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Spiders (Araneae) of stony debris in North Bohemia

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Abstract: The arachnofauna was studied at five stony debris sites in northern Bohemia. In Central Europe, the northern and montane species inhabiting cold places live not only on mountain tops and peat bogs but also on the lower edges of boulder debris, where air streaming through the system of inner compartments gives rise to an exceedingly cold microclimate. At such cold sites, spiders can live either on bare stones (*Bathyphantes simillimus*, *Wubanoides uralensis*), or in the rich layers of moss and lichen (*Diplocentria bidentata*). *Kratochviliella bicapitata* exhibits a diplostenoecious occurrence in stony debris and on tree bark. *Latithorax faustus* and *Theonoe minutissima* display diplostenoecious occurrence in stony debris and on peat bogs. The occurrence of the species *Scotina celans* in the Czech Republic was documented for the first time.

Key words: Spiders, stony debris, microclimate, geographic distribution.

INTRODUCTION

Stony debris constitute, in Central Europe, island ecosystems which have remained virtually intact over the entire Holocene. Due to the unfeasibility of utilization, stony debris areas are among the few ecosystems that have only minimally been affected by man. In bulky accumulations, air can flow through the system of internal spaces. In this way, cold air can accumulate in the lower part of the talus, so that ice can form and persist there until late spring. This phenomenon, well known from the Alp region (FURRER 1966), occurs widely in North Bohemia (KUBÁT 1971). Owing to the specific substrate and microclimate, stony debris areas are inhabited by specific plant (SÁDLO & KOLBEK 1994) and animal communities, contributing thus significantly to the biodiversity of the landscape (RŮŽIČKA 1993a). We investigated spiders in five boulder accumulations in North Bohemia.

MATERIALS AND METHODS

Trapping

The spiders were trapped in modified pitfall traps made of rigid plastic. The traps contained a mixture of 7% formaldehyde and 10% glycerol with a few drops of a surfactant (RŮŽIČKA 1982, 1988). These traps were positioned 20 to 100 cm under the surface of stony debris. They were exposed for one year. The preserved catch was then processed in the laboratory.

Sites

Kamenec. The Kamenec hill near Starý Šachov, organism grid mapping quadrat 5252. The northern slope, which declines into the Plou nice river valley, hosts a basalt debris accumulation at an elevation of about 350 m. Air flows through a system of underground compartments in a thick boulder layer. Whereas warm water vapour leaves the upper part of the boulder field in winter, cold air streams from the lower part of the field in spring and early summer and ice forms there. Characteristic of this debris accumulation is an exceedingly rich moss cover of the stones. The arcto-alpine moss species *Gymnomitrion corallioides* and the montane fern *Cryptogramma crispa* were found at the lower edge of the accumulation. Kamenec is the lowest lying site where those species have been observed in the Czech Republic (PUJMANOVÁ 1988, 1989). 26 traps were positioned here from June 1993 to July 1995, predominantly on the surface with some of them located within the debris. The surface ones were emptied approximately at monthly intervals.

Milešovka. Milešovka is the highest mountain of the Ceské Stredohorí Mountains, organism grid mapping quadrat 5449. A narrow strip of fine phonolite debris lies on the foot of the southwestern slope at an altitude of about 550 m, under the Výrí Skály rocks. Six traps were positioned here from June 1993 to July 1994 within the debris.

Suchý Vrch. Suchý Vrch hill in the Luzické Hory mountains, west of the Marenice village, organism grid mapping quadrat 5153. The whole northern slope of the Suchý Vrch is covered by phonolite boulders. Under the top, at an elevation of roughly 620 m, is a minor boulder accumulation; the slope is grown with a forest. At an elevation of 580 m is a pseudo-karst ice cave, a vertical fissure in the compact phonolite 1-2 m wide and 29 m long. The ceiling of the cave is formed by stone blocks which are part of the stone

accumulation (KRÁL & ŘEZÁČ 1950). Cold air streams among blocks into the cave and causes ice formation there, particularly during the spring thawing. This is the only cave in the Czech Republic where ice persists all the year round (HROMAS 1971). 12 traps were positioned within bare and forested debris and in the cave from June 1993 to July 1994.

