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Microhabitats of ground-living spiders in a peat bog

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Abstract
Microhabitats of ground-living spiders were studied, using pitfall traps and sieving, in a *Sphagnum - Eriophorum vaginatum* bog near Turku, southwestern Finland. Density of spider specimens found by moss sieving was low in very wet *Sphagnum papillosum* hollows. The densities were higher in moist hollows, low hummocks and in higher *Sphagnum fuscum* hummocks: 1.7 – 2.1 fold higher than in wet hollows. Total individual numbers/trap/day did not differ significantly in moist hollow and drier hummock microhabitats. Most of the abundant species showed no clear preference for hollows or hummocks; however, *Drepanotylus uncatus* and *Pardosa sphagnicola* were more abundantly collected in moist hollows and *Robertus arundineti* in hummocks.

Key words: peatbog, *Sphagnum*, North Europe, Araneae

INTRODUCTION

Spiders found in different habitats (or bog types) within an individual bog or mire have been studied by many authors in different parts of Europe, e.g. in France (Villepoux 1990), Germany (Schikora 1994), England (Mackie 1972), Iceland (Hoffmann 1997, 2002), Sweden (Lohmander 1956; Schikora 1994), Lithuania (Relys & Dapkus 2002), Estonia (Vilbaste 1972) and Finland (Krogerus 1960; Koponen 1979; Hoffmann 2002). The microhabitat requirements of certain spider species in bogs have been dealt with in a few studies. Norgaard's (1951, 1952) investigations on some Danish lycosid species are classical works of this kind (see also Toft 2002). Little is known about occurrence in, or preference to microhabitats by spiders within a small-sized area in a peat bog.

In the present paper, the spider catches in moist hollows and drier hummocks within an open *Sphagnum – Eriophorum* peat bog, in southwestern Finland, are compared.

MATERIAL AND METHODS

The peat bog Karevansuo is situated near the city of Turku, ca. 60°30'N, 22°10'E. Karevansuo is a raised bog consisting of several bog types with varying moisture and openness; its total area is 1 km^2. For a general view of the spider fauna of this bog, see Koponen (1979, 2002).

The study area is an open (treeless) *Sphagnum – Eriophorum vaginatum* bog with moist hollows and drier hummocks. Different *Sphagnum* species and cotton grass (*Eriophorum vaginatum*) dominate in hollows and low hummocks, and *Sphagnum fuscum* in the driest and highest hummocks. Also *Carex*, *Vaccinium oxycoccus*, *Empetrum*, *Andromeda* and *Rubus chamaemorus* grow sparsely at the site. The area of individual hummocks is small, maximally 0.5 m^2, and their height is up to 30-40 cm. The size of the open part of the bog is about 100 x 200 m, and it is surrounded by pine bogs, characterized by *Calluna*, *Ledum*, *Empetrum*, *Vaccinium uliginosum*, *Betula nana* and sparsely growing low pines (*Pinus sylvestris*).

The area of the selected study area within the open part of the bog was 30 x 40 m. The study site was a small-scaled mosaic of hollow surfaces and hummocks of different height and size. Material was collected mainly by pitfall traps (diameter 6 cm, ethylene glycol and detergent as preservation liquid, and aluminium covers). Traps were in 5 lines (10 traps/line); distance between the traps was 2-3 m, and that between the trapping lines ca. 5 m. There were 22 traps in hummocks and 28 in hollows. The trapping period covered the whole growing season (6th May – 5th November), and traps were emptied once a month. Pitfall trapping is known to be suitable for studying habitat requirements of peat bog spiders (e.g. Koponen 1979; Hoffmann 2002).

In addition, some material was collected by sieving the moss. In contrast to pitfall trapping (hollows *vs*. hummocks), four microhabitats were studied: wet hollows, moist hollows, low hummocks and high and dry hummocks (Table 1). Four sieving samples (each 0.25 m²) were taken in each studied microhabitat.

