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Spiders of the Domica drainage area (Slovak Karst Mts.): community composition and habitat evaluation (Araneae)

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Abstract: In 2003 and 2004 a research of araneofauna and spider communities of the Domica drainage area was performed on 27 study sites (on 12 of them by pitfall trapping). Altogether, more than 2,712 specimens belonging to 198 species were captured. The species diversity in the Domica drainage area is rather high, representing approximately 23% of the Slovak araneofauna. Of the identified species, 15 are listed in the Red List of Spiders of Slovakia. The occurrences of *Centromerus capucinus* (EN), *Diaea livens* (CR), *Hahnia picta* (EN) and *Sintula spiniger* (EN) are of great importance since these species had been reported in Slovakia only a few times before. The great richness of the spider fauna and the occurrence of rare and threatened species for Slovakia confirm the high biotic value of the investigated areas. Ten study sites (sites 1-10) investigated by means of pitfall traps for a period of one year were assessed according to their biological importance based on the occurrence of endangered and rare spider species. Three of the study sites, such as dry calcareous pasture in lime sink (site 6), dry calcareous grassland in the karren area of the National Nature Reserve Domicke Škrapy (Domica Karren) (site 3) and an old extensively used orchard near Kečovo (site 7) have been assigned to the biologically most valuable areas (territories with the highest proportion of endangered and rare species).

Key words: spiders, nature conservation, Domica, karst, southeastern Slovakia

Introduction

The Domica drainage area, one of the areas of the Slovak Karst Mts., having well-preserved dry calcareous grasslands and other xerothermic habitats, is a suitable model area for research of animal communities of karst habitats including also spider communities. Dry calcareous grasslands belong among the endangered types of biotopes in Europe and they are listed in the Annex 1 of the Habitat Directive (Council 1992). The area is important not only for national nature conservation but also for the whole of Europe, as part of the investigated area is National Nature Reserve and also a Natura 2000 site. Spiders, an important component of xerothermic fauna, are used as bio-indicators of environmental quality (Buchar 1983, 1991, Clausen 1986, Maelfait 1996, Růžička 1986, 1987) and for evaluation of biota changes in relation to the land management (Maelfait *et al*. 1990, Maelfait, Seghers 1986, Maelfait, de Keer 1990, Maelfait *et al*. 1997, Svatoň 1987, Svatoň, Majkus 1994). This type of bio-indication, which is based on the investigation of species diversity and community composition is called ecological indication (Blandin 1986).

From the point of view of arachnological research, insufficient attention has been devoted to the territory of the Domica drainage area. Only a few papers with sporadic records (Chyzer, Kulczyński 1891, 1894, 1897, 1899, Miller, Kratochvíl 1940, Miller 1971, Svatoň 1994, Kůrka 1996, Buchar 1999 and Gajdoš *et al.* 1999) present the spider fauna of the region. Up to the present only 42 spider species have been published from the Domica drainage area. This fact initiated an arachnological research on this territory in the period 2003-2004. The aim of this study was to describe the spider species composition, to characterise the spider communities of

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the Domica drainage area and to classify the study sites according to their importance from the point of view of nature conservation.

Material and Methods

Study area

The Domica drainage area is situated around Domica cave on the south-western edge of the Silická Plateau in Slovak Karst (the largest karst region in Central Europe), 10 km to the southwest of Plešivec, near the borders with Hungary. It represents a typical landscape of the Slovak Karst Mountains. Centrally situated, Domica Cave (World Heritage Site) is a pearl of the National Nature Reserve Domické škrapy (Domica Karren), which is part of investigated area. The drainage area is covered with sunny, rocky and forest-steppe habitats, dry calcareous meadows and pastures, orchards, dry oak forests, wet depressions, arable fields with typical karst formations as lime sinks, karren, karst plateaus, abysses, caves, etc. The selected study sites present the different habitat types characteristic of this territory. The mosaic of habitats creates good conditions for high biodiversity of the spider fauna and occurrence of many rare and threatened spider species.

