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Spider wasps (Hymenoptera, Pompilidae) as predators of a spider taxocoenosis

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ABSTRACT

The foraging range and prey items of spider wasps were investigated in a dune area near Oldenburg, NW-Germany. Data of spider species actually used as prey were related to the spider taxocoenosis in the field. Available spider prey was examined by pitfall trap sampling, sweep-net catches and hand collecting.

No species of spider wasps appear to be very specialized hunters with regard to certain spider species. However, only a relatively narrow range of taxonomic groups of spider species were recorded as spider prey (Araneidae, Lycosidae, Salticidae). Eighty per cent of the prey specimens belong to the Lycosidae. Pompilids prey upon juvenile spiders of both genders, whereas the prey on adult spiders is restricted to females. Prey size is expected to be an important factor of prey selection.

INTRODUCTION

Very little is known about the interactions between spiders and their natural predators in the central-European area. Except for different groups of vertebrates, there are several families of Hymenoptera which are important predators of spiders. Within the taxonomical group of Hymenoptera - Aculeata, spiders form the prey of several species of Sphecidae and invariably of all species of Pompilidae (spider wasps). Female pompilids provide each cell of their nest with only a single paralysed spider. On this spider one egg is laid. After hatching the larva feeds parasitically on the paralysed host. This investigation was carried out to get more detailed information concerning the microhabitats during foraging, and information on prey selection by spider wasps.

MATERIAL AND METHODS

The study site was a dune area at the river Hunte near Oldenburg, Lower Saxony, NW-Germany. The investigated microhabitats were heterogeneous and represented different stages of succession: areas of bare sand with sparse

vegetation, areas with a dry moss/lichen carpet, dry vegetation, mainly grasses as well as bushes and trees, especially pines. Spiders were sampled throughout the summer of 1994 (22 April to 9 September) using 41 pitfall traps. In addition, standardized sweep-net sampling and hand collecting were carried out monthly (May to August). Both pompilids and their prey were observed and intercepted in the same area and during the same period of time.

RESULTS

4,611 spiders representing 170 species (= 18 % of the German fauna) were captured. The dominance ratio was calculated for catches of pitfall traps and sweep-net samples. The distribution of ground-dwelling spiders was analysed by a correspondence analysis. Four different microhabitats can be distinguished (mainly on the first axis, representing a vegetation gradient; Fig. 1). It is assumed that the pompilids hunting ground-dwelling spiders use the microhabitats of their prey predominantly during hunting activity.

244 individual pompilids comprising 25 species (= 26 % of the German fauna) were collected, including four obligate brood parasites of other pompilids. 44 spider prey of twelve species at least were obtained from seven pompilid species. Not all spiders could be identified to species level, because some were juvenile. Data of spiders actually used as prey were related to the spider taxocoenosis in the field (Tab. 1, 2).

Considering the prey species list and field observations, three types of foraging areas could be postulated for nine species of pompilids:

1. Areas of bare sand and sparse vegetation. This microhabitat is intensively patrolled by *Pompilus cinereus* (indicated by the spider prey species *Arctosa perita* and *Sitticus distinguendus*; both species were not well represented in the pitfall traps, because only few traps were situated in these microhabitats). Other microhabitats might be used by *P. cinereus* or misdirected spider individuals from other microhabitats are also attacked on the bare sand (*Xerolycosa nemoralis*, *X. miniata*, *Alopecosa* sp.).

2. Higher vegetation is used by four species of spider wasps: *Caliadurgus fasciatellus* and *Episyron rufipes* prey upon orb weavers. *Agenioideus cinctellus* and *Dipogon intermedius* hunt along the trunks of pine trees and other wooden structures of the habitat (no prey observed; potential prey species are: *Marpissa muscosa*, *Salticus zebraneus*, *Segestria senoculata* as well as other species).

3. Vegetation on or near the ground level. Four pompilid species (*Anoplius infuscatus*, *Anoplius viaticus*, *Arachnospila anceps*, *Priocnemis perturbator*) hunt on ground-dwelling spider species or on species which live in low vegetation (*Alopecosa* sp., *A. cuneata*, *Evarcha flammata*, *Pardosa prativaga*, *Trochosa* sp., *T. terricola*).

