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SPIDERS (ARANEAE) OF ZBRAŠOVSKÉ ARAGONITOVÉ JESKYNĚ NATIONAL NATURE MONUMENT (MORAVIA, CZECH REPUBLIC)

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Abstract

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Spiders of non-cave part of Zbrašovské aragonitové jeskyně National Nature Monument were investigated during the year 2011. Several capture methods were used from April to October. Altogether, 71 species from 20 families were recorded and 46 more species were allready found in previous studies. Until 2012, there are 89 species known from this NNM in total. Several remarkable species were found: *Ceratinella major*, *Megalepthyphantes nebulosus*, *Porrhomma convexum*. Most of spider species from the locality belong to climax (C) and semi-natural (SN) habitat species.

Spiders, Araneae, Zbrašovské aragonitové jeskyně NNM, faunistics

The spider fauna of Zbrašovské aragonitové jeskyně National Nature Monument (NNM) has never been published. There exist several studies focused on spider fauna, mainly from the caves and underground (Tajovský *et al*., unpubl. data; Tajovský, unpubl. data; Tuf and Tufová, unpubl. data; Mlejnek, unpubl. data; Růžička, unpubl. data) and from the Hůrka National Nature Reserve (Majkus, 1988 and 1991; Tuf *et al*., 2009; Mikula, 2009; Machač, 2011). Spider fauna of Hůrka NNR is manily thermophilous and contains a lot of rare and interesting species (cf. Machač, 2011) and arachnofauna of underground and caves is mainly psychrophilous. Zbrašovské aragonitové jeskyně (NNM) is the only un-explored area. The aim of this study was to investigate spider fauna of this area, except cave spider fauna, and to improve our knowledge of spiders within this remarkable karst territory.

MATERIAL AND METHODS

Locality

Zbrašovské aragonitové jeskyně NNM: The Zbrašovské aragonitové jeskyně were declared as a national nature monument in 2003, it takes 7.74 ha and lies in the land register of Teplice nad Bečvou. The altitude of protected area is between 250–300 m a.s.l. (Patzelt, 2008). Locality belongs to the faunistic square 6472.

The territory was divided into two parts due to investigation namely of ground dwelling spiders.

T1 – dry forest, GPS coordinates: 49°31'51"N, 17°44'42"E is the habitat on the slope with direction to Bečva river. The majority of trees are: Oaks *Quercus* spp., Beech (*Fagus sylvatica*), Hornbean (*Carpinus betulus*), three species of Maples (*Acer* spp.), Ash (*Fraxinus excelsior*), Lime tree (*Tilia cordata*) and Silver Fir (*Abies alba*). The gound is stony slope with north-east orientation.

T2 – semi-humid forest, GPS coordinates: 49°31'37"N, 17°44'45"E. Traps where located at the lower part of incision with small stream. This is the only place at the locality with nitrophilous and hygrophilous vegetation (*Urtica dioica*, *Scirpus sylvaticus*). Trees are represented by Alder (*Alnus glutinosa*), Norwegian Spruce (*Picea abies*), Fir (*Abies alba*), Sycamore Maple (*Acer pseudoplatanus*) and Beech (*Fagus sylvatica*). The locality has north orientation.

Methods

We used AOPK methodology for spiders collecting (Řezáč, 2009) including pitfall traps, detritus sifting, sweeping from vegetation and hand-collecting. Pitfall traps were placed on both localities (dry and semi-humid forest). There were three pitfall traps arranged in line at about five-metre intervals on each locality. We used 0.5l plastic cups as pitfall traps (diameter 9 cm) and 4% formaldehyde solution as a fixative fluid.

Spiders from the pitfall traps were collected monthly in the following intervals: April 12–May 21, May 21–July 14, July 14–August 21, August 21–October 4. The rest of collecting methods, mentioned above, were employed each month. Collected spiders were preserved in 70% alcohol.

The majority of spiders were determined by the authors according to the basic arachnological literature (Miller, 1971; Heimer & Nentwig, 1991; Roberts, 1987 and 1995 etc.). All specimens of *Porrhomma* spp. were determined by Vlastimil Růžička. Nomenclature follows Platnick (2012) applying the Clerck name extension in accordance with Art. 3.1 of ICZN (1999).

