

Wolf spiders (Araneae, Lycosidae) on the parched slopes of Rokua, in central Finland

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The Rokua area is an exceptional dune area in central Finland modified by waves and wind after the last ice age. In the summer of 2005 we inventoried the invertebrate fauna of the area. In this article we present the results on the part of wolf spiders (Araneae, Lycosidae). The spiders were collected using 25 pitfall traps constructed from plastic jars (Ø 12 cm). As collection sites we selected five esker slopes facing directly south.

Altogether 860 wolf spiders were caught. The total number of species was 14. There were three almost equally abundant species, *Alopecosa aculeata* (Clerck) (28.6%), *Pardosa schenkeli* Lessert (26.0%) and *P. lugubris* (Walkenaer) (25.3%). Another species that favours these parched slopes is *Xerolycosa nemoralis* (14.1%). The most remarkable find was *P. schenkeli*, which occurred abundantly at sites 1, 2, 4 and 5, but was totally missing from site 3. The first mentioned sites are ornamented by patches of open sand and *Thymus serpyllum*, but site 3 has an almost continuous lichen cover. The find is several hundred kilometres north from the previous known records.

1. Introduction

The hill and dune area of Rokua is a 20 km long and 1.5–5 km wide esker rising up in the middle of bog terrain in the Pohjois-Pohjanmaa region in central Finland. The landscape of Rokua is very varied and the geomorphology of the area is exceptional in Finland. The area was born after the ice age, when the hills rose up like islands from the sea due to land uplift. Waves and wind started to strongly modify the islands that are mostly composed of sand. Wind piled fine sand dunes, which are still visible, although they are mostly covered by vegetation. The hills are on average 140–145 m a.s.l., the highest one reaching up to 194 m a.s.l.

The slopes of the hills are surrounded by old beach ridges modified by waves and ice and situated on different levels. There are also several kettle holes with steep slopes in the area. (Aartolahti 1973)

The forests are infertile pine (*Pinus sylvestris*) dominated lichen heaths. The most valuable biotopes in terms of invertebrates are the south-facing slopes of the dunes and kettle holes, which are really extremely parched habitats. Altogether about 70 slopes with a total area of 50 hectares have been located.

Rokua is probably the northernmost site for plants specialised on the parched slopes of eskers. Typical plants in this habitat are e. g. *Thymus serpyllum* subsp. *serpyllum*, *Carex ericetorum* and

the more locally occurring *Pilosella peleteriana* (Jalas 1953). Due to effective prevention of forest fires, most of the slopes are gradually overgrown by pine saplings spreading to the slopes. At the same time the lichen and moss cover is becoming more and more continuous. In order to prevent this overgrowth, a management plan has been compiled for the state owned land governed by Metsähallitus (Virnes 2004). Most of the area belongs to the Natura network, which covers a total of 4244 hectares.

This article presents the results concerning wolf spiders, Araneae, Lycosidae, found in the area in the summer of 2005.

2. Material and methods

The study was carried out between May 5 and September 13, 2005, in the village of Rokua, in the parishes of Vaala and Muhos (Grid 27°E, 716:47). As collection sites we selected five esker slopes facing directly south.

The spiders were collected using 25 pitfall traps constructed from plastic jars (Ø 12 cm, volume 1l). Five traps were deposited in each of the areas so that they were running from the bottom (trap a) of the slope to the top (trap e), the distance between traps being 3–5 metres, depending on the total height of the slope. The traps were covered with a lid and filled to 5 cm with a saturated salt solution with some drops of detergent added. They were emptied as follows: 23.5., 13.6., 21.6., 6.7., 21.7., 8.6., 16.8. and 13.9. In the field the material was preserved in alcohol.

The trapping sites are characterised as follows:

Site 1 (1.8 ha) (Ostrobothnia ouluensis: Muhos, 71653:4744). The wide open north slope of a large kettle hole, with much open sand and abundant *T. serpyllum*. Traps a, c, d and e were on open sand; b was surrounded by lichen (*Cladonia* spp).

Site 2 (0.4 ha) (Ostrobothnia kajanensis: Vaala, 71613:4774). The SE slope of a dune, not very large, but steep, rich in *T. serpyllum*, with open sand and lichen patches. Traps a and b were amongst lichens, c and d on open sand, and e was surrounded by both lichens and sand.

Site 3 (0.1 ha) (Ostrobothnia kajanensis: Vaala, 71618:4775). The smooth S slope of a dune covered almost totally by lichen and with single old pines (*P. sylvestris*). All the traps were surrounded by lichen. At some distance from the traps there were two small *T. serpyllum* growths.

Site 4 (0.4 ha) (Ostrobothnia kajanensis: Vaala, 71617:4775). The rather steep south-facing slope of a dune, with a moderate amount of open sand and *T. serpyllum*. The traps were among lichens.

Site 5 (0.7 ha) (Ostrobothnia kajanensis: Vaala, 71618:4778). Rather similar to the previous site, but with big trees on the south side of the slope that cast a shadow on the lower parts. Some sandy patches with *T. serpyllum*. All the traps were surrounded by lichen.

