4 and 29.8 %.

- In *Hilaira tatrica*, in contrast, not a single specimen was found on the non-shaded sites of Labská louka, however, it was dominant to eudominant in five from seven shaded sites; in one of the latter sites its abundance reached 76 individuals (38.8 %) and was even higher than in *P. saltuaria* (59 individuals, 30.1 %). It seems that the closed canopy of krummholz provides small refugia, where this species successfully survives.

TABLES
Explanation of symbols:
f - family:
AMA – Amaurobiidae, ARA – Araneidae, CLU – Clubionidae, GNA – Gnaphosidae, LIN - Linyphiidae
THO – Thomisidae, LIO – Liocranidae, LYC – Lycosidae, PHI – Philodromidae, TET – Tetragnathidae,
THE – Theridiidae
d - dominance:
m/f – male specimen/female specimen, N – total number of adults (f+m)
ED - eudominant (more than 10%), D - dominant (5 to 10%), sd - subdominant (2 to 5%),
r - recedent (1 to 2%) s - subrecedent (less than 1%)

SW– sweeping of herb layer, Bk – beating of dwarf pine, Bs – beating of spruces
Cross designates occurrence of species on the appropriate site
Other symbols – see Material and methods.

Tab. 1. List of species found in investigated sites

Species	f	a	t	i	Ll	Hk	HV
1. Aculepeira ceropegia (Walckenaer, 1802)	ARA	I	P	2	+	+	-
2. Agroeca proxima (O. P.-Cambridge, 1871)	LIO	II	P	2	+	-	-
3. Allomengea scopigera (Grube, 1859)	LIN	II	P	2	-	-	+
4. Alopecosa pulverulenta (Clerck, 1757)	LYC	I	N	3	+	-	-
5. Alopecosa taeniata (C. L. Koch, 1835)	LYC	II	P	1	+	+	+
6. Araeoncus humilis (Blackwall, 1841)	LIN	I	N	3	+	-	-
7. Araneus diadematus Clerck, 1757	ARA	I	N	3	+	-	-
8. Araneus quadratus Clerck, 1757	ARA	I	N	3	+	-	-
9. Araniella cucurbitina (Clerck, 1757)	ARA	I	N	3	+	-	-
10. Bathyphantes gracilis (Blackwall, 1841)	LIN	I	N	2	+	-	-
11. Bolyphantes luteolus (Blackwall, 1833)	LIN	III	P	1	+	+	+
12. Centromerita bicolor (Blackwall, 1833)	LIN	I	P	3	+	+	+
13. Centromerus arcanus (O. P. – Cambridge, 1873)	LIN	III	P	1	+	+	+
14. Centromerus pabulator (O. P.- Cambridge, 1875)	LIN	III	P	1	+	+	+
15. Centromerus sylvaticus (Blackwall, 1841)	LIN	I	N	3	+	-	-
16. Ceratinella brevipes (Westring, 1851)	LIN	II	P	2	+	-	-
17. Clubiona reclusa O. P.- Cambridge, 1863	CLU	I	P	2	+	-	-
18. Cnephalocotes obscurus (Blackwall, 1834)	LIN	II	N	2	+	-	-
19. Coelotes terrestris (Wider, 1834)	AMA	I	N	2	+	-	+
20. Dicymbium tibiale (Blackwall, 1836)	LIN	III	N	1	+	+	+
21. Diplocephalus latifrons (O. P.- Cambridge, 1863)	LIN	I	N	2	+	-	-
22. Dismodicus bifrons (Blackwall, 1841)	LIN	I	P	2	+	-	-
23. Entelecara congenera (O. P.- Cambridge, 1879)	LIN	III	?	1	+	-	-
24. Episinus angulatus (Blackwall, 1836)	THE	II	M	2	+	-	-
25. Erigone atra Blackwall, 1833	LIN	I	N	3	+	+	-
26. Erigone dentipalpis (Wider, 1834)	LIN	I	N	3	+	-	-
27. Gnathonarium dentatum (Wider, 1834)	LIN	I	M	2	+	-	-
28. Gonatium rubellum (Blackwall, 1841)	LIN	I	P	2	+	+	-
29. Gongylidiellum murcidum Simon, 1884	LIN	III	M	1	+	-	-
30. Gongylidiellum vivum (O. P.- Cambridge, 1875)	LIN	II	P	2	+	-	-
31. Haplodrassus signifer (C. L. Koch, 1839)	GNA	I	N	3	+	+	+
32. Hilaira tatrica (Kulczynski, 1915)	LIN	III	P	1	+	+	+
33. Lepthyphantes mughi (Fickert, 1875)	LIN	III	P	1	+	-	-
34. Lepthyphantes obscurus (Blackwall, 1841)	LIN	III	P	1	+	-	-
35. Lepthyphantes tenebricola (Wider, 1834)	LIN	I	P	2	+	-	+
36. Lepthyphantes tripartitus Miller et Svatoň, 1978	LIN	-	-	-	-	+	-
37. Maro sublestus Falconer, 1915	LIN	III	P	1	+	+	-
38. Meioneta milleri Thaler, Buchar et Kůrka, 1998	LIN	-	-	-	+	-	-
39. Meioneta rurestris (C. L. Koch, 1836)	LIN	I	N	3	+	+	-
40. Metellina mengei (Blackwall, 1869)	TET	I	P	2	+	-	-
41. Micrargus georgescuae Millidge, 1976	LIN	-	-	-	-	-	+