Pitfall trap material consisted of ca. 1900 and sieving material ca. 100 specimens. The material is deposited in the Zoological Museum, University of Turku. The nomenclature is mainly according to Platnick (2002).

RESULTS AND DISCUSSION

Sieving material

The density of spiders in different *Sphagnum* microhabitats is shown in Table 1. Only 14.0 individuals/m² were found in wet *S. papillosum* hollows. The densities in other microhabitats (moist hollows, low hummocks and high *S. fuscum* hummocks) were 1.7 – 2.1 fold higher (24.0 – 29.0 ind./m²). The observed densities are similar to those found in Estonian raised bogs: average 29.0/m² in pine bogs and 12.9/m² in hollows (Vilbaste 1972). Somewhat higher densities were reported by Palmgren (1972) from *Sphagnum* on open bogs at Tvärminne, also situated in southwestern Finland. Altogether, 19 identifiable spider species were found by sieving. The most numerous species were *Robertus arundineti* (O.P.-Cambridge, 1871), *Tricca alpigena* (Doleschall, 1852), *Pardosa hyperborea* (Thorell, 1872), *Pirata uliginosus* (Thorell, 1856) and *Maro lepidus* Casemir, 1961.

The data obtained by sieving shows that the density of *Robertus arundineti* was markedly higher in hummocks (4.0 ind./m²) than in hollows (1.0 ind./m²). The trend in *Pirata uliginosus* was opposite (0.5/m² in hummocks and 1.0/m² in hollows).

Pitfall trap material

The average number of spiders caught in hollows and hummocks by pitfalls did not differ significantly: 6.42 and 6.32 ind./trap/month in hollows and hummocks respectively (Table 2). In most of the abundant species, no clear preference for hollows or hummocks was found (Table 3). *Drepanotylus uncatus* (O.P.-Cambridge, 1873) and *Pardosa sphagnicola* (Dahl, 1908), and *Maro lepidus* to a lesser degree, were found more abundantly in hollows than hummocks. None of the abundantly trapped species showed a marked preference for hummocks (Table 3). Altogether, 74 spider

Table 1. Mean density of spiders (ind./m²) in different microhabitats at Karevansuo (sieving samples).

Microhabitat	Mean density
Wet *Sphagnum papillosum* – *Eriophorum* hollows	14.0
Moist *Sphagnum* spp. – *Eriophorum* hollows	24.0
Low (10-15 cm) hummocks (no *Sphagnum fuscum*)	26.0
Sphagnum fuscum hummocks (20-30 cm high)	29.0

Table 2. Catches of spiders by pitfall traps in hollows and hummocks at Karevansuo. (mean ± S. E.).

Microhabitat	Ind./trap/month	No. of traps
Hollows	6.42 ± 0.52	28
Hummocks	6.32 ± 0.52	22

species were caught by pitfall traps; the 30 most abundant species are shown in Table 3. The well-known dweller of wet bog habitats (e.g. Villepoux 1990; Schikora 1994), *Antistea elegans* (Blackwall, 1841), was also more abundant here in hollows than in hummocks (ratio +2.33); however, it was only caught in low numbers.

According to Hoffmann's (1997) data from bogs in Iceland, *Drepanotylus uncatus* was found in moist-wet open sites, while *Pardosa hyperborea* and *Tricca alpigena* had no strong correspondence to moisture or vegetation cover. The habitat preferences of these species in Iceland and at the present study site are therefore similar. In southern Sweden, *Pirata uliginosus* and *Drepanotylus uncatus* preferred wet-moist open sites (Schikora 1994), also resembling the present study site. In Finnish Lapland, *D. uncatus* was found on wet floating

Table 3. One season catches (ind./trap/season) of abundant spiders at Karevansuo. Ratio hollow: hummock (+ preference to hollow, - to hummock). For species with less than 20 individuals caught, the ratio is not given.

Species	Hollow	Hummock	Ratio	Inds
Pardosa hyperborea (Thorell, 1872)	10.14	11.68	- 1.15	542
Pirata uliginosus (Thorell, 1856)	6.71	5.32	+ 1.26	303
Tricca alpigena (Doleschall, 1852)	2.75	2.32	+ 1.19	128
Trochosa spinipalpis (F.O.P.-Cambr., 1895)	1.10	1.50	- 1.36	64
Macrargus carpenteri (O.P.-Cambr., 1894)	1.21	1.36	- 1.12	64
Alopecosa pulverulenta (Clerck, 1757)	1.21	1.32	- 1.09	63
Pardosa sphagnicola (Dahl, 1908)	1.32	0.64	**+ 2.06**	51
Walckenaeria antica (Wider, 1834)	1.00	0.82	+ 1.22	46
Centromerita concinna (Thorell 1875)	0.93	0.77	+ 1.21	43
Drepanotylus uncatus (O.P.-Cambr., 1873)	1.11	0.41	**+ 2.71**	40
Maro lepidus Casemir, 1961	0.68	0.45	+ 1.51	32
Drassodes pubescens (Thorell, 1856)	0.36	0.40	- 1.11	20
Agyneta affinis (Kulczynski, 1898)	0.36	0.40	- 1.11	20
Pirata insularis Emerton, 1885	0.32	0.36	- 1.13	20
Thanatus formicinus (Clerck, 1757)				19
Stemonyphantes lineatus (Linnaeus, 1758)				19
Pardosa pullata (Clerck, 1757)				18
Tenuiphantes mengei (Kulczynski, 1887)				18
Robertus arundineti (O.P.-Cambridge, 1871)				17
Scotina palliardi (L. Koch, 1881)				13
Agroeca proxima (O.P.-Cambridge, 1871)				11
Haplodrassus signifer (C.L. Koch, 1839)				11
Zelotes latreillei (Simon, 1878)				10
Gnaphosa lapponum (L. Koch, 1866)				8
Antistea elegans (Blackwall, 1841)				8
Bathyphantes gracilis (Blackwall, 1841)				8
Bolyphantes luteolus (Blackwall, 1833)				8
Tallusia experta (O.P.-Cambridge, 1871)				8
Centromerita bicolor (Blackwall, 1833)				7
Centromerus arcanus (O.P.-Cambridge, 1873)				7

Sphagnum carpet and in very moist hummocky bog (Hoffmann 2002), indicating its preference for high moisture. Again, this is in good agreement with the present data.

In several studies on spiders in different bog types, the general tendency for many of the abundant species in the present study has been their rather wide ecological amplitude, i. e. they have been found in many bog types. The author has studied spiders in different bog types (i.e. *Alnus* swamp, *Phragmites* fen and *Calluna* peat bog) at Karevansuo (Koponen 1979). *Pardosa sphagnicola* and *Trochosa spinipalpis* (F.O.P.-Cambridge, 1895) were found commonly in all of the three previously studied bog types, *Maro lepidus* in moist sites, and *Pardosa hyperborea* and *Pirata uliginosus* in open sites (Koponen 1979). In general, many species showed no clear preference for an individual bog type. This is in accordance with the present microhabitat data from the small-sized study area.

A reason for rather similar numbers in hollows and hummocks for many species is probably the fine-scale mosaic structure of the small-sized (30 x 40 m) study site. Therefore spider species, especially actively moving ones, can easily reach all kinds of microhabitats. The mobility of some lycosid species in bogs was discussed by Hoffmann (2002). Probably only a few species are mainly dwellers of either hummocks or hollows, like *Robertus arundineti* and *Drepanotylus uncatus* respectively.

According to the present data, when studying bog-dwelling spiders, it is recommended to place at least the majority of pitfall traps in hummocks, due to limited differences in the habitat preference of abundant species. This will reduce the risk of flooding after heavy rain.

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