Sampling and study sites

Research on the spider fauna was carried out in 2003 and 2004. The spiders were collected mainly by pitfall traps on 10 study sites (1-10) in 2003-2004 during the whole research period (from August 21, 2003 to November 26, 2004) and on two additional sites (study sites 11-12) in 2004 (from beginning of May to November) on dry calcareous habitats. As pitfall traps 0.7 liter jars - 9 cm in diameter, were used, one-third filled with a 4 % formaldehyde solution with a drop of added detergent, during winter season - with antifreeze liquid. The traps were emptied approximately once a month during the vegetation season and once in every three months during winter time. The traps were placed in pairs at site *ca*. 10 m apart on the 12 following study sites:

St. 1 – abandoned wet meadow on the top of a small hill surrounded by arable land

St. 2 – willow (*Salix cinerea*) stand on the top of a small hill surrounded by arable land

St. 3 – dry calcareous grassland with shrubs in the karren area near Domica cave

St. 4 – hornbeam forest at the bottom of a lime sink near hill top

St. 5 – Veľký Polder, abandoned polder overgrown with sparse poplar trees in herbal layer with mesophilous grasses

St. 6 – dry calcareous pasture at the bottom of a lime sink near Kečovo

St. 7 – mown old extensively used orchard near Kečovo

St. 8 – oak-hornbean forest

St. 9 – extensively used mesophilous meadow

St. 10 – wet grassland (*Molinietum*) with solitary birch trees near St. 9

St. 11 – dry calcareous pasture above Kečovo

St. 12 – dry calcareous grassland with shrubs in the karren area near Domica cave (100 m above St. 3)

At the other 15 study sites the spiders were collected sporadically by sweeping (sw), sifting of detritus and dead leaves (si), beating from trees and shrubs (be) and by individual collection under stones and in grass and leaves (ic):

St. A – Domica, shrubby margin of the mesophilous meadow on a hill top near st. 1 (be)

St. B – Domica - small polder opposite the Domica cave entrance overgrown with shrubs and tall sedges (be)

St. C – Domica, dams of the Domický Potok stream overgrown with poplars (sw, ic)

St. D – Domica, pastured dry calcareous grassland in the margin of the lime sink near Kečovo - near st. 6 (be, ic)

St. E – Domica, Veľký polder, litoral zone overgrown with *Carex* sp. and *Phragmites* sp. near St. 5 (ic)

St. F – Domica, wetlands overgrown with willow trees near main road, undergrown with *Urtica dioica* (sw)

St. G – Domica, dry calcareous grassland on the hill top of the National Nature Reserve Domické Škrapy (ic)

St. H – Domica, mesophilous meadows fallow among the arable land near study site 1 (sw)

St. I – Domica, pastured dry calcareous grassland near Kečovo (near St. 11) (sw, ic)

St. J – Domica, dry calcareous grassland near a cave between study sites 3 and 12 (si)

St. K – Domica, shrubby and tree margin in a dry calcareous grassland near a cave (near st. 12)

St. L – Domica, rocky slope of the lime sink near Kečovo (near St. 6) (ic)

St. M – Domica, shrubby and tree margin of the dry calcareous grassland in the margin of the lime sink near st. 4 (be)

St. N – Domica, shrubby and tree margin of the dry calcareous grassland near a cave (near St. 3) (be)

St. O – desolate buildings of the camp opposite cave entrance (ic)

Evaluation of the study sites was performed only on ten study sites (study sites 1-10) in which pitfall traps were situated during a whole year. The study sites have been assigned to three categories of biological importance on the basis of species composition (the presence of threatened and rare spider species): **category I** – the biologically most valuable sites – sites with high species diversity and with the highest proportion of the threatened/rare species; **category II** – biologically valuable sites – sites with high or average species diversity and with lower proportion of threatened/rare species than in category I; **category III** – sites of low biological importance – sites with lower or average species diversity and a low number of the threatened/rare species. The nomenclature and systematic order of species follow Platnick (2005). A comparison of the epigeic spider communities of the individual study sites was done according to Ward's clustering method. This method was chosen as the most proper for this type of data.

Results

Species and family composition

Altogether 2,712 specimens belonging to 198 species from 28 families were captured in the Domica drainage area (Appendix 1). The majority of spiders come from pitfall traps (2,556 specimens belonging to 155 spider species from 27 families). The species diversity in the Domica drainage area is rather high, representing approximately 23% of the Slovak araneofauna. From the identified species, fifteen are included in The Red List of Spiders of Slovakia (Gajdoš, Svatoň 2001) (Tables 2-3). The occurrences of the critically endangered (CR) species *Diaea livens* and the endangered (EN) species *Centromerus capucinus*, *Hahnia picta* and *Sintula spiniger* (EN) are of great importance since these species had been reported in Slovakia only a few times before. In the epigeic communities of all sites, the Lycosidae were eudominant (D = 15.08 – 63.7%). From the other families, the Linyphiidae were eudominant on sites 2-8 and 10 (D = 12.9 – 25.8%), Amaurobiidae - on sites 4 and 8 (D = 34.2 and 16.8%), Liocranidae - only on site 2 (D = 12.5%) and Gnaphosidae - on sites 1, 3, 6, 7 and 9 (D = 13 – 15.8%). The majority of other families is defined as recedent and subrecedent (Table 1). The composition of spider communities on individual study sites differs depending on habitat types.