Malý Stožec. The Malý Stožec hill, the Lužické Hory Mountains, organism grid mapping quadrat 5153. A phonolite boulder accumulation lies below the top rocks, at an elevation of about 600 m. Three traps were positioned here within the debris from September 1993 to July 1994.

Muchov. The Muchov hill lies at the eastern edge of the erná Studnice crest, south of the town of Tanvald, organism grid mapping quadrat 5257. An extensive granite block field lies at the northern to northeastern edge of the top of the hill, at an elevation of 700-750 m (VÍTEK 1987).
Five traps were positioned here within the debris from September 1993 to July 1994.

RESULTS AND COMMENTS ON SOME SPECIES

872 spiders representing 108 species were collected on five sites. Twelve species were detected at three sites at least; some of them (e. g. *Rugathodes bellicosus, Lepthyphantes notabilis, Micrargus apertus*) are regular and exclusive inhabitants of stony debris. The species richness of spider communities living in stony debris was confirmed again, as was the differentiation of the species location with respect to the different microclimatic conditions existing at the different sites of the stone accumulations (RŮŽIČKA, 1994; RŮŽIČKA et al. 1995).

Scotina celans was found at the Kamenec hill at the forest edges of the upper part of the debris field: this is consistent with the data concerning this species published by GRIMM (1986). Although MILLER (1971) reported occurrence of this species in the former Czechoslovakia, he failed to specify the location. Thus the finding at the Kamenec site represents the only documented occurrence of *Scotina celans* in the Czech Republic.

Latithorax faustus was observed in moss at the lower edge of the debris at the Kamenec hill. Until now, this northern species has only been known to inhabit peat bogs. Its occurrence has been reviewed by KŮRKA (1995).

Kratochviliella bicapitata has been found in the Czech Republic, in Poland, Austria and Germany. WUNDERLICH (1982) and WUNDERLICH & NIKOLAI (1984) reported on the occurrence of this species on tree bark, CZAJKA (1971) found it in deep, shaded cracks in tree bark exposed to the north and, to a lesser extent, under stones in the surroundings. Czech literature gives the following information on the environmental demands of this species: under stones sunk into loose forest litterfall under old pines and spruces (MILLER 1971), in leaf litter and under stones near a brook (BUCHAR & HAJER 1990). In the Podyjí National Park in southern Moravia, specimens of *Kratochviliella bicapitata* were observed in stony debris and in pseudokarst caves within a decaying gneiss massif (RŮŽIČKA 1996). The fact that the spiders were found in stony debris on the Kamenec hill is a confirmation of the fact that this species inhabits stony biotopes (Fig. 1). FRANC & HANZELOVÁ (1995) recorded *Kratochviliella bicapitata* in the underground spaces of a basalt block accumulation in the Cerová Vrchovina highland in southern Slovakia.

Diplocentria bidentata has only been found three times in the Czech Republic, viz. in moss at the lower edge of stony debris on the Plešivec hill in the České Středohoří Protected Landscape Area (BUCHAR 1989), in moss at the lower edge of an accumulation of sandstone rock blocks in the Teplické Skály within the Broumovsko Protected Landscape Area (RŮŽIČKA 1992), and in moss at the lower edge of the block debris in the Vydra river valley in the Šumava National Park (RŮŽIČKA in press). At the Kamenec hill, specimens of this spider were caught in pitfall traps laid in moss between boulders at the lower edge of the debris (Fig. 1).

Bathyphantes simillimus is an exclusive lithobiont, whose occurrence has been reviewed by RŮŽIČKA (1994). Since then, specimens of this spider have been observed in the Harz Mountains (lgt. P.Sacher). At the Kamenec hill, this species was found both at the lower edge of the debris and within the inner space at a depth of approximately 2 m. At the Suchý Vrch hill, it was found within the debris and in the ice cave. At the Muchov site, it was found within the debris.

Wubanoides uralensis was found at the Kamenec and Muchov sites within the debris, between bare stones. Although stony debris in the Czech Republic has been examined rather extensively (RŮŽIČKA 1993b), this species has only been found at the northernmost sites (Fig. 1), only several tens of kilometers from the boundary of the maximum extent of the northern Pleistocene glacier (Fig. 1). A review of the overall occurrence of the species *W. uralensis* has been presented by RŮŽIČKA & ZACHARDA (1994).