RESULTS

There were 71 spiders species collected in the Zbrašovské aragonitové jeskyně NNM during our investigations and other 46 species were found in previews studies by Tajovský *et al.*, Tajovský, Tuf and Tufová, Mlejnek (unpublished). All our findings are mentioned in Annotated list of species (below). Previous unpublished data (mentioned above) were used for comparision only and are still adequately unpublished in this study.

The communities of spiders identified at the localities may be characterized as a community of forest species (*Cybaeus angustriarum*, *Coelotes* spp., *Harpactea lepida*, *Inermocoelotes inermis*, *Malthonica silvestris* etc.), light forest species (*Pardosa lugubris*, *Dipoena melanogaster*, *Anyphaena accentuata*, *Nigma flavescens*), and species which are typical for floodplain localities, especially at the locality T2 (*Tetragnatha montana*, *Pachygnatha listeri*, *Piratula hygrophilus*, *Pardosa amentata*).

Species from well-preserved habitats were highly prevalent (C + SN species = 80%) and indicated the satisfactory condition of habitat conservation in this territory. Rare or interesting species inhabiting the locality included: *Ceratinella major*, *Megalepthyphantes nebulosus*, *Porrhomma convexum*, and *Hyptiotes paradoxus*.

Annotated list of species

Abbreviations of collecting methods: PtT1 – pitfall traps in T1 (dry forest), PtT2 – pitfall traps in T2 (semi-humid forest), Sf – sifting detritus, Sw – sweeping on vegetation, Hc – hand collecting. Spider species marked with an asterisk (*) were recorded from faunistic square 6472 before (Buchar & Růžička, 2002; Tuf *et al.*, 2009; Machač, 2011; and unpublished data).

Family: DYSDERIDAE

Dysdera erythrina lantosquensis Simon, 1882*

Species from the *D. erythrina* (Walcknenaer, 1802) complex. It is scarce, in various xerothermic forests, taxonomically clarified by Řezáč *et al.* (2008). April 12. 2011, Sf, 1♂; May 21.–July 14. 2011, PfT1, 2♂, 5♀.

Harpactea lepida (C. L. Koch, 1838)*

Very abundant, lives mainly in forest habitats. Common in screes. Species was found by Tajovský et al., Tajovský, Tuf and Tufová underground near caves in 2004 (unpublished). April 12. 2011, Sf, 3♂, 1♀; April 12.–May 21. 2011, PtT1, 1♀; April 12.–May 21. 2011, PtT2, 2♂, 1♀; May 21. 2011, Sf, 2♀; August 21.–October 4. 2011, PtT2, 1♀.

Harpactea rubicunda (C. L. Koch, 1838)*

Very abundant, lives under stones and other debris in warm, open and forest habitats, typical of the dry upper margins of scree slopes, rock and forest steppes, spoil heaps; numerous in and around houses. April 12.–May 21. 2011, PtT1, 1♀; May 21.–July 14. 2011, PtT2, 1♂; July 14.–August 27. 2011, PtT1, 1♂, 2♀.

Family: MIMETIDAE

Ero furcata (Villers, 1789)*

Very abundant, in open and forest habitats, among moss, in detritus and on vegetation. August 21.–October 4. 2011, PtT1, 1♂.

Family: THERIDIIDAE

Dipoena melanogaster (C. L. Koch, 1837)*

Scarce species, on trees, bushes and herbs in xerothermic habitats and in Oak-Hornbeam forests. May 21. 2011, Sw, 3♀.

Enoplognatha latimana Hippa & Oksala, 1982

Scarce, on herb vegetation in cultural landscape. July 14. 2011, Sw, 2♂.

Episinus angulatus (Blackwall, 1836)

Abundant, among low vegetation in oak forests, in birch forests on emission clearings, on forest margins. May 21. 2011, Sw, 1♂.

Robertus lividus (Blackwall, 1836)*

Very abundant, in various forest habitats in leaf litter and moss. Sporadically in open habitats. May 21. 2011, Sw, 1♂, 1♀.

Theridion melanurum Hahn, 1831*

Rare, in houses and in deciduous forests. May 21. 2011, Sw, 1♂.