42. Micrargus subaequalis (Westring, 1851)	LIN	II	N	3	+	-	-
43. Microlinyphia pusilla (Sundevall, 1830)	LIN	I	N	3	+	+	-
44. Neottiura bimaculata (Linné, 1767)	THE	I	N	3	+	-	-
45. Oedothorax apicatus (Blackwall, 1850)	LIN	I	M	3	+	-	-
46. Oreonetides vaginatus (Thorell, 1872)	LIN	III	P	1	+	+	+
47. Ozyptila trux (Blackwall, 1846)	THO	I	P	3	+	+	-
48. Pachygnatha degeeri Sundevall, 1830	TET	I	N	3	-	+	-
49. Pardosa amentata (Clerck, 1757)	LYC	I	P	3	+	-	-
50. Pardosa palustris (Linné, 1758)	LYC	I	N	3	+	+	-
51. Pardosa pullata (Clerck, 1757)	LYC	I	N	3	+	+	-
52. Pardosa riparia (C. L. Koch, 1833)	LYC	II	N	1	+	+	+
53. Pardosa saltuaria (L. Koch, 1870)	LYC	III	P	1	+	+	+
54. Philodromus collinus C. L. Koch, 1835	PHI	I	N	2	+	-	-
55. Pocadicnemis juncea Locket et Millidge, 1953	LIN	-	-	-	+	-	-
56. Porrhomma microphthalmum (O. P. - C. 1871)	LIN	I	N	3	+	-	-
57. Porrhomma oblitum (O. P. - Cambridge, 1871)	LIN	-	-	-	+	-	-
58. Robertus lividus (Blackwall, 1836)	THE	I	P	2	+	-	+
59. Robertus scoticus Jackson, 1914	THE	III	P	1	-	-	+
60. Robertus truncorum (L. Koch, 1872)	THE	III	P	1	+	-	+
61. Singa hamata (Clerck, 1757)	ARA	II	M	2	+	-	-
62. Sintula corniger (Blackwall, 1856)	LIN	III	P	1	+	-	-
63. Steatoda phalerata (Panzer, 1801)	THE	II	N	2	+	-	-
64. Theridion impressum L. Koch, 1881	THE	I	N	3	+	-	-
65. Theridion sisyphium (Clerck, 1757)	THE	I	N	3	+	-	-
66. Tiso vagans (Blackwall, 1834)	LIN	II	P	2	+	-	-
67. Walckenaeria antica (Wider, 1834)	LIN	I	N	2	+	+	+
68. Walckenaeria atrotibialis O.P.- Cambridge, 1878	LIN	I	M	2	+	-	-
69. Walckenaeria nudipalpis (Westring, 1851)	LIN	I	P	2	+	+	-
70. Walckenaeria vigilax (Blackwall, 1853)	LIN	II	?	?	+	-	-
71. Xerolycosa nemoralis (Westring, 1861)	LYC	I	N	2	+	-	-
72. Zelotes latreillei (Simon, 1878)	GNA	I	N	2	+	+	-
73. Zelotes subterraneus (C. L. Koch, 1833)	GNA	I	N	2	+	-	-