Table 1. Dominance (in %) of spider families in epigeic communities on study site 1-10.

Family	Study site (St.)									
	St. 1	**St. 2**	**St. 3**	**St. 4**	**St. 5**	**St. 6**	**St. 7**	**St. 8**	**St. 9**	**St. 10**
Pholcidae	-	-	0.4	-	-	-	-	-	-	-
Dysderidae	-	4.0	0.4	1.8	0.8	2.8	2.1	4.4	-	-
Mimetidae	0.3	0.4	-	0.9	-	-	0.3	-	-	0.4
Eresidae	-	-	0.4	-	-	-	-	-	-	-
Theridiidae	0.3	1.8	1.2	-	0.5	0.9	0.7	0.9	0.7	1.3
Linyphiidae	3.4	15.4	25.9	18.4	18.9	23.1	13.4	13.3	2.2	12.9
Tetragnathidae	2.5	-	-	-	5.2	-	-	-	1.8	1.3
Araneidae	0.8	-	1.2	-	-	-	-	-	-	-
Lycosidae	63.2	50.4	27.5	15.8	58.6	46.3	31.2	42.5	63.7	45.3
Pisauridae	1.4	1.8	0.4	-	0.8	0.9	2.7	-	2.2	2.2
Oxyopidae	-	-	-	-	-	-	-	-	-	-
Zoridae	-	1.1	-	-	0.5	-	0.7	0.9	-	9.8
Agelenidae	0.6	-	4.7	7.0	0.3	0.9	1.0	0.9	-	-
Cybaeidae	-	-	-	-	-	0.9	-	-	-	-
Hahnidae	2.0	1.1	0.4	-	0.3	-	0.7	-	1.4	1.3
Dictynidae	0.8	4.4	-	11.4	3.0	4.6	-	8.0	2.2	3.6
Amaurobiidae	-	-	9.4	34.2	0.5	0.9	7.5	16.8	-	-
Miturgidae	-	-	-	-	-	-	-	0.9	0.4	-
Anyphaenidae	-	-	-	1.8	-	-	0.3	-	-	-
Liocranidae	2.8	12.5	2.7	4.4	3.8	3.7	9.9	0.9	0.7	11.6
Clubionidae	0.3	-	-	-	0.3	-	-	-	-	0.4
Corinnidae	-	-	-	-	0.8	-	1.4	-	1.1	0.9
Zodariidae	-	-	-	-	-	-	-	2.7	-	-
Gnaphosidae	14.3	4.0	14.9	2.6	4.4	13.0	19.2	5.3	15.8	6.2
Sparassidae	-	-	0.4	-	-	-	-	-	-	0.4
Philodromidae	0.6	-	1.2	-	-	-	-	-	0.4	0.9
Thomisidae	4.8	2.9	7.5	1.8	0.5	1.9	7.9	1.8	6.5	0.9
Salticidae	2.0	-	1.6	-	0.5	-	1.0	0.9	1.1	0.4
Number of specimens	**356**	**272**	**255**	**114**	**365**	**108**	**292**	**113**	**278**	**225**

Evaluation of study sites 1-10 on the basis of epigeic spider communities

The spider communities of the investigated study sites (1-10) consist of various coenoses, which are characterised by different plant communities in the Domica drainage area. On the basis of the chosen criteria, three of the sites (3, 6 and 7) have been assigned to category I as the biologically most valuable areas (Table 3). They present sites with high species diversity, with a high number of threatened and rare species. Open dry calcareous grasslands found on sites 3 and 6 seems to be the most valuable habitats in the area. The spider communities found in these study sites are composed mainly of species, which have high claims on stable environmental conditions (light, soil humidity and vegetation structure). The low soil humidity, high intensity of solar radiation and sparse vegetation, which characterize both study sites, provide conditions for the occurrence of many xerothermophilous threatened species. It is interesting that besides the characteristic karst habitats also old extensively used fruit orchards (st. 7) belong among the habitats important for conservation of threatened and rare species. The communities of the sites 1, 2, 4, 8 and 10 were classified to category II as biologically valuable. In this category, the spider communities of

Table 2. Dominance (in %) of the threatened species in epigeic communities on study site 1- 10 and their presence in the other sites (rest). RL – Red list of spiders of Slovakia (Gajdoš, Svatoň 2001). Categories of threat: CR - critically endangered, EN – endangered, VU – vulnerable, LR - lower risk (nt - near threatened, lc - least concern), DD - data deficient.