Specimens of *Theonoe minutissima* were found in moss on the debris at the Kamenec hill as well as within the debris, between bare stones, at the Suchý Vrch and Muchov sites. MILLER (1971) reported the occurrence of this species on wet peat moss, BUCHAR (1989), within stony debris.

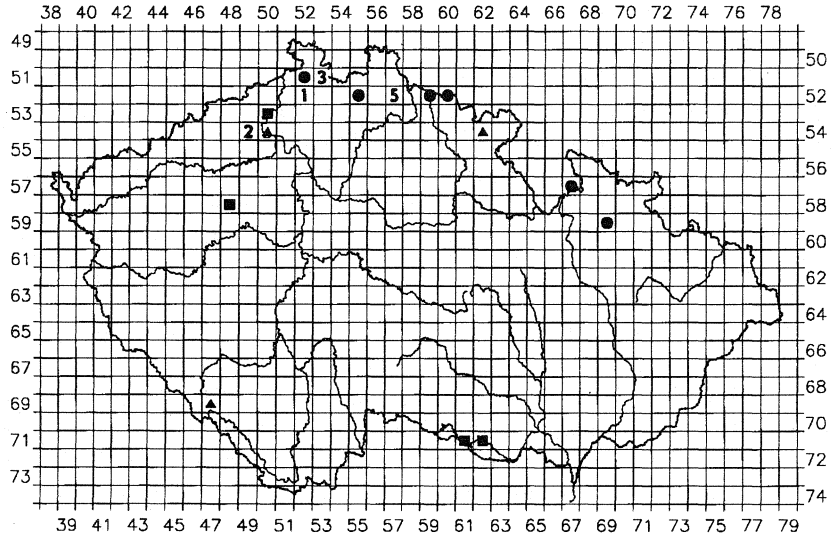

Fig. 1. Location of collection sites: 1 - Kamenec, 2 - Milešovka, 3 - Suchý Vrch and in the same quadrat lies the locality No. 4 - Malý Stožec, 5 - Muchov. The distribution of three species in the Czech Republic: *Wubanoides uralensis* ● and the localities No. 1 and 5, *Kratochviliella bicapitata* ■ and the locality No. 1, *Diplocentria bidentata* ▲ and the locality No. 1.

Tab. 1. Survey of material. 1. Kamenec, 2. Milešovka, 3. Suchý Vrch, 4. Malý Stožec, 5. Muchov. Number of specimens.

Species	Locality 1	2	3	4	5
Segestriidae					
Segestria senoculata (Linné, 1758)	7	-	1	-	-
Dysderidae					
Harpactea hombergi (Scopoli, 1763)	5	1	-	-	1
Harpactea lepida (C.L.Koch, 1838)	-	-	1	-	-
Nesticidae					
Neticus cellulanus (Clerck, 1757)	1	10	-	1	-
Theridiidae					
Paidiscura pallens (Blackwall, 1834)	2	-	-	-	-
Pholcomma gibbum (Westring, 1851)	4	-	4	-	-
Rugathodes bellicosus (Simon, 1873)	3	5	-	1	2
Theonoe minutissima (O.P.-Cambridge, 1879)	2	-	2	-	1
Theridion bimaculatum (Linné, 1767)	2	-	-	-	-
Linyphiidae					
Asthenargus helveticus Schenkel, 1936	4	-	-	-	-
Bathyphantes gracilis (Blackwall, 1861)	9	-	-	-	-
Bathyphantes parvulus (Westring, 1851)	2	-	-	-	-
Bathyphantes simillimus buchari RUZICKA, 1988	16	-	6	-	3
Centromerita bicolor (Blackwall, 1833)	5	-	-	-	-
Centromerus arcanus (O.P.-Cambridge, 1873)	9	-	-	3	1
Centromerus pabulator (O.P.-Cambridge, 1875)	1	-	-	-	-
Centromerus sylvaticus (Blackwall, 1841)	3	-	-	-	-
Ceratinella brevis (Wider, 1834)	7	-	1	1	-
Dicymbium nigrum (Blackwall, 1834)	6	-	-	-	-
Diplocentria bidentata (Emerton, 1882)	23	-	-	-	-
Diplocephalus cristatus (Blackwall, 1833)	16	-	-	-	-
Diplocephalus latifrons (O.P.-Cambridge, 1863)	5	-	-	-	-
Diplocephalus picinus (Blackwall, 1841)	1	-	-	-	-
Erigone atra Blackwall, 1833	4	-	-	-	-
Erigonella hiemalis (Blackwall, 1841)	11	-	-	-	-
Kratochviliella bicapitata Miller, 1938	3	-	-	-	-
Latithorax faustus (O.P.-Cambridge, 1900)	1	-	-	-	-
Lepthyphantes alacris (Blackwall, 1853)	67	-	-	-	1
Lepthyphantes alutatius Simon, 1884	4	-	-	-	-
Lepthyphantes cristatus (Menge, 1866)	2	-	-	-	-