Tab. 2. Spiders of the herb and shrub layer in the study sites

Species	SW	Bk	Bs
Aculepeira ceropegia	+	+	+
Erigone atra	+	+	+
Erigone dentipalpis	+	+	+
Meioneta rurestris	+	+	+
Theridion impressum	+	+	
Bathyphantes gracilis	+	+	
Maro sublestus	+	+	
Pardosa saltuaria	+	+	
Pocadicnemis juncea	+	+	
Tiso vagans	+	+	
Araeoncus humilis	+		+
Micrargus subaequalis	+		+
Walckenaeria vigilax	+		+
Araneus diadematus		+	+
Gongylidiellum vivum		+	+
Lepthyphantes mughi		+	+
Neottiura bimaculata		+	+
Araneus quadratus	+		
Ceratinella brevipes	+		
Dicymbium tibiale	+		
Episinus angulatus	+		
Gnathonarium dentatum	+		
Lepthyphantes tenebricola	+		
Microlinyphia pusilla	+		
Oedothorax apicatus	+		
Porrhomma microphthalmum	+		
Singa hamata	+		
Dismodicus bifrons		+	
Gongylidiellum murcidum		+	
Lepthyphantes obscurus		+	
Meioneta milleri		+	
Metellina mengei		+	
Philodromus collinus		+	
Porrhomma oblitum		+	
Theridion sisyphium		+	
Araniella cucurbitina			+
Entelecara congenera			+

Tab. 3. Labská louka, non-shaded sites

Habitat	SD				EI				EII				C			
Species	m/f	N	%	d	m/f	N	%	d	m/f	N	%	d	m/f	N	%	d
Alopecosa pulverulenta									1/-	1	0.2	s				
Alopecosa taeniata	6/1	7	1.1	r	4/2	6	1.2	r	6/2	8	1.7	r	10/10	20	3.0	sd
Bolyphantes luteolus													-/1	1	0.1	s
Centromerita bicolor	1/4	5	0.8	s	1/4	5	1.0	s	2/5	7	1.5	r	2/1	3	0.4	s
Centromerus arcanus	2/-	2	0.3	s	2/1	3	0.6	s	-/1	1	0.2	s	2/-	2	0.3	s
Centromerus pabulator	26/2	28	4.3	sd	11/-	11	2.1	sd	13/4	17	3.7	sd	18/3	21	3.1	sd
Ceratinella brevipes	-/1	1	0.2	s												
Cnephalocotes obscurus									1/-	1	0.2	s				
Coelotes terrestris	4/1	5	0.8	s	2/1	3	0.6	s	2/2	4	0.9	s	2/1	3	0.4	s
Dicymbium tibiale	3/4	7	1.1	r	-/2	2	0.4	s	5/7	12	2.6	sd	3/6	9	1.3	r
Erigone atra	-/1	1	0.2	s	-/1	1	0.2	s								
Gonatium rubellum					-/1	1	0.2	s					1/1	2	0.3	s
Haplodrassus signifer	1/-	1	0.2	s	3/7	10	2.0	r	3/2	5	1.1	r	5/4	9	1.3	r
Meioneta sp.													-/1	1	0.1	s
Meioneta milleri	1/1	2	0.3	s					1/1	2	0.4	s				
Ozyptila trux	23/3	26	4.0	sd	9/2	11	2.1	sd	17/4	21	4.5	sd	17/3	20	3.0	sd
Pardosa palustris													-/1	1	0.1	s
Pardosa pullata	4/-	4	0.6	s					-/1	1	0.2	s				
Pardosa riparia					4/-	4	0.8	s	-/1	1	0.2	s	1/-	1	0.1	s
Pardosa saltuaria	315/243	558	85.6	ED	225/223	458	88.9	ED	235/144	379	81.5	ED	288/275	563	84/3	ED
Robertus lividus	1/1	2	0.2	s					2/1	3	0.6	s	3/3	6	0.9	s
Sintula corniger													1/-	1	0.1	s
Walckenaeria antica	1/-	1	0.2	s					1/-	1	0.2	s				