Family: ULOBORIDAE

Hyptiotes paradoxus (C. L. Koch, 1834) *

Abundant, on spruce trees. May 21. 2011, Sw, 1 juv.; July 14. 2011, Hc, 1♂.

Family: LINYPHIIDAE

Centromerus sellarius (Simon, 1884)
Abundant, in forest habitats among moss. August 21.–October 4. 2011, PtT1, 1♂.

Centromerus sylvaticus (Blackwall, 1841)
Very abundant in wide range of open and forest habitats, among moss and detritus. April 12, 2011, Sf, 1♂; April 12.–May 21. 2011, PtT2, 2♀.

Ceratinella brevipes (Westring, 1851)
Scarce, among detritus and moss in waterlogged meadows, on pond margins, in inundation area of rivers. April 12.–May 21. 2011, PtT2, 4♂.

Ceratinella major Kulczyński, 1894*
Rare, in deciduous forests among detritus, often asociated with scree slopes. May 21.–July 7. 2011, PtT1, 1♂.

Diplostyla concolor (Wider, 1834)*
Very abundant, in detritus and among leaf litter of forests of all types, in open habitats as well. April 12.–May 21. 2011, PtT2, 1♂; May 21.–July 14. 2011, PtT2, 2♂; August 21.–October 4. 2011, PtT2, 1♂.

Entelecara acuminata (Wider, 1834)*
Abundant, in various forest on bushes and trees. May 21. 2011, Sw, 4♂, 1♀; May 21. 2011, Sf, 1♀.

Erigone dentipalpis (Wider, 1834)*
Very abundant, in meadows, fields, among grass in a wide range of open habitats. May 21. 2011, Sw, 1♂.

Floronia bucculenta (Clerck, 1758)*
Abundant, in alder woods, on pond margins, among high-grown tall vegetation. August 21. 2011, Sw, 1♀.

Labulla thoracica (Wider, 1834)*
Scarce, web near foot of tree trunk or on rock walls. August 21. 2011, Sf, 1♀; August 21.–October 4. 2011, PtT2, 2♀.

Lepthyphantes minutus (Blackwall, 1833)*
Abundant, in forest habitats on and under the tree bark. October 4. 2011, Sf, 2♂.

Leptorhoptrum robustum (Westring, 1851)
Abundant, among detritus and stones on river and brook banks and in wetlands. April 12, 2011, Sf, 1♀.

Linyphia hortensis Sundevall, 1830*
Abundant, on shrubs in forests and neighbouring habitats. May 21. 2011, Sw, 1♀.

Linyphia triangularis (Clerk, 1758)*
Very abundant, on herb and bushes in forests, on forest edges and meadows. August 21. 2011, Sw, 3♀.

Mansuphantes mansuetus (Thorell, 1875)
Very abundant, in forest habitats among grass and detritus. August 21. 2011, Sw, 1♀.

Maso sundevalli (Westring, 1851)*
Very abundant, in forest habitats on herb vegetation and among leaf litter. May 21. 2011, Sf, 1♀.

Megalepthyphantes nebulosus (Sundevall, 1830)
Abundant, in cellars and sporadically in ruderal places. July 14.–August 21. 2011, PtT1, 1♀.

Micrargus herbigradus (Blackwall, 1854)*
Highly abundant, living among leaves and detritus in all forest habitats, sporadically also in open habitats. April 12. 2011, Sw, 3♀.

Microlinyphia pusilla (Sundevall, 1830)*
Very abundant, on vegetation in meadows and other open habitats. May 21. 2011, Sw, 1♂.

Microneta viaria (Blackwall, 1841)*
Very abundant in forest habitats among leaf litter and detritus. April 12. 2011, Sw, 3♀; May 5.–July 14. 2011, PtT1, 1♂, 1♀; April 12.–May 25. 2011, PtT1, 8♂; April 12.–May 21. 2011, PtT2, 11♂, 1♀; May 21. 2011, Sf, 6♀; July 14. 2011, Sf, 2♀; October 10. 2011, Sf, 1♀.

Moebelia penicillata (Westring, 1851)
Scarce, in forest habitats on tree bark. April 12, 2011, Sf, 1♂; May 21. 2011, Sw, 1♂.

Neriene clathrata (Sundevall, 1830)*
Very abundant, in forest among leaf litter, in wet meadows. August 21. 2011, Sw, 1♀.

Neriene peltata (Wider, 1834)*
Abundant, on bushes in forest habitats, especially in scree forest. May 21. 2011, Sw, 3♀.

Oedothorax agrestis (Blackwall, 1853)*
Abundant, among gravel on gravel banks, sporadically in alder woods and other wetlands. April 4. 2011, Sf, 1♀; April 12.–May 21. 2011, PtT2, 1♀.

Palliduphantes pallidus (O. P. – Cambridge, 1871)*
Very abundant, open and forest habitats. May 21. 2011, Sf, 1♀; August 21.–October 4. 2011, PtT2, 1♂, 2♀.

Porrhomma convexum (Westring, 1851)
Rare, in various cold and wet habitats (including caves) among detritus and under stones, on brook banks, peat bogs, in mountain corries. April 12. 2011, Sf, 1♀.

Tapinocyba affinis Lessert, 1907
Abundant in forest, among moss and detritus. April 12, 2011, Sf, 1♂.

Tenuiphantes alacris (Blackwall, 1853)*
Abundant, in cold forests among moss and detritus, on scree slopes. July 14.–August 21. 2011, PtT1, 2♀; August 21.–October 4. 2011, PtT2, 1♂, 2♀; August 21. 2011, Sw, 3♀.

Tenuiphantes flavipes (Blackwall, 1854)*
Very abundant, in deciduous forest among leaf litter, sporadic in other forests and in open habitats. May 21.–July 7. 2011, PtT1, 2♀; April 12.–May 21. 2011, PtT1, 1♂, 3♀; August 21.–October 4. 2011, PtT1, 3♂, 2♀; October 4. 2011, Sf, 2♂.

Trematocephalus cristatus (Wider, 1834)*
Abundant, on vegetation in deciduous forest and in open habitats. May 21. 2011, Sw, 4♂, 1♀; October 4. 2011, Sw, 2♂.

Family: TETRAGNATHIDAE

Metellina mengei (Blackwall, 1870)*
Very abundant, in open and forest habitats on vegetation. May 21. 2011, Sw, 1♀.

Metellina segmentata (Clerk, 1758)*
Very abundant, in open and forest habitats on vegetation. August 21. 2011, Sw, 2♀; October 4. 2011, Sw, 1♀.

Pachygnatha listeri C. L. Koch, 1845*
Very abundant, in wetlands, wet meadows, floodplain forests, lives among leaf litter and grass in floodplains. May 5. 2011, PtT2, 1♂; May 21.–July 14. 2011, PtT2, 1♂; August 21.–October 4. 2011, PtT2, 1♂, 1♀; October 4. 2011, Sf, 2♀.

Tetragnatha montana Simon, 1874
Abundant, on pond and river banks, in floodplain forests and wet meadows on herb vegetation. May 21. 2011, Sw, 1♂, 1♀; August 21. 2011, PtT1, 1♂.

Family: ARANEIDAE

Araneus diadematus Clerck, 1758*
Very abundant, in all forest and open habitats on vegetation. August 21. 2011, PtT2, 1♀; August 21. 2011, Sw, 1♀.

Cyclosa conica (Pallas, 1772)*
Very abundant, in forests and on forest edges, on bushes and lower branches of trees. October 4. 2011, Sw, 1♀.

Family: LYCOSIDAE

Pardosa amentata (Clerk, 1758)*
Very abundant, in wetlands, on river banks, in wet meadows, gardens and fields. April 12.–May 21. 2011, PtT2, 3♂.

Pardosa lugubris (Walckenaer, 1802)*
Very abundant, on sun-exposed forest edges, in light forests. May 21.–July 14. 2011, PtT1, 1♂; April 12.–May 5. 2011, PtT1, 2♂, 1♀.

Piratula hygrophilus Thorell, 1872
Very abundant, in shaded wetlands, in reed swamps, in alder forests, in floodplain forests. April 12.–May 21. 2011, PtT2, 10♂, 3♀; May 21.–July 14. 2011, PtT2, 13♂, 1♀.