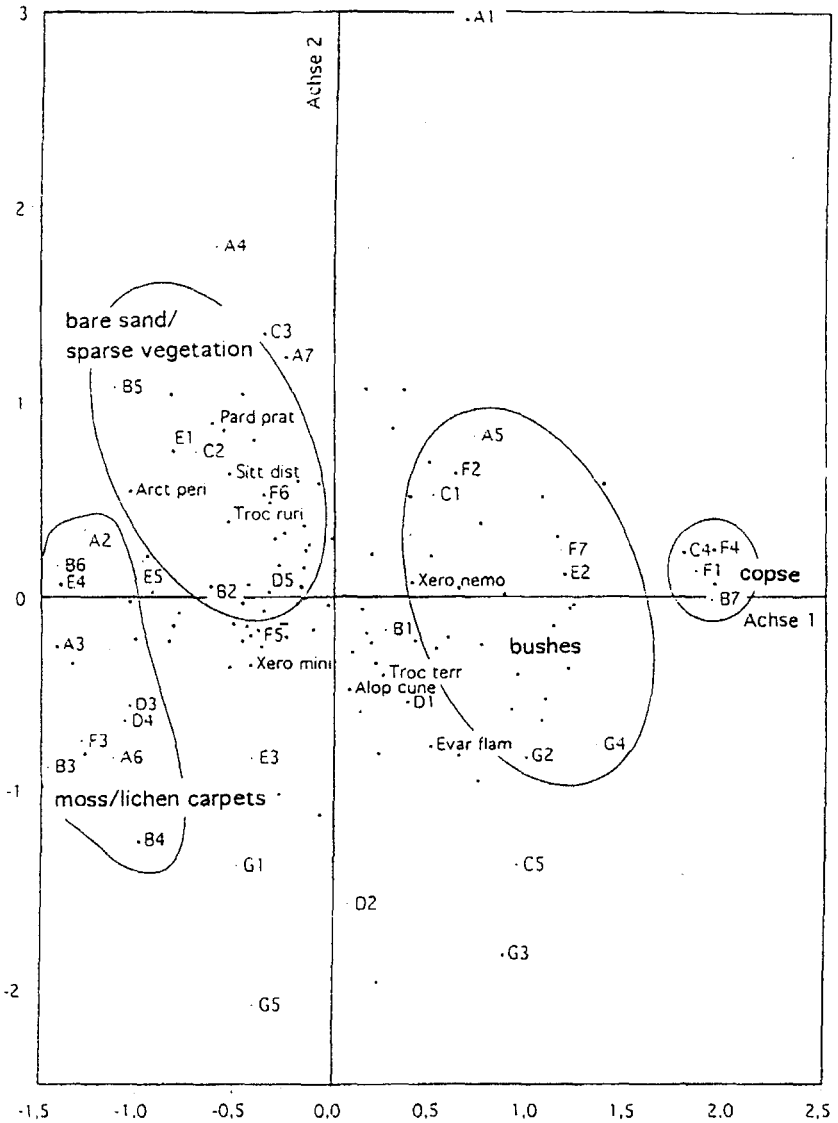

Fig. 1: CA Plot of the pitfall traps and spider species (41 trap-sites (A1 - G5), 118 species, 3628 Ind.). Only the ground-dwelling spider prey species are listed in detail:

Alopecosa cuneata	Alop cune	Trochosa terricola	Troc terr	Sitticus distinguendus	Sitt dist
Arctosa penta	Arct peri	Xerolycosa miniata	Xero mini	Trochosa ruricola	Troc rur
Evarcha flammata	Evar flam	Pardosa prativaga	Pard prat	Xerolycosa nemoralis	Xero nemo

Tab. 1: Spider prey species of seven pompilid species, their frequency and dominance in the study area (ind. = individuals, juv. = juvenile, pf = pitfall traps, sn = sweep-net sampling).