Walckenaeria nudipalpis	-/1	1	0.2	s									1/-	1	0.1	s
Zelotes latreillei	-/1	1	0.2	s									4/-	4	0.6	s
Zelotes subterraneus									1/-	1	0.2	s				
Total:		652	100			515	100			465	100			668	100	

Tab. 4. Labská louka, shaded sites

Habitat	PI				PII				Pp			
Species	m/f	N	%	d	m/f	N	%	d	m/f	N	%	d
Agroeca proxima									1/-	1	0.5	s
Alopecosa taeniata	2/1	3	1.5	r	4/-	4	2.7	sd	8/-	8	3.6	sd
Bolyphantes luteolus									1/-	1	0.5	s
Centromerita bicolor	1/-	1	0.5	s					1/-	1	0.5	s
Centromerus arcanus	8/2	10	5.1	D	6/-	6	4.0	sd	1/1	2	0.9	r
Centromerus pabulator	19/8	27	13.8	ED	3/5	8	5.4	D	9/8	17	7.7	D
Centromerus sylvaticus					-/1	1	0.7	s				
Ceratinella brevipes	2/-	2	1.0	r								
Cnephalocotes obscurus									-/1	1	0.5	s
Coelotes terrestris	9/-	9	4.6	sd	26/2	28	18.8	ED	5/3	8	3.6	sd
Dicymbium tibiale	1/-	1	0.5	s	2/-	2	1.3	r	2/11	13	5.9	D
Diplocephalus latifrons	1/-	1	0.5	s								
Erigone atra	1/-	1	0.5	s								
Gonatium rubellum	-/1	1	0.5	s					5/1	6	2.7	sd
Haplodrassus signifer	1/-	1	0.5	s	2/3	5	3.4	sd	6/3	9	4.1	sd
Hilaira tatrica	47/29	76	38.8	ED	11/4	15	10.1	ED				
Oreonetides vaginatus	1/-	1	0.5	s								
Ozyptila trux					4/-	4	2.7	sd	7/2	9	4.1	sd
Pardosa pullata									1/-	1	0.5	s

Pardosa saltuaria	31/28	59	30.1	ED	30/44	74	49.7	ED	25/113	138	62.7	ED
Robertus lividus	1/-	1	0.5	s	1/1	2	1.3	r				
Steatoda phalerata									1/-	1	0.5	s
Walckenaeria antica	1/-	1	0.5	s					-/3	3	1.4	sd
Walckenaeria atrotibialis	1/-	1	0.5	s								
Walckenaeria nudipalpis									1/-	1	0.5	s
Total:		196	100			149	100			220	100	

Tab. 5. Labská louka, shaded sites

Habitat	SI				S II			
Species	m/f	N	%	d	m/f	N	%	d
Alopecosa taeniata	1/-	1	1.2	r				
Araniella cucurbitina					-/1	1	1.0	r
Centromerita bicolor					2/2	4	4.0	sd
Centromerus pabulator	1/2	3	3.7	sd	6/9	15	15.0	ED
Coelotes terrestris	1/2	3	3.7	sd	2/1	3	3.0	sd
Dicymbium tibiale	1/-	1	1.2	r	2/3	5	5.0	D
Diplocephalus latifrons	-/2	2	2.5	sd				
Erigone atra	1/-	1	1.2	r	-/1	1	1.0	r
Gonatium rubellum	1/-	1	1.2	r	-/1	1	1.0	r
Haplodrassus signifer	1/-	1	1.2	r	1/-	1	1.0	r
Hilaira tatrica	-/2	2	2.5	sd	6/3	9	9.0	D
Meioneta rurestris	2/-	2	2.5	sd				
Oreonetides vaginatus	-/1	1	1.2	r				
Ozyptila trux					4/2	6	6.0	D
Pardosa saltuaria	2/-	2	2.5	sd	17/36	53	53.0	ED

Robertus lividus	24/35	59	72.9	ED				
Walckenaeria antica	1/-	1	1.2	r				
Walckenaeria nudipalpis	1/-	1	1.2	r	1/-	1	1.0	r
Total:		81	100			100	100	