When the sites were grouped according to the amount of sandy patches, the order was 1, 2, 4, 5 and 3. In other words, site 1 had the most open sand and site 3 had an almost continuous lichen cover. Floods caused by heavy rains filled the traps a couple of times with either water or sand. Animals also destroyed some single traps. The catch figures were not, however, corrected in any way, as the faunistic goals were the most important for us. The spiders were identified by Itämies. Only adult individuals were included. Some qualified samples are preserved in the collections of the zoological museum of the University of Oulu. The spider nomenclature follows Almqvist (2005), the vascular plants Field Flora of Finland (Hämetsä *et al.* 1998).

3. Results

Altogether 860 wolf spiders were caught. Most individuals were collected from area 2 and least from area 1 (Table 1). The total number of species was 14. Nine species were found in both areas 2 and 4, while only five species were represented in the catch of area 3.

The total material contained three almost equally abundant species, *Alopecosa aculeata* (246 ex.), *Pardosa schenkeli* (224 ex.) and *P. lugubris* (218 ex.). Another species that favours this kind of habitat is *Xerolycosa nemoralis* (121

Table 1. Total catches of wolf spiders (Araneae, Lycosidae) by pit fall traps at Rokua, central Finland in summer 2005. Numbers (1–5) refer to the study sites and letters (A–E) to the traps (see also material and methods). 1 = *Alopecosa aculeata* (Clerck), 2 = *A. fabrilis* (Clerck), 3 = *A. pinetorum* (Thorell), 4 = *A. pulverulenta* (Clerck), 5 = *A. taeniata* (C.L. Koch), 6 = *Pardosa lugubris* (Walkenaer), 7 = *P. palustris* (Linnaeus), 8 = *P. pullata* (Clerck), 9 = *P. riparia* (C.L. Koch), 10 = *P. schenkeli* Lessert, 11 = *P. sphagnicola* (Dahl), 12 = *Trochosa ruricola* (De Geer), 13 = *T. terricola* Thorell, 14 = *Xerolycosa nemoralis* (Westring).

Species	1A	1B	1C	1D	1E	1	2A	2B	2C	2D	2E	2	3A	3B	3C	3D	3E	3	4A	4B	4C	4D	4E	4	5A	5B	5C	5D	5E	5	1–5	
1	–	3	2	2	1	8	23	9	8	6	6	52	6	10	10	7	45	78	27	11	7	9	20	74	17	3	5	6	3	34	246	
2	1	–	–	–	–	1	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	1	1	2	
3	–	–	–	–	–	0	1	–	–	–	1	2	–	–	1	–	2	3	1	1	–	–	–	2	–	–	–	–	–	0	7	
4	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	2	2	–	–	–	–	–	0	2	
5	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	2	2	–	–	–	–	–	–	0	2	
5	4	2	–	–	–	6	29	18	12	11	18	88	3	2	6	5	2	18	41	12	5	4	3	65	17	14	3	3	4	41	218	
7	–	1	–	–	–	1	1	–	–	–	–	1	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	0	2	
8	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	0	1	–	–	–	–	–	1	1
9	–	–	–	–	–	0	–	1	–	–	–	1	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	–	0	1
10	16	11	13	6	3	49	2	5	14	8	18	47	–	–	–	–	–	0	–	4	10	11	11	36	13	14	23	17	25	92	224	
11	–	–	–	–	–	0	–	–	–	–	–	0	–	–	1	–	–	1	–	1	–	–	–	1	–	–	–	–	–	–	0	2
12	–	–	–	–	–	0	1	–	–	–	–	1	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–	–	0	1
13	4	–	–	–	–	4	–	1	1	–	–	2	–	–	–	–	–	0	6	3	1	–	1	11	9	5	–	–	–	–	14	31
14	14	12	1	5	3	35	3	3	13	2	23	44	1	5	9	6	1	22	2	8	4	2	1	17	1	2	–	–	–	–	3	121
Total						104						238						122						210						186	860	

ex.). The focal point of occurrence of the species *Trochosa terricola* was in areas 4 and 5. The remaining nine species seemed to be more or less accidental invaders. Some kind of exception was the species *Alopecosa pinetorum*, however, of which not more than seven individuals were caught, but from three sites, anyway.

A. aculeata clearly favoured slopes with a rich lichen cover. It occurred sparsely at sandy site 1. Another obvious feature was that its catch was the biggest in the traps located either at the bottom or at the top of the collecting line, i.e. closest to the forest. The distribution of the catch of *P. lugubris* was also rather similar, but its most abundant catch was from site 2. *P. schenkeli* occurred abundantly at sites 1, 2, 4 and 5, but it was totally missing from site 3. The greatest numbers were collected from site 5. On the other hand, the focal point of *X. nemoralis* was at the two most open sites (1 and 2), and it occurred the least at site 5. However, it also seemed to thrive in the almost continuous lichen cover of site 3.

4. Discussion

Perhaps the most interesting find in our material was the species *P. schenkeli*. There seems to be rather few published records of it in Finland. It has been found in the dune area of southern Finland, around Hanko, where it is said to favour especially *Cladonia* patches in open pine forest (Palmgren 1972). Surprisingly, Perttula (1984) does not mention this species in his study of almost the same area, which also includes *Calluna/Cladonia* habitats. Huhta (1971) has recorded one specimen from a burnt area at Juupajoki, Hyytiälä (686:35). The species is found in the Central European alps at heights of 1,500–2,000 metres in the border zone of coniferous forests and cattle meadows (Tongiorgi 1966). The collections of the Zoological Museum of Turku contain some samples from SW Finland (Koponen pers.comm.). The typical habitat requirements still seem obscure. Our observations seem to indicate that the species favours really open parched habitats. In addition it seems to need open sand to some extent. It was missing from the closed lichen cover, although the site otherwise was sunny and parched. The present find also changes the distributional image of the spe-

cies in Finland, as our study area is several hundred kilometres north of earlier finds. Known occurrences are few so far, so the obviously strong population in the Rokua area is really important.

Some attention can also be paid to the species *Alopecosa fabrilis*, in spite of the fact that the catch was only two individuals. Palmgren (1939, 1972) considers it a typical shore species, which thrives on sunny dunes even up to Hailuoto on the coast of the Bothnian Bay, but it has also been found at rocky sites. However, the species was not found among the fauna of Ulkokrunnit, an isolated island in the Bothnian Bay (Caselius & Itämies 1993). It has been spotted on sunny rocks in the Åland archipelago in SW Finland (Lehtinen *et al.* 1979). What comes to openness and amount of sunshine, the Rokua sites fit well into the figure, but the low catch points to either the rarity of the species or the fact that the area is not so optimal. The species is said to hide in a silken tube in the sand (Holm 1947), and maybe it is not as easily collected with pitfall traps as are some other species in the same genus.

The most abundant species, *A. aculeata* and *P. lugubris*, are typical forest species (comprehensive reference list in Matveinen-Huju 2004). In addition, *P. lugubris* has been stated to seek especially warm sites (34–36 °C) (Bliss 1988). In this sense the parched habitats of Rokua meet the demands of the species well. The species *X. nemoralis* and *Trochosa terricola* have most often been collected from light forests (Matveinen-Huju 2004), the first mentioned species occurring also in burnt areas (Huhta 1971). The species *A. pinatorum* favours more humid forests (Matveinen-Huju 2004), which seems to explain the low catch in our study. It is, however, quite common at these latitudes and even further north (Itämies & Jarva-Kärenlampi 1989, Immonen & Itämies 1994, Similä & Itämies 2000). *Pardosa sphagnicola* is more an inhabitant of bogs and marshes, and it is especially connected to *Sphagnum* turfs (Koponen 1968, 1978, Itämies & Jarva-Kärenlampi 1989). In addition to bogs, it has been found in other moist habitats (Immonen & Itämies 1994, Similä & Itämies 2000). This seems to suffice to explain its low catch in our material. The scarcity of *Alopecosa pulverulenta* seems to be connected to the fact that it occurs mostly in humid meadows (

Itämies & Ruotsalainen 1985, Caselius & Itämies 1993). *Pardosa palustris* belongs to similar spiders living in meadows (Palmgren 1939, Holm 1947). *Alopecosa taeniata* and *Pardosa riparia* are forest living species like *A. aculeata* and *P. lugubris*, but they live in obviously more humid ones (Similä & Itämies 2000), and therefore they avoided the sunny sites of Rokua. The species *Trochosa ruricola* is considered a resident of shores (Palmgren 1939, Hackman 1957 and Kleemola 1963) and meadows, as well as settled habitats (Lehtinen & Kleemola 1962, Itämies & Ruotsalainen 1985). The only individual in our material may have invaded from the shores of a nearby lake.

The parched slopes of the Rokua eskers and kettle holes make an exceptional habitat, in sunny weather the temperature on the ground rises really high, and on the other hand during bright nights evaporation is considerable, making the temperature drop really low. Accommodating to these conditions places great demands on the species. In our material this is shown by the fact that only four species occurred more abundantly here. Even two of these, i.e. *A. aculeata* and *P. lugubris*, are species that occur in forest openings more than in actual parched areas. This could also be seen in the fact that most of the individuals were collected from traps closest to forest. On the contrary, *P. schenkeli* and *X. nemoralis* represent species that are adapted to this kind of extreme habitat.

The composition of the spider fauna on the parched slopes of the Rokua eskers clearly points to the exceptional nature of these habitats. How isolated the population of *P. schenkeli* is, for instance, is left for further studies to solve, but at present it seems to be a valuable observation. There is one big threat concerning the area, namely that the open sand patches are covered by lichens and moss, mostly due to prevention of forest fires. That will destroy the *Thymus* vegetation little by little, and simultaneously the moths living on it will disappear. Obviously, the open sand patches are important for certain wolf spiders, which will also disappear if these sunny spots are wiped out. Therefore, the area would need at least some restoration measures. Metsähallitus (Finnish Forest and Park Service) has already started some experiments in this direction (Virnes 2004).

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