RL	Threatened species	Study site										
		St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7	St. 8	St. 9	St. 10	Rest
CR	*Diaea livens*											M.N
EN	*Centromerus capucinus*			13.33								
EN	*Sintula spiniger*		0.74	10.59			8.33	7.19				
EN	*Hahnia picta*										0.44	
EN	*Agroeca lusatica*	0.84		0.39			1.85	3.77		0.72		
VU	*Dysdera hungarica*		4.04	0.39	0.88	0.27	2.78	2.05	4.42			
VU	*Gnaphosa modestior*						8.33					st.12
VU	*Xysticus lineatus*	2.25									0.44	
LR.lc	*Cheiracanthium punctorium*											H
LR.lc	*Tmarus stelio*											N
LR.lc	*Marpissa nivoyi*					0.27						
LR.lc	*Pseudicius encarpatus*											M.N
LR.nt	*Kishidaia conspicua*						0.93					
DD	*Megalepthyphantes pseudocollinus*				2.63				0.88			
DD	*Pocadicnemis juncea*										0.89	
	Totally	**3.09**	**4.78**	**24.71**	**3.51**	**0.54**	**22.2**	**13.0**	**5.31**	**0.72**	**1.77**	

Table 3. Evaluation of epigeic communities of the study sites (St.) 1-10 D – dominance, SI – category of the site importance.

	Study site									
	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7	St. 8	St. 9	St. 10
Number of species	57	37	46	29	41	25	45	25	41	47
Number of threatened species (category EN)	1	1	3			2	2		1	1
Number of threatened species (category VU)	1	1	1	1	1	2	1	1		1
Number of threatened species (cat. LR. DD)				1	1	1		1		1
Total number of threatened species	2	2	4	2	2	5	3	2	1	3
Dominance of threatened species (D%)	3.1	4.8	24.7	3.5	0.5	22.2	13.0	5.3	0.7	1.8
Category of SI	**II**	**II**	**I**	**II**	**III**	**I**	**I**	**II**	**III**	**II**

forest habitats (St. 4, 8), of shaded wet habitats (St. 2, 10) and of open or semi-open wet habitats (St. 1) were included. In this category the main attention in terms of protection should be paid to wetland habitats, the occurrence of which is very rare in this generally very dry territory. The forest habitats have lower species richness.

The other two evaluated study sites (5 and 9) have been classified as sites with lower biological importance and were assigned to category III. In this category an extensively used site (St. 9) and a site considerably disturbed by man (St. 5) are listed. Although the spider communities on the mentioned sites are rich in species, they consist mainly of species which are widespread and common or expansive. Occurrence and proportion of rare and threatened species is low (Table 3).

Comparison of the epigeic spider communities in the individual study sites

The majority of the compared spider communities is highly dissimilar (Fig. 1). On the basis of the hierarchical classification, spider epigeic communities were divided into two main clusters. The first cluster (I) represents spider communities of the forest sites (St. 4, St. 8), shaded willow stand (St. 2) and poplar stand (St. 5). They are relatively dissimilar (values of their dissimilarity are about 56%) and characterized by the eudominant representation of the species *Pardosa lugubris* (Appendix 1). The similarity of the communities of sites 2 and 8 was the highest (about 76%). Both sites have similar conditions for ground living spiders – shaded ground covered by detritus and dead leaves without low vegetation. The second cluster (II) represents epigeic communities of non-forest habitats which are open or only partly shaded. The compositions of these communities are very dissimilar with values of dissimilarity of more than 60%. At this level the cluster is divided into two subclusters. Subcluster IIa demonstrates considerable similarity between site 6 (dry calcareous pasture at the bottom of a lime sink) and site 10 (wet grassland *Molinietum* with solitary birch trees). In both communities the same common widespread species occur abundantly (e.g. *Centromerus sylvaticus* and *Alopecosa trabalis*). Subcluster IIb combines four habitats with different spider communities. Within this subcluster similarity of the communities of sites 1 and 7 was the highest (about 60%). The similarity of 2 other communities (dry calcareous grassland - St. 3 and cultivated meadow - St. 9) was evidently lower than what corresponds to different habitat types of the compared sites.