	prey	**Σ (ind.)**	**stage of prey**	**frequency (pf+sn)**	**dominance (%)**
Anoplius infuscatus	*Trochosa* sp.	2	juv. female (2)	-	-
Anoplius viaticus	*Alopecosa cuneata*	1	adult female (1)	7	4.79 (pf)
	Trochosa terricola	1	adult female (1)	7	3.67 (pf)
Arachnospila anceps	*Alopecosa* sp.	1	juv. female (1)	-	-
	Pardosa prativaga	1	adult female (1)	4	0.33 (pf)
	Evarcha flammata	1	adult female (1)	7	6.05 (sn)
Caliadurgus fasciatellus	*Araniella cucurbitina*	1	adult female (1)	3	0.53 (sn)
	Araniella opistographa	1	adult female (1)	7	1.58 (sn)
Episyron rufipes	*Araneus diadematus*	1	juv. female (1)	2	0.26 (sn)
	Araneus quadratus	3	juv female (3)	6	1.84 (sn)
	Araneus sp.	1	juv male (1)	-	-
Pompilus cinereus	*Arctosa perita*	25	adult female (2), juv. male (6), juv (17)	3	0.17 (pf)
	Alopecosa sp.	1	juv (1)	-	-
	Xerolycosa miniata	1	adult female (1)	7	8.60 (pf)
	Xerolycosa nemoralis	1	adult female (1)	6	0.36 (pf)
	Sitticus distinguendus	1	adult female (1)	3	0.06 (pf)
Priocnemis pertubator	*Trochosa terricola*	1	adult female (1)	7	3.67 (pf)
7 species	min. 12 species	44		max. = 7	

Tab. 2 Potential and recorded prey species of pompilids in the study area ((excl. *Evagetes*, only recorded spider families listed; # = records from the study area; + = after Day (1981, 1988), Koomen & Peters (1993), Oehlke & Wolf (1971)).

	Lycosidae	*Gnaphosidae*	*Salticidae*	*Thomisidae*	*Clubionidae*	*Agelenidae*	*Pisauridae*	*Araneidae*	*Tetragnathidae*	*Philodromidae*	*Segestriidae*	*Amaurobiidae*	*Liocranidae*	*Zoridae*	*Mimetidae*	*Theridiidae*	*Linyphiidae*	*Hahniidae*	*Dictynidae*	Σ
Pompilus cinereus	#	+	#	+	+		+	+						+						8
Anoplius viaticus	#	+	+	+		+	+			+			+							8
Arachnospila anceps	#	+	#	+	+	+														6
Chyptocheilus notatus	+	+			+	+						+								5
Arachnospila trivialis	+	+		+	+	+														5
Anoplius infuscatus	#			+		+				+										4
Priocnemis pusilla	+	+	+		+															4
Anoplius nigerrimus	+	+					+													3
Priocnemis hyalinata	+		+		+															3
Priocnemis parvula	+		+	+																3
Priocnemis pertubator	#	+		+																3
Arachnospila spissa	+		+																	2
Agenioideua cinctellus			+	+																2
Dipogon subintermedius			+								+									2
Caliadurgus fasciatellus								#	+											2
Episyron rufipes								#	+											2
Priocnemis susterai		+																		1
Priocnemis minuta		+																		1
Arachnopsila abnormis																				-
Arachnospila pseudabnomis																				-
Priocnemis coriacea																				-
Σ	12	10	9	8	6	5	3	3	2	2	1	1	1	1						

No species of spider wasps appears to be very specialized hunters with regard to certain spider species. The spider prey consists of individuals with a minimal body size (> 5 mm) and of a certain spectrum of life forms (depending on pompilid species). The pompilids mostly carry off abundant or widespread species which fulfil these criteria (Tab. 1). No pompilid species have been observed preying upon adult male spiders.

Only three of the 19 ascertained spider families occurring in the study area comprise species which have been recorded as prey of the pompilids. 80 % of the specimens belong to the Lycosidae. Altogether at least 7 % (n = 12) of the 170 spider species in the study area have been recorded as prey.

DISCUSSION

Only a relatively narrow range of taxonomic groups of spider species in the study area were recorded as spider prey of pompilids (Araneidae, Lycosidae, