Spatial and temporal distribution of five syntopic species of the genus *Alopecosa* (Araneae, Lycosidae) and some remarks on their ecology

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As part of a research project on limestone grasslands (mesobromions) the spider fauna of a small area in the vicinity of Hessisch Lichtenau (Northern Hesse) was studied in 1987 and 1988. In this area characterized by a distinct structural pattern the rare lycosid ***A.striatipes*** (C.L.KOCH 1834) was caught in very high numbers. Besides *A.striatipes*, four other species of the genus Alopecosa were found: ***A.accentuata*** (LATREILLE 1817), ***A.cuneata*** (CLERCK 1757), ***A.pulverulenta*** (CLERCK 1757) and ***A.trabalis*** (CLERCK 1757). Therefore, it was possible to study the small-scale distribution of these species and - with regard on the total catch of these species during the study - to determine the factors the distribution is based on.

The study sites

The four sites representing four main types of structure and microclimate, too, are situated within about 1100 m².

Site 1: plant society (ELLENBERG 1979): mesobromion (Gentiano-Koelerietum); soil: bare ground with scattered stones; structure of the vegetation: very sparse, discontinuous; humidity of the soil: mF (moisture figure, ELLENBERG 1979) 3.42; temperature (BECKER 1975): max.52°C; light value (WASNER 1976): 8105.8 lux/h.
Site 2: plant society: mesobromion (Gentiano-Koelerietum); soil: ground partly with stones; structure of the vegetation: sparse, short, but continuous (grass, lichenes, mosses); humidity of the soil: mF 3.5; temperature: max. 35°C; light value: 6757.6 lux/h.
Site 3: plant society: mesobromion in succession to a dry meadow (Arrhenatherion); soil: ground without stones; structure of the vegetation: discontinuous, dense (grass); humidity of the soil: mF 3.55; temperature: max. 29°C; light value: 5145 lux/h.
Site 4: plant society: mesobromion in succession to a forest community; soil: litter layer; structure of the vegetation: discontinuous field layer of median to high density, continuous scrub layer (pine of 1.2-1.5 m in height); humidity of the soil: mF 3.56; temperature: max. 24 °C; light value: 3342 lux/h.

The spider fauna of these types of habitat was studied by pitfalls (10 at each site). The distance between the pitfalls of the sites 1/2 and 2/3 was about 10 m, the distance between 1/4 and 2/4 was about 15 m.

The spatial distribution

In the studied area (table 1) ***A.accentuata*** and ***A.cuneata*** were mainly caught at the sites 1, 2 and 3 with ***A.accentuata*** prefering the sites 2 and 1 and ***A.cuneata*** prefering the sites 2 and 3. At site 4 both species were found only as single individuals. ***A.pulverulenta*** lightly prefered site 3, but it was active at all

sites. ***A.striatipes*** was mainly active at the sites 1 and 2. ***A.trabalis*** was mainly active at site 4, but appeared in higher numbers at the sites 2 and 3, too.

species	site 1	site 2	site 3	site 4
A.accentuata	41	62	9	1
A.cuneata	18	38	22	1
A.pulverulenta	15	22	40	33
A.striatipes	140	95	2	-
A.trabalis	15	68	30	72

Table 1: Abundance of the species at the study sites

The temporal distribution

In the studied area (4 week-series, table 2) ***A.accentuata*** was active from mid-May to early August (week 17-33) with males active until mid-July (week 29). The main period of activity lasted from mid-April to mid-May (week 17-21). ***A.cuneata*** was active from mid-April to early September (week 17-37) with males active until mid-July (week 29). The main period of activity lasted from mid-April to mid-May (week 17-21). ***A.pulverulenta*** was active from mid-April to early December (week 17-49) with males active until mid-July (week 29) and the main period of activity lasting from mid-April to mid-May (week 17-21). ***A.striatipes*** was active from late March to early November (week 13-45) with males active until mid-May (week 13-21) and from mid-July to early November (week 29-45). There are two periods of activity: the main one lasting from the end of March until mid-May (week 13-21) and the second lasting from early September to early November (week 37-41). ***A.trabalis*** was active from mid-April to early November (week 17-45) with males active until mid-July (week 17-29). The main period of activity lasted from mid-May to mid-July (week 21-29).

species m,f	week 13-17	17-21	21-25	25-29	29-33	33-37	37-41	41-45	45-49
A.accentuata	-	84,16	5,2	1,3	0,2	-	-	-	-
A.cuneata	-	61,5	6,0	5,0	-	0,2	-	-	-
A.pulverulenta	-	75,5	14,2	5,3	0,5	-	-	-	0,1
A.striatipes	65,26	72,9	0,12	0,8	1,6	4,4	22,5	3,0	-
A.trabalis	-	17,8	63,7	65,6	0,9	0,1	0,7	0,2	-

Table 2: Abundance of the species during the year (m,f males, females)

Ecological remarks

In the studied area the five species of the genus Alopecosa showed different spatial maxima of activity, but only *A.striatipes* and the nocturnal *A.trabalis* differed from the other species by their temporal distribution. But a more exact location of the main periods of activity of the species (fig. 1) based on the total catch of the study (21 sites; 2-week- and 4-week-series; HOFMANN in prep.

reveals that except *A.pulverulenta* which is active at the same periods as *A.accentuata* and *A.cuneata* the peaks of activity of the species are different:

A.accentuata: early May to mid-May (week 18-20)

A.cuneata: mid-May to the end of May (week 20-22)

A.pulverulenta: May (week 18-22)

A.striatipes: mid-April to the end of April (week 16-18) and early September (week 35-37)

A.trabalis: early May to early June (week 19-23)

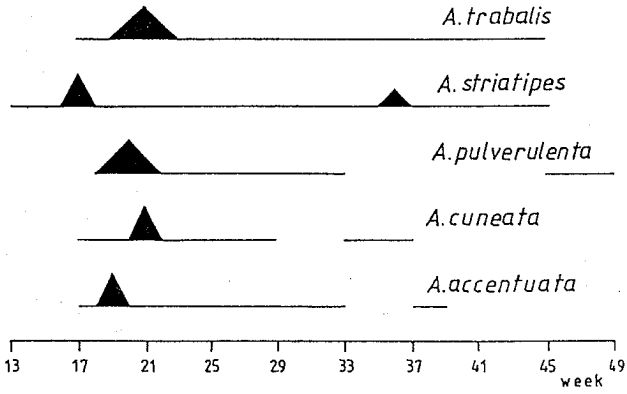


Figure 1: Maxima of activity of the species

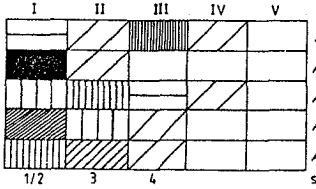
Therefore, interspecific competition is not the main factor causing the distributional patterns, although this mechanism may be the evolutionary basis of the actual patterns.

In order to test the influence of the environmental factors on the distribution of the species, an analysis of preference (BAEHRMANN 1980) and niche breadth (AH: PIELOU 1969) based on the total catch of the study was carried out.

For this analysis, the following components of the environment had been taken into consideration: the plant society, the structural components (structure of the soil, structure of vegetation in general, density and distributional pattern of the litter and the vegetation layers), the microclimate (humidity of the soil, temperature and light) and the type of habitat derived from the composition of these components (fig. 2).

At site 1 environmental conditions are realized which are not only prefered but mostly demanded (AH: 1-2) by ***A.striatipes*** . In accordance, this species is mainly active at this site. The likewise low grade of humidity and the low density of the vegetation are the decisive factors for the activity of *A.striatipes* at the neighbouring site 2. This species avoids the environmental conditions of the sites 3 and 4. ***A.accentuata*** prefers the environmental conditions of site 2. The

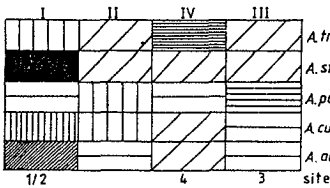
plant society



plant society:

I mesobromion
II mesobromion in succession to a dry meadow
III mesobromion in succession to a forest community
IV pine forest
V beech forest

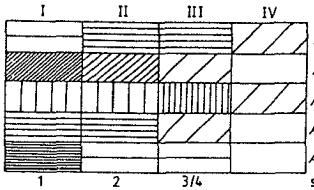
field layer: density



density:

I sparse
II median
III dense
IV between II and III

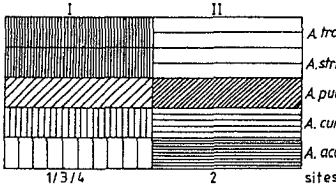
structure of the soil



soil:

I stony
II partly with stones
III without stones
IV dense litter layer

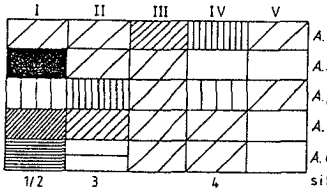
field layer: distribution



distribution:

I discontinuous
II continuous

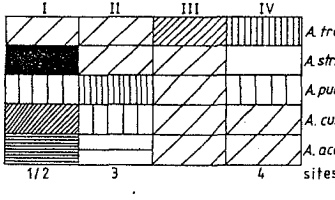
litter



litter.

I without litter
II very sparse or temporary litter
III sparse litter
IV litter layer of median density
V dense litter layer

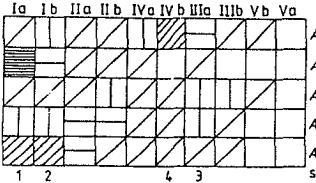
scrub layer



scrub layer:

I without scrubs
II single scrubs
III discontinuous scrub layer
IV continuous scrub layer

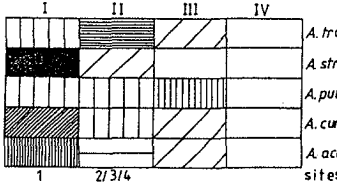
structure of the vegetation in general



vegetation.

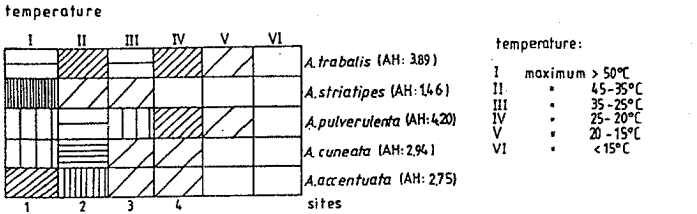
I sparse vegetation ± single scrubs
  a discontinuously distributed
  b continuously distributed
II vegetation of median density ± single scrubs
  a discont.
  b cont.
III dense vegetation, single scrubs
  a discont.
  b cont.
IV density of the discontinuously distributed vegetation between medium and dense
  a + discont. scrub layer
  b + cont. scrub layer
V field layer ± missing
  a only trees
  b trees + scrubs

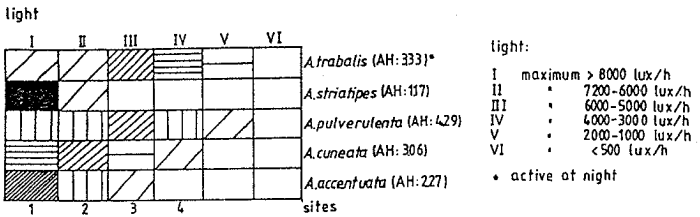
humidity of the soil

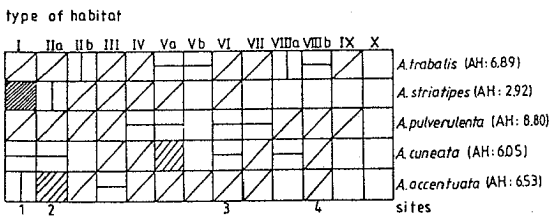


humidity:

I dry (moisture figure < 3.5)
II moderately dry (mF 3.5–4.0)
III moderately fresh (mF 4.0–4.5)
IV fresh (mF 4.5–5.0)

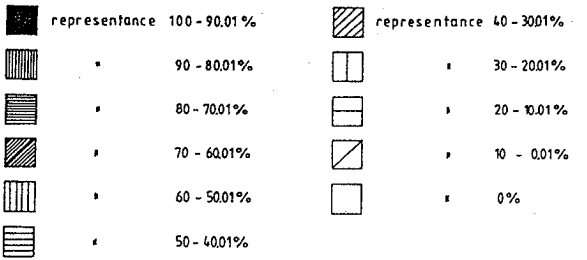






habitat =	P	E	S	V	D	K	G	mF	T	B
I	I	I	I	Ia	I	I	I	I	I	I
IIa	I	I/II	I	Ib	I	II	I	II	II	II
IIb	I	I	II	Ib	I	II	II	II	I	II
III	I	I/II	I/II	IIa	II	I	I	II	II/III	II/III
IV	I	II	II	IIb	II	II	II	II	III	II
Va	I	II	III	IVa	IV	I	III	II	II	III
Vb	I	II	III	IVa	IV	I	III	II	III	III
VI	II	III	II	IIIa	III	I	II	II	III	III
VII	II	III	II	IIIb	III	II	II	III	IV	IV
VIIIa	III	II	IV	IVb	IV	I	IV	II	III	IV
VIIIb	III	III	IV	IVb	IV	I	IV	II	IV	IV
IX	IV	IV	V	Vb				II/III	V	V
X	V	IV	V	Va				IV	VI	VI

P plant society
E structure of the soil
S litter
V structure of the vegetation in general
D field layer: density
K field layer: distribution
G scrub layer
mF moisture of the soil
T temperature
B light



AH: 1-1.5 stenotopic (specialist)

AH: 1.5-2 almost stenotopic

AH: 2-n less-not at all restricted (generalist)

Figure 2: Representence and niche breadth of the species

basis of the likewise high activity of this species at site 1 is its preference for the dry and stony soil and high light values. Besides *A.accentuata*, *A.cuneata* is mainly active at site 2, but this species was caught in high numbers at site 3, too. The probable reason is its high tolerance concerning the density and the distribution of the field layer, the structure of the soil and the microclimate. According to its preferences, *A.pulverulenta* has its center of activity at site 3. But its high tolerance of all environmental factors allows an intensive penetration of this species into other habitats. *A.trabalis* prefers the environmental conditions of site 4. Based on the humidity of the soil and the tolerance of high temperature values this species can be active at the sites 2 and 3, as well. The conditions of site 1 are avoided, especially the stony and dry soil.

Conclusions

The analysis of the spatial and temporal distribution of the five species of the genus Alopecosa reveals that their patterns of distribution in this area correspond to their preferences to the respective environmental conditions of the sites and specific levels of tolerance, as well. The small-scale distribution of the five species in the studied area is caused by ecological separation, not by interspecific competition. Among the occuring species, *A.striatipes* is the most restricted one, followed by *A.accentuata*. *A.trabalis*. *A. cuneata* and especially *A.pulverulenta* are less restricted.

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