Trochosa terricola Menge, 1879*
Very abundant, on forest edges and in adjacent open habitats. April 12.–May 21. 2011, PtT2, 3♂; May 21. 2011, Sw, 1♂; July 14.–August 21. 2011, PtT1, 1♀.

Family: ZORIDAE

Zora spinimana Emerton, 1911*
Very abundant, in open habitats. April 12.–May 21. 2011, PtT2, 2♂; May 21.–July 14. 2011, PtT2, 1♂; July 14.–August 21. 2011, PtT2, 2 juv.

Family: AGELENIDAE

Histopona torpida (C. L. Koch, 1837)*
Very abundant, in all forest habitats, in hollow trees, among stones. May 21.–July 14. 2011, PtT1, 19♂, 2♀; April 12.–May 21. 2011, PtT2, 4♂; May 21.–July 14. 2011, PtT2, 17♂, 2♀; July 14. 2011, Hc, 1♂; July 14.–August 21. 2011, PtT1, 3♂; July 14.–August 21. 2011, PtT2, 3♀; August 21.–October 4. 2011, PtT1, 1♀, 1juv.; August 21.–October 4. 2011, PtT2, 1♂.

Malthonica silvestris L. Koch, 1872*
Abundant, in scree forests, other stony forest, especially under stones. April 12.–May 21. 2011, PtT2, 5♂; May 21.–July 14. 2011, PtT2, 2♂, 1♀.

Coelotes terrestris (Wider, 1834)*
Very abundant, in forests at ground level. August 21.–October 4. 2011, PtT1, 23♂, 1♀; August 21.–October 4. 2011, PtT2, 4♂.

Inermocoelotes inermis (L. Koch, 1855)*
Very abundant, in all forests except floodplain forests. April 12. 2011, Hc, 1♀; April 12.–May 21. 2011, PtT1, 1♀ May 21.–July 14. 2011, PtT1, 1♀; April 12.–May 21. 2011, PtT2, 24♂, 1♀; May 21.–July 14. 2011, PtT2, 9♂; July 14.–August 21. 2011, PtT1, 1♂, 1♀; August 21.–October 4. 2011, PtT1, 2♂; August 21.–October 4. 2011, PtT2, 2♂; August 21.–October 4. 2011, PtT1, 4♂.

Family: CYBAEIDAE

Cybaeus angustriarum L. Koch, 1868*
Probably abundant, in shaded forests in wet decaying trunks, among dense vegetation in mountain corries. July 14.–August 21. 2011, PtT2, 41♂; August 21.–October 4. 2011, PtT2, 6♂, 4♀.

Family: DICTYNIDAE

Cicurina cicur (Fabricius, 1793)*
Very abundant, in decaying wood in forests, under stones, in leaf litter, in open habitats in humid soil crevices. August 21.–October 10. 2011, PtT1, 1♀.

Dictyna arundinacea (Linnaeus, 1758)*
Very abundant, on rock steppes, xerothermic slopes, and in open habitats in cultural landscapes, along paths, etc. May 21. 2011, Sw, 1♀; October 4. 2011, Sw, 2♂.

Nigma flavescens (Walckenaer, 1825)*
Abundant, in oak forests, on shrubs on forest edges. May 21. 2011, Sw, 10♂, 2♀.

Family: AMAUROBIIDAE

Amaurobius fenestralis (Ström, 1768)*
Very abundant, under tree bark, under stones, among leaf litter in all forests. In the crevices of shaded rock walls. April 12. 2011, Hc, 3♀.

Amaurobius ferox (Walckenaer, 1830)*
Probably scarce, in shaded parts of houses. April 12. 2011, Hc, 1♀; July 14. 2011, Hc, 1♀.

Family: ANYPHAENIDAE

Anyphaena accentuata (Walckenaer, 1802)*
Scarce, in deciduous forests, on leaves and branches. May 21. 2011, Sw, 1♂; July 14. 2011, Sf, 1♂.

Family: LIOCRANIDAE

Apostenus fuscus Westring, 1851*
Abundant, in stony area of deciduous forests among leaf litter and under stones, on forest steppes. April 12.–May 21. 2011, PtT1, 1♂.