Discussion

The recording of 198 spider species in a sixteen-month research programme in a restricted area indicates a very rich spider fauna of this karst ecosystem. This is approximately 23% of the Slovak araneofauna, in spite of the fact that a relatively small part of Slovakia and a limited set of habitats were studied. The compositions of the studied spider communities in the study area showed great variation depending mainly on vegetation structure, as well as on environmental factors and land use. The vegetation of the habitats modifies microclimatic factors such as moisture, intensity of sunshine, and also determines its spatial structure (Wise 1993). More authors (Abraham 1983, Robinson 1981, Uetz 1975, etc.) have demonstrated narrow relationships between spider and plant communities. Of the investigated habitats, the open dry calcareous grasslands with threatened spider communities are especially interesting from a nature conservation point of view. The area of these types of habitat is continually decreasing as the result of natural succession after grazing has been reduced or stopped. At present their spider communities are bound to only small fragments of habitat which are spatially limited and into which some forest species have spread from surrounding forest and shrubby habitats, such as *Pardosa lugubris, Cicurina cicur*, etc. In the case that this negative trend continues, the typical karst habitats will disappear and with them also numerous stenotopic, rare and threatened species will be lost. For this reason it will be necessary very soon to suggest and to realize management activities insuring the efficient protection of

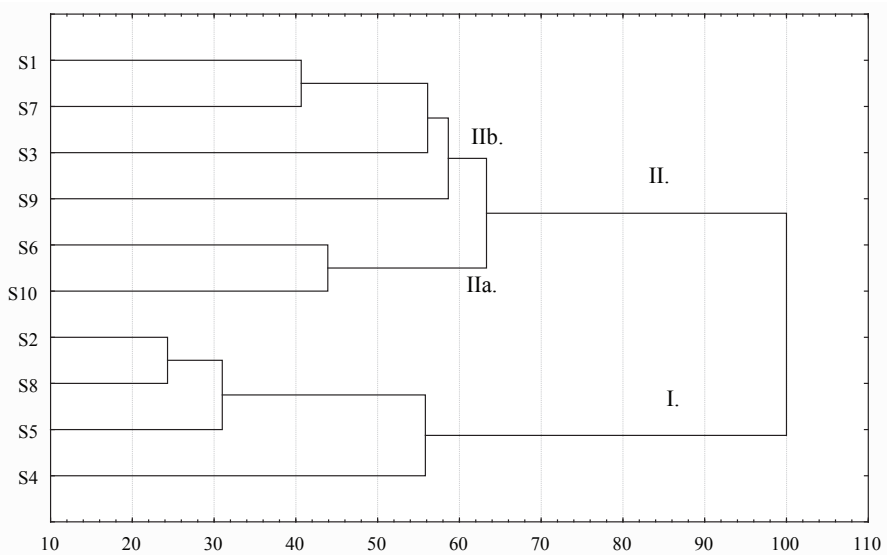

Fig. 1. Hierarchical classification of epigeic spider communities of the sites 1-10 according to Ward´s clustering method.

these rare habitats. Suggested management activities might consist of cutting of shrubs and trees, grazing, mowing and burning of the selected parts, respectively.

Also the sites of the mown old extensively used orchard show high spider species richness and present a habitat for some threatened species, such as *Dysdera hungarica*, *Sintula spiniger*, *Agroeca lusatica*, etc. This type of habitat is relatively numerous in the area, therefore has a great importance from a protection point of view. Because this type of habitat is vulnerable, it is also necessary to consider/include protection of these semi-natural habitats in the management programmes.

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Паяците на Домица (Словашки Карстови планини): състав на съобществата и оценка на хабитатите (Araneae)

П. Гайдош

(Резюме)

Статията представя резултатите от изследване на съобществата от паяци в района на Домица (Словашки Карстови планини), състояло се в периода 2003-2004 г. Проучването е проведено в 27 площадки, като в 12 от тях са заложени земни капани. Уловени са над 2712 екземпляра от 198 вида, което показва високото видово разнообразие на изследвания район – приблизително 23% of цялата словашка аранеофауна. Петнадесет вида са включени в Червения списък на Словакия, а намирането на видове като *Centromerus capucinus* (EN), *Diaea livens* (CR), *Hahnia picta* (EN) and *Sintula spiniger* (EN) е от голямо значение, тъй като тези паяци са много редки в страната. Голямото видово богатство и наличието на редки видове показва голямата консервационна значимост на района на Домица. Сравнителният анализ на отделните хабитати, направен въз основа на уловените редки и застрашени паяци показва, че най-консервационно значими са сухите варовикови пасища в понори (площадка No. 6), сухите варовикови поляни в карстовите райони на резервата Домицке шкарпи (площадка No. 3) и старата, интензивно използвана градина в близост до Кечово (площадка No. 7).

Appendix 1. List of species and number of specimens collected from study sites of the Domica drainage area. See text for explanation of classification numbers and letters for individual study sites.