Tab. 6. Harrachovy kameny and Hanč & Vrbata monument

Habitat	Hk PIII (shaded)				Hk M (non-shaded)				HV PIV (shaded)			
Species	m/f	N	%	d	m/f	N	%	d	m/f	N	%	d
Allomengea scopigera									1/-	1	1.2	r
Alopecosa taeniata					1/2	3	1.2	r	1/1	2	2.4	sd
Bolyphantes luteolus									3/-	3	3.6	sd
Centromerita bicolor	2/-	2	3.5	sd	1/-	1	0.4	s	-/1	1	1.2	r
Centromerus arcanus	1/-	1	1.8	r	2/-	2	0.8	s	7/1	8	9.5	D
Centromerus pabulator	3/14	17	29.8	ED	19/6	25	10.1	ED	9/5	14	16.7	ED
Coelotes terrestris									1/-	1	1.2	r
Dicymbium tibiale	-/1	1	1.8	r	4/2	6	2.4	sd	4/1	5	6.0	D
Erigone atra					4/-	4	1.6	r				
Gonatium rubellum	1/-	1	1.8	r	-/1	1	0.4	s				
Haplodrassus signifer	1/2	3	5.2	D	-/2	2	0.8	s	3/2	5	6.0	D
Hilaira tatrica	4/-	4	7.0	D	3/1	4	1.6	r	7/-	7	8.3	D
Lepthyphantes tripartitus	1/-	1	1.8	r								
Lepthyphantes tenebricola									-/1	1	1.2	r
Maro sp.					1/-	1	0.4	s				
Micrargus georgescuae									1/-	1	1.2	r
Microlinyphia pusilla					1/-	1	0.4	s				
Oreonetides vaginatus					1/-	1	0.4	s	4/1	5	6.0	D

Ozyptila trux					2/-	2	0.8	s				
Pardosa palustris					5/-	5	2.0	sd				
Pardosa pullata					1/-	1	0.1	s				
Pardosa riparia					4/1	5	2.0	sd	-/1	1	1.2	r
Pardosa saltuaria	15/12	27	47.4	ED	136/43	179	72.2	ED	9/18	27	32.1	ED
Robertus lividus									1/-	1	1.2	r
Robertus scoticus									1/-	1	1.2	r
Walckenaeria antica					2/1	3	1.2	r				
Walckenaeria nudipalpis					2/-	2	0.8	s				
Total:		57	100			248	100			84	100	

4. DISCUSSION

The above described investigations of spider communities, performed in the area between Labská louka plateau and Harrachovy kameny, offer a comparison with the earlier observations on Pančavská louka plateau (BUCHAR 1967) and Studniční hora (RŮŽIČKA et VANĚK 1997) carried out by similar methods. In their sample areas, *Pardosa saltuaria* prevailed as a eudominant species. In Pančavská louka, the additional dominants were *Ozyptila trux, Centromerus pabulator* and *Centromerus arcanus*, and thus resembled the spider community in shaded habitats of Labská louka in our study. Moreover, the dominance of *P. saltuaria* (60 %) is closer to the dominance of the shaded sites (30.1 to 72.9 %) than to that of non-shaded sites (81.5 to 88.9 %) on Labská louka.

On the contrary, the dominance of *P. saltuaria* observed between 1983 and 1990 on Studniční hora, is rather close to the open sites on Labská louka (except for 51.3 % in a sample from 1983), with values 80.6 %, 73.6 %, 86.6 % and 83,5 % observed in 1984, 1998, 1989 and 1990, respectively. Comparison of male (m) and female (f) numbers from pitfall traps is also interesting. While the index m/f ranged between 4.9 and 69.5 (!) on Studniční hora, its values in non-shaded sites between Labská louka and Harrachovy kameny reached to 1.3, 1.0, 1.6, 1.0 and 3.2 (this last value recorded in a moss cushion at Harrachovy kameny). In most shaded sites, this index showed the prevalence of females (m/f: 0.5, 1.1, 0.7, 0.2, 0.7, 0.5 and 1.2). Among the important relic species, *Mecynargus morulus* was missing on Labská louka, a species sometimes dominant on Pančavská louka and Studniční hora. In addition, *Gnaphosa lapponum* was missing on Labská louka though reported as frequent not only on Studniční hora but also in Úpské rašeliniště. Also the wolf-spider *Acantholycosa norvegica sudetica*, which occupies stony debris on topmost summits, including Studniční hora, and *Coelotes atropos* are missing in the habitats of Labská louka.