Lepthyphantes flavipes (Blackwall, 1854)	2	-	-	-	-
Lepthyphantes leprosus (Ohlert, 1865)	8	-	-	-	-
Lepthyphantes mansuetus (Thorell, 1875)	1	-	-	-	-
Lepthyphantes mengei Kulczynski, 1887	7	-	-	-	-
Lepthyphantes notabilis Kulczynski, 1887	1	1	6	-	-
Lepthyphantes obscurus (Blackwall, 1841)	-	-	-	-	1
Lepthyphantes tenebricola (Wider, 1834)	4	-	-	-	-
Lepthyphantes tripartitus Miller & Svaton, 1978	43	-	6	-	-
Linyphia hortensis Sundevall, 1830	1	-	-	-	-
Linyphia triangularis (Clerck, 1757)	2	-	-	-	-
Macrargus rufus (Wider, 1834)	2	-	-	-	-
Maso sundevalli (Westring, 1851)	3	-	-	-	-
Meioneta beata (O.P.-Cambridge, 1906)	1	-	-	-	-
Meioneta rurestris (C.L.Koch, 1836)	3	-	-	-	-
Meioneta saxatilis (Blackwall, 1844)	6	-	-	-	-
Micrargus apertus (O.P.-Cambridge, 1871)	3	-	2	-	3
Microneta viaria (Blackwall, 1841)	-	1	-	-	-
Minyriolus pusillus (Wider, 1834)	7	-	-	-	-
Neriene clathrata (Sundevall, 1830)	1	-	-	-	-
Neriene peltata (Wider, 1834)	1	-	-	-	-
Oedothorax apicatus (Blackwall, 1850)	20	-	-	-	-
Oedothorax retusus (Westring, 1851)	2	-	-	-	-
Porrhomma egeria Simon, 1884	2	1	-	-	-
Porrhomma microphthalmum (O.P.-Cambridge, 1871)	1	-	-	-	-
Porrhomma pallidum Jackson, 1913	-	-	1	-	-
Porrhomma pygmaeum (Blackwall, 1834)	1	-	-	-	-
Talusia experta (O.P.-Cambridge, 1871)	2	-	-	-	-
Walckenaeria antica (Wider, 1834)	1	-	-	-	-
Walckenaeria atrotibialis (O.P.-Cambridge, 1878)	7	-	-	-	-
Walckenaeria capito (Westring, 1861)	1	-	-	-	1
Walckenaeria corniculans (O.P.-Cambridge, 1875)	1	-	2	-	-
Walckenaeria cuculata (C.L.Koch, 1936)	-	-	-	-	1
Walckenaeria furcillata (Menge, 1869)	1	-	-	-	-
Wubanoides uralensis (Pakhorukov, 1981)	1	-	-	-	2
Tetragnathidae					
Meta menardi (Latreille, 1804)	1	-	2	1	-
Metellina merianae (Scopoli, 1763)	2	-	-	-	-
Pachygnatha clercki Sundevall, 1823	2	-	-	-	-
Pachygnatha degeeri Sundevall, 1830	4	-	-	-	-
Tetragnatha obtusa C.L.Koch, 1837	1	-	-	-	-