Family / species	Study sites												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Other**
PHOLCIDAE													
Pholcus opilionoides (Schrank, 1781)			1										
DYSDERIDAE													
Dysdera hungarica Kulczyński, 1897		11	1	1	1	3	6	5					
Harpactea rubicunda (C.L. Koch, 1838)				1	2								
MIMETIDAE													
Ero furcata (Villers, 1789)	1	1		1			1			1			
ERESIDAE													
Eresus cinnaberinus (Olivier, 1789)			1									1	
THERIDIIDAE													
Achaearanea sp. (*lunata*)						1							
Dipoena melanogaster (C.L. Koch, 1837)													K, M, N
Enoplognatha ovata (Clerck, 1757)		2											
Episinus angulatus (Blackwall, 1836)		2								1			
E. truncatus (Latreille, 1809)										1			
Euryopis flavomaculata (C.L. Koch, 1836)												4	
Lasaeola tristis (Hahn, 1833)													B
Neottiura bimaculata (Linnaeus, 1767)							2				1		J
N. suaveolens (Simon, 1879)	1								1				K
Robertus lividus (Blackwall, 1836)		1			2			1	1	1			
Simitidion simile (C.L. Koch, 1836)													N
Steatoda phalerata (Panzer, 1801)			1								1		
Theridion impressum (L. Koch, 1881)			1										
T. nigrovariegatum (Simon, 1873)													K,N
T. sisyphium (Clerck, 1757)													
T. tinctum (Walckenaer, 1802)													E,K,N
Theridion sp. ? *neglectum*			1										
LINYPHIIDAE													
Anguliphantes angulipalpis (Westring, 1851)				1				1		1			
Bathyphantes parvulus (Westring, 1851)					1					6			
Centromerus capucinus (Simon, 1884)			34										
C. incilium (L. Koch, 1881)	1												
C. sylvaticus (Blackwall, 1841)	5	7	1	1	31	16	9	4		15			
Ceratinella brevis (Wider, 1834)	1	7	2		1					1		1	
C. scabrosa (O. P.-Cambridge, 1871)										1			
Dicymbium brevisetosum Locket, 1962					1								
Diplostyla concolor (Wider, 1834)		2	1	1	19		3	1	1				
Erigone dentipalpis (Wider, 1834)									1				
Floronia bucculenta (Clerck, 1757)													D,E
Gnathonarium dentatum (Wider, 1834)								1					D
Palliduphantes insignis (O. P.-Cambridge, 1913)							1						
Lepthyphantes minutus (Blackwall, 1833)				1									
Macrargus rufus (Wider, 1834)				1									
Megalepthyphantes pseudocollinus (Saaristo, 1997)				3				1					
Meioneta rurestris (C.L. Koch, 1836)	1								4				N
Microneta viaria (Blackwall, 1841)		3		2	2			2					

Appendix 1. Continued.

Family / species	Study sites												
	1	2	3	4	5	6	7	8	9	10	11	12	Other
Neriene clathrata (Sundevall, 1830)		1			2					1			E
N. montana (Clerck, 1757)													D
Panammomops fagei Miller, Kratochvíl, 1939					1								
Pocadicnemis juncea Locket, Millidge, 1953										2			
P. pumila (Blackwall, 1841)										1			
Sintula spiniger (Balogh, 1935)		2	27			9	21						
Stemonyphantes lineatus (Linnaeus, 1758)	1												
Syedra gracilis (Menge, 1869)		2											
Tenuiphantes flavipes (Blackwall, 1854)				6				5					
T. mengei (Kulczyński, 1887)		1	1		1		1						
Trematocephalus cristatus (Wider, 1834)													K,N
Walckenaria alticeps (Denis, 1952)	2	14			6								
W. antica (Wider, 1834)				2									
W. capito (Westring, 1861)	1						4						
W. cucullata (C.L. Koch, 1836)				2						1			
W. dysderoides (Wider, 1834)		2			3								
W. mitrata (Menge, 1868)				1									
W. obtusa (Blackwall, 1836)					1								
TETRAGNATHIDAE													
Metellina segmentata (Clerck, 1757)													C,E
Pachygnatha degeeri (Sundevall, 1830)	9								5				
Pachygnatha listeri Sundevall, 1830					19					3			
Tetragnatha pinicola L. Koch, 1870													C
ARANEIDAE													
Aculepeira ceropegia (Walckenaer, 1802)													C
Agalenatea redii (Scopoli, 1763)													C,I
Araneus quadratus Clerck, 1757	1												A,C
A. triguttatus (Fabricius, 1793)													B
Araniella sp. (*cucurbitina – opisthographa*)													K,M
Argiope bruennichi (Scopoli, 1772)	1		1										
Cercidia prominens (Westring, 1851)			1										
Cyclosa conica (Pallas, 1772)													C, I,M
Hypsosinga sanquinea (C.L. Koch, 1844)													I
Gibbaranea bituberculata (Walckenaer, 1802)													C
Mangora acalypha (Walckenaer, 1802)			1										C,K,N
Singa hamata (Clerck, 1757)	1												D,E
Zilla dioda (Walckenaer, 1802)													K
LYCOSIDAE													
Alopecosa accentuata (Latreille, 1817)			6			5						6	
A. cuneata (Clerck, 1757)	12		1				8		11	1	1		
A. pulverulenta (Clerck, 1757)	26	1	1			1			23	1			
A. sulzeri (Pavesi, 1873)			3										
A. trabalis (Clerck, 1757)	12	9	3	2	10	18	16	1	8	26	29		L,M
Hogna radiata (C.L. Koch, 1838)												2	
Pardosa amentata (Clerck, 1757)	1	2			62								