Family: CLUBIONIDAE

Clubiona comta C. L. Koch, 1839*
Scarce, in deciduous forest under stones and among moss. May 21. 2011, Sw, 1♀.

Clubiona terrestris Westring, 1851*
Very abundant, in forest habitats, among leaf litter. July 14.–August 21. 2011. PtT1, 1♂.

Family: GNAPHOSIDAE

Haplodrassus silvestris (Blackwall, 1833)*
Abundant, among leaf litter in deciduous forests. April 12.–May 21. 2011, PfT1, 1♂; May 21.–July 14. 2011, PfT1, 3♂, 2♀.

Zelotes apricorum (L. Koch, 1876)*
Probably scarce, in oak forests and in floodplain forests, under stones on a sand dune. August 21.–October 4. 2011, PtT1, 1♂.

Family: PHILODROMIDAE

Philodromus albidus Kulczyński, 1911*
Abundant, in oak forests, in orchards, on shrubs, and trees on forest steppes. May 21.2011, Sw, 1♀.

Philodromus dispar Walckenaer, 1826*
Scarce, in forests vegetation and on forest edges. October 4. 2011, Sw, 1 juv.

Family: THOMISIDAE

Diaea dorsata (Fabricius, 1777)*
Very abundant, in forest habitats on bushes and trees. October 4. 2011, Sw, 1 juv.

Family: SALTICIDAE

Ballus chalybeius (Walckenaer, 1802)*
Abundant, in dry deciduous forests on bushes and among leaf litter. May 21. 2011, Sw, 1♀.

Neon reticulatus (Blackwall, 1853)*
Very abundant in forest habitats among moss, leaf litter and detritus. May 21. 2011, Sf, 1♂.

DISCUSSION

The study area includes different species from the thermopreference point of view of: thermophilous species (*Dipoena melanogaster, Dysdera erythrina lantosquensis, Ceratinella major*) and psychrophilous species (*Porrhomma convexum*, *Nesticus cellulanus*). Although karst areas are often very valuable and host many endangered species, we did not find any species mentioned on the Red List of Invertebrates of the Czech Republic (Růžička, 2005). The number of found species is quite high and similar in comparison to the other deciduous warm forests (Bílek, 1981; Machač, 2011). From the arachnological point of view, the most valuable were foundings of the following species: *Ceratinella major*, *Megalepthyphantes nebulosus*, *Porrhomma convexum*, *Dipoena melanogaster*, and *Hyptiotes paradoxus*.

The most interesting discovery is two rare thermophilous linyphiid species, *Ceratinella major* and *Megalepthyphantes nebulosus*. These are known mainly from the best xerothermic habitats of the Czech Republic, e.g. Pálava, Křivoklátsko (Bryja *et al*., 2005; Buchar & Růžička, 2002). Also presence of a relatively common theridiid *Dipoena melanogaster* shows us, that the habitat is relatively xeric. On the other hand, we found psychrophilous species *Porrhomma convexum*, which is rare and sparsely found in Czech Republic (Buchar & Růžička, 2002). *Hyptiotes paradoxus* was found on solitary spruce, this species is usually found in wide spruce forests (planted spruce forests included) (Kůrka *et al*., 2006; Řezáč, 2009).

SUMMARY

Zbrašovské aragonitové jeskyně caves NNM has never been arachnologically studied, except underground spaces. Therefore, we aimed to fill this gap in the data and to improve our knowledge of spiders in this karst territory. Investigation took place from April to October 2011 and we used AOPK methodology for spiders collecting. Altogether, 71 spider species from 20 families were recorded. Spider community were evaluated according habitat origin, it was found that the most spider species belong to climax (C) and semi-natural (SN) habitats. It indicates high valuability of this area. Among the most interesting species were rare thermophilous species *Ceratinella major* and *Megalepthyphantes nebulosus*. The other important spider species was psychrophilous *Porrhomma convexum*, which is less frequently found in Czech Republic. The findings of *Hyptiotes paradoxus* are really untypical for the reserve territory, because this species typically inhabits planted spruce forests.

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