The newly discovered *Meioneta milleri* (THALER, BUCHAR et KŮRKA 1997) was collected in all three sample localities, and may represent a quite common species on the summits of the Giant Mts.

CONCLUSIONS

1. Arachnological research of the summit area in the Giant Mts. between the Labská louka and Harrachovy kameny revealed 73 spider species, which belong mostly to psychrophilous and ecologically indifferent elements.
2. Species composition of the epigeic arachnofauna did not show any substantial difference between microrelief elevations, depressions and heaths in the patterned grounds of non-shaded sites. Fine differences were found only in recedent fauna.
3. Epigeic arachnofauna of both the non-shaded mat grasslands and shaded krummholz (with dwarf pine and shrubby spruce) is marked by a degree of indigenousness. In non-shaded sites *Pardosa saltuaria* was usually the only species dominant. In shaded sites, in addition to the mostly eudominant *Pardosa saltuaria,* several other species created dominant populations.
4. Species composition of arachnofauna did not show any substantial differences between sites investigated recently and in the past on Pančavská louka. Habitats between Labská louka and Harrachovy kameny are obviously unsuitable for the occurrence of *Gnaphosa lapponum* and *Acantholycosa norvegica sudetica*, the two species characteristic for the topmost stone debris, e.g. those on Studniční hora.

SOUHRN

V letech 1997–1999 jsme sledovali faunu pavouků na západní části hřebenů Krkonoš mezi Labskou loukou a Harrachovými kameny. Zjišťovali jsme rozdíly v druhové a kvantitativní skladbě arachnocenóz zastíněných a nezastíněných ploch (tj. stanovišť bez keřového porostu a úplných keřových zápojů kleče a smrku). Pro získání kvantitativních vzorků jsme použili zemní formalinové pasti umístěné po dvojicích na každém stanovišti. Pro zjišťování druhového spektra arachnocenóz bylinného a keřového patra jsme použili metodu smyků bylinné vegetace a sklepávání keřů (kleče a smrku).

V rámci uvedeného výzkumu bylo získáno a determinováno 5145 kusů pavouků. Zjištěných 73 druhů náleželo převážně k psychrofilní a nespecifické složce. Neprokázaly se významné rozdíly ve složení epigeické pavoučí fauny vrcholů elevací, depresí ani vřesového porostu na otevřených nezastíněných plochách. Jemné diference jsou pouze mezi recedentní faunou. Epigeická arachnofauna volných nezastíněných stanovišť i zápojů kleče a smrků ukazuje na vysoký a srovnatelný stupeň původnosti sledovaných stanovišť. Na volných plochách je obvykle dominantní jen jediný druh – *Pardosa saltuaria*. Na zastíněných stanovištích se na dominanci kromě většinou eudominantní *Pardosa saltuaria* podílí i některé další druhy.

Ve skladbě druhového spektra nebyly zjištěny podstatné rozdíly mezi arachnofaunou výzkumné plochy a dříve sledované Pančavské louky. Biotopy plochy Labská louka – Harrachovy kameny nejsou zřejmě vhodným prostředím pro výskyt druhů *Gnaphosa lapponum* a *Acantholycosa norvegica sudetica*, které se vyskytují v nejvyšších partiích s kamenitou sutí, např. na Studniční hoře.

REFERENCES

ANTUŠ M. 1982: Příspěvek k poznání arachnofauny Krkonoš. [Beitrag zur Kenntnis der Arachnofauna von Krkonoše (Riesengebirge).]. Opera Corcontica 19: 207–214 (in Czech, German summary).

BÍLEK P. 1985: Pavouci Rýchor. [The spiders of the Rýchory Mt.]. Opera Corcontica 22: 199–203 (in Czech, English summary).

BUCHAR J. 1967: Pavoučí fauna Pančické louky a blízkého okolí. [Die Spinnenfauna der Pančická louka und der nahen Umgebung.]. Opera Corcontica 4: 79–93 (in Czech, German summary).