Appendix 1. Continued.

Family / species	Study sites												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Other**
P. bifasciata (C.L. Koch, 1834)	2		38			4	2		3		3	4	
P. hortensis (Thorell, 1872)							2		26				
P. lugubris (Walckenaer, 1802)	6	92		11	102	4	4	42	1	22		8	
P. monticola (Clerck, 1757)											5		
P. paludicola (Clerck, 1757)	10	5			7		1		3	18			
P. palustris (Linnaeus, 1758)	2								45		8		
P. prativaga (L. Koch, 1870)										1			
P. pullata (Clerck, 1757)	16								23				
P. riparia (C.L. Koch, 1833)	20					10	13		1				
Pardosa sp.	2		5			1	2		12	2	1		
Pirata hygrophilus Thorell, 1872		1			1								
P. latitans (Blackwall, 1841)	2									1			
Trochosa ruricola (De Geer, 1778)	14	2			7		8						
T. terricola Thorell, 1856	7	19		5	24	6	7	5	5	13	1	1	D
Trochosa sp.	4												
Xerolycosa nemoralis (Westring, 1861)									8				
PISAURIDAE													
Pisaura mirabilis (Clerck, 1757)	5	5	1		3	1	8		6	5			B,C,H
OXYOPIDAE													
Oxyopes ramosus (Martini, Goeze, 1778)													C,F
ZORIDAE													
Zora spinimana (Sundevall, 1833)		3			2		2	1		22			
AGELENIDAE													
Agelena gracilens C.L. Koch, 1841	2				1	1					1		C,E,H
Tegenaria agrestis (Walckenaer, 1802)			12				3					4	
T. campestris C.L. Koch, 1834				3				1					
T. ferruginea (Panzer, 1804)													C,O
T. silvestris L. Koch, 1872				5									
CYBAEIDAE													
Cybaeus angustiarum L. Koch, 1868						1							
HAHNIDAE													
Cryphoeca silvicola (C.L. Koch, 1834)			1										
Hahnia nava (Blackwall, 1841)	7	3			1		2		4	2	3	1	
H. picta Kulczyński, 1897										1			
DICTYNIDAE													
Argenna subnigra (O. P.-Cambridge, 1861)											1		
Cicurina cicur (Fabricius, 1793)	3	12		13	11	5		9	6	8			
Lathys humilis (Blackwall, 1855)													N
AMAUROBIIDAE													
Coelotes inermis (L. Koch, 1855)				37		1		19					
Urocoras longispinus (Kulczyński, 1897)			24	2	2		22					14	
MITURGIDAE													
Cheiracanthium elegans Thorell, 1875								1					
C. punctorium (Villers, 1789)													H
Cheiracanthium sp.									1				
ANYPHAENIDAE													
Anyphaena accentuata (Walckenaer, 1802)				2			1						B,E,K
LIOCRANIDAE													
Agroeca brunnea (Blackwall, 1833)		4		3	10	1	1	1		25			

Appendix 1. Continued.

Family / species	Study sites												
	1	2	3	4	5	6	7	8	9	10	11	12	Other
A. lusatica (L. Koch, 1875)	3		1			2	11		2				
Scotina celans (Blackwall, 1841)	2					1							
CLUBIONIDAE													
Clubiona caerulescens C.L. Koch, 1839													M
C. comta C.L. Koch, 1839													K,M
C. diversa O.P.-Cambridge, 1862	1												
C. neglecta O.P.-Cambridge, 1862													E,H
C. pallidula (Clerck, 1757)										1			
Clubiona sp.					1								
CORINNIDAE													
Phrurolithus festivus (C.L. Koch, 1835)					3		4		3	2		1	L
ZODARIIDAE													
Zodarion germanicum (C.L. Koch, 1837)								3				2	
GNAPHOSIDAE													
Drassodes lapidosus (Walckenaer, 1802)			3									6	
D. pubescens (Thorell, 1856)	3				1					2			
Drassodes sp.							16		1				
Drassyllus praeficus (L. Koch, 1866)	5		8			2	4		9		3	2	
D. pumilus (C.L. Koch, 1839)							9						
D. pussilus (C.L. Koch, 1833)	18	1		1			13		28	2	5	1	
D. villicus (Thorell, 1875)												1	
Gnaphosa lucifuga (Walckenaer, 1802)			9									3	L
G. modestior Kulczyński, 1897						9						1	
Gnaphosa sp.										1			
Haplodrassus signifer (C.L. Koch, 1839)	3						8		3	2		1	
H. silvestris (Blackwall, 1833)		5		1				3	1				
Micaria pulicaria (Sundevall, 1831)					2								
Kishidaia conspicua (L. Koch, 1866)						1							
Trachyzelotes pedestris (C.L. Koch, 1837)	7	1	2			2	1			2	2	1	
Zelotes apricorum (L. Koch, 1876)	1	3			8			2		1		1	
Z. erebeus (Thorell, 1871)			1										
Z. latreillei (Simon, 1878)	11			1	1		3		2	3			
Z. petrensis (C.L. Koch, 1839)	1	1	11				1	1		1	3	6	J
Zelotes sp.	2		4		4		1					2	
SPARASSIDAE													
Micrommata virescens (Clerck, 1757)			1							1			C
PHILODROMIDAE													
Philodromus aureolus (Clerck, 1757)													M,N
P. dispar Walckenaer, 1826													
P. margaritatus (Clerck, 1757)													F,K
Thanatus arenarius L. Koch, 1872									1		5		
T. formicinus (Clerck, 1757)	1		3								2		
Tibellus maritimus (Menge, 1875)										1			
T. oblongus (Walckenaer, 1802)	1									1			C
THOMISIDAE													
Diaea livens Simon, 1876													M,N
Misumena vatia (Clerck, 1757)													C,N
Misumenops tricuspidatus (Fabricius, 1775)	1		1										A,B,C,E, K,M,N

Appendix 1. Continued.

Family / species	Study sites												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Other**
O. nigrita (Thorell, 1875)			6										
O. praticola (C.L. Koch, 1837)		8		2	1		5	1					
O. pullata (Thorell, 1875)	2		9				2		2			3	
O. scabricula (Westring, 1851)			1				2		9		3		
O. trux (Blackwall, 1846)	1												
Pistius truncatus (Pallas, 1772)			1										A,B,K,M
Synema globosum (Fabricius, 1775)	1												A,B,C,G,H,K,M,N
Tmarus piger (Walckenaer, 1802)			1										B,C,G,K
T. stelio Simon, 1875													N
Xysticus audax (Schrank, 1803)									1		2		
X. bifasciatus C.L. Koch, 1837	2					1	3						
X. cristatus (Clerck, 1757)	1								1				
X. lanio C.L. Koch, 1835													K
X. lineatus (Westring, 1851)	8									1			
X. luctator L. Koch, 1870)					1			1					
X. ninni Thorell, 1872												4	
X. striatipes L. Koch, 1870									4		2		
X. ulmi (Hahn, 1831)													N
Xysticus sp.						1	6			1			
SALTICIDAE													
Asianellus festivus (C.L. Koch, 1834)			1		1							2	
Ballus chalybeius (Walckenaer, 1802)													A,B,K,M
Sibianor aurocinctus (Ohlert, 1865)									1				
Carrhotus xanthogramma (Latreille, 1819)													M,N
Dendryphantes rudis (Sundevall, 1833)													F
Euophrys frontalis (Walckenaer, 1802)													M,N
Evarcha arcuata (Clerck, 1757)	4												C,H
E. falcata (Clerck, 1757)	1		1										
E. laetabunda (C.L. Koch, 1846)													L
Heliophanus flavipes (Hahn, 1832)									2				
H. kochii Simon, 1868													
Macaroeris nidicolens (Walckenaer, 1802)													M,N
Marpissa muscosa (Clerck, 1757)								1					
M. nivoyi (Lucas, 1846)					1								
Myrmarachne formicaria (De Geer, 1778)							1						
Pellenes nigrociliatus (Simon, 1875)												1	
Phlegra fasciata (Hahn, 1826)	2		1				2			1		1	
Pseudeuophrys obsoleta (Simon, 1868)			1									1	
Pseudicius encarpatus (Walckenaer, 1802)													M,N
Salticus sp. (? *cingulatus* or *zebraneus*)													N