Araneidae					
Mangora acalypha (Walckenaer, 1802)	3	-	-	-	-
Lycosidae					
Acantholycosa norvegica sudetica (L.Koch, 1875)	60	15	-	-	-
Alopecosa cuneata (Clerck, 1757)	1	-	-	-	-
Alopecosa pulverulenta (Clerck, 1757)	5	-	-	-	-
Alopecosa taeniata (C.L.Koch, 1835)	19	-	2	-	-
Pardosa amentata (Clerck, 1757)	5	-	-	-	-
Pardosa lugubris (Walckenaer, 1802)	8	-	1	-	-
Pardosa palustris (Linné, 1758)	2	-	-	-	-
Trochosa robusta (Simon, 1876)	-	1	-	-	-
Trochosa terricola Torell, 1856	2	-	-	-	-
Xerolycosa nemoralis (Westring, 1861)	31	-	1	-	-
Agelenidae					
Histopona torpida (C.L.Koch, 1834)	11	-	1	-	-
Tegenaria ferruginea (Panzer, 1804)	2	-	-	-	-
Tegenaria silvestris L.Koch, 1872	8	1	8	-	-
Cybaeidae					
Cybaeus angustiarum L.Koch, 1868	1	1	-	-	-
Hahniidae					
Cryphoeca silvicola (C.L.Koch, 1834)	24	1	-	-	-
Hahnia helveola Simon, 1875	1	-	-	-	-
Hahnia ononidum Simon, 1875	2	-	-	-	-
Hahnia pusilla C.L.Koch, 1841	1	-	-	-	-
Dictynidae					
Cicurina cicur (Fabricius, 1793)	4	-	-	-	1
Amaurobiidae					
Amaurobius fenestralis (Stroem, 1768)	9	-	-	-	-
Callobius claustrarius (Hahn, 1833)	46	1	2	-	-
Coelotes inermis (L.Koch, 1855)	-	-	-	1	-
Coelotes terrestris (Wider, 1834)	67	-	-	-	-
Liocranidae					
Agroeca brunnea (Blackwall, 1833)	2	-	-	-	-
Apostenus fuscus Westring, 1851	4	2	-	-	-
Liocranum rupicola (Walckenaer, 1830)	10	1	-	-	-
Phrurolithus festivus (C.L.Koch, 1835)	1	-	-	-	-
Scotina celans (Blackwall, 1841)	5	-	-	-	-

Gnaphosidae					
Drassodes cupreus (Blackwall, 1834)	1	-	-	-	-
Drassodes lapidosus (Walckenaer, 1802)	1	1	-	-	-
Echemus angustifrons (Westring, 1862)	3	-	-	-	-
Micaria pulicaria (Sundevall, 1832)	1	-	-	-	-
Zelotes subterraneus (C.L.Koch, 1833)	29	-	-	-	-
Zoridae					
Zora spinimana (Sundevall, 1833)	6	-	-	-	-
Salticidae					
Euophrys frontalis (Walckenaer, 1802)	1	-	-	-	-
Evarcha flammata (Clerck, 1757)	1	-	-	-	-
Neon reticulatus (Blackwall, 1853)	2	-	-	-	-
Sitticus pubescens (Fabricius, 1775)	1	-	3	-	-

CONCLUSIONS

The occurrence in central Europe of northern species, living in cold places, is known from two climatically cold types of sites, viz. high mountain sites and peat bogs. A third habitat is to be added to those two, viz. lower edges of stony debris with a dynamic air streaming regime, where places of exceedingly cold microclimate can be found even at lower elevations: although their area is very small, it is sufficient for the survival of prospering populations of invertebrates.

Not only the bare boulder surface but also moss and lichen layers form a suitable substrate for habitation within the debris. Boulder surface can be inhabited, for instance, by the species *Bathyphantes simillimus* and *Wubanoides uralensis*, whereas the species *Diplocentria bidentata* has never been observed in bare stony formations although it can be found in moss layers at lower edges of cold stony debris.

The wet and cold environment of the inner space and lower edges of stony debris resembles the wet and cold environment of peat bogs. Diplostenoecious occurrence both on peat bogs and in stony debris has been ascertained for the species *Theonoe minutissima* and *Latithorax faustus*, whereas for the species *Kratochviliella bicapitata*, this type of occurrence is known on tree bark and also in stony biotopes.

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