BUCHAR J. 1983: Výsledky faunistického výzkumu Krkonoš I. (Příspěvek k zoologickému inventarizačnímu výzkumu). [Results of the faunistic investigation of the Krkonoš (Giant Mountains) I (Contribution to the zoological inventorial investigation).]. Opera Corcontica 20: 99–114 (in Czech, English summary).

BUCHAR J. 1993: Komentierte Artenliste der Spinnen Böhmens. Acta Univ. Carolinae - Biologica 36 [1992]: 383–428.

BUCHAR J., RŮŽIČKA V. et KŮRKA A. 1995: Check list of spiders of the Czech Republic. Proceeding of the 15th European Colloquium of Arachnology. Institute of Entomology, České Budějovice: 35–53.

DAHL F. 1902: Über die Stufenfänge echter Spinnen am Riesengebirge. - Sit.-Ber. Ges. naturforsch. Fr. zu Berlin 9: 185–202.

DAHL F. 1903: Berichtigungen zu seinem Vortrag über Stufenfänge echter Spinnen am Riesengebirge. - Sit-Ber. Ges.naturforsch. Fr. zu Berlin: 183–184.

FICKERT C. 1876: Verzeichnis der schlesien Spinnen. - Zeitsch. f. Entomol. herausg. v. Verein f. schles. Insektenk., Breslau, N. F. 5: 46–76.

KOCH L. 1875: Beschreibungen einiger von Herrn dr. Zimmermann bei Niesky in der Oberlausitz und im Riesengebirge entdecker neuer Spinnenarten. - Abh. naturf. des Görlitz 15: 1–21.

LEBERT H. 1875: Verzeichnis schlesischer Spinnen mit Aufzählung der schlesischen Myriapoden. - Tübingen.

NOSEK A. 1895: Seznam českých a moravských pavouků. [A survey of Czech and Moravian spiders.]. Věstník Král. České Společnosti Nauk. Třída mathematicko-přírodovědecká 1895 (3): 1–56 (in Czech).

PILAWSKI S. 1962: Wstepne badania pajaków w karkonoszkim parku narodowym. Acta Univ. Wratislaviensis 1 (3): 181–188 in Polish).

PILAWSKI S. 1965: O kilkunastu gatunkach pajaków zlowionych w Sudetach Slaskich nowych dla fauny Dolnego Slaska i Polski. - Przeglad Zoologiczny 9 (3): 254–265 (in Polish).

RŮŽIČKA V. et HEJKAL J. 1997: Succession of epigeic spider communities (Araneae) on spoil banks in North Bohemia. Acta Soc. Zool. Bohem. 61: 381–388.

RŮŽIČKA V. et VANĚK J. 1997: Pavouci (Araneae) Úpské rašeliny a Studniční hory. Spiders (Araneae) of the Úpská rašelina peatbog and Studniční hora mountain. - Opera Corcontica 34: 179–187.

RŮŽIČKA V. et ZACHARDA M. 1994: Arthropods of stony debris in the Krkonoše Mountains, Czech Republic. Arctic and Alpine Research 26: 332–338.

SCHENKEL E. 1929: Spinnen von Riesengebirge, gesammelt von E. Nielsen. - Ent. Medd. 16 (6): 335–338.

SCHENKEL E. 1930: Spinnen von Petzer, Riesengebirge, und Mayrhof, Tirol, gesammelt von E. Nielsen. - Ent. Medd. 17: 228–231.

SCHENKEL E. 1939: Spinnen aus dem Riesengebirge, gesammelt von Prof. Cl. Špaček in Trautenau. - Festschr. Strand 5: 456–459.

THALER K., BUCHAR J. et KŮRKA A. 1997: A new species of Linyphiidae (Araneae) from the sudeto-carpathian range (Czech Republic and Slovakia). Acta Soc. Zool. Bohem. 61: 389–394.

ZIMMERMANN H. 1871: Die Spinnen der Umgegend von Niesky. Verzeichnis I: Ein Beitrag zur Kenntnis der Arachnidenfauna der Oberlausitz. - Abh. Naturf. Ges. Görlitz 14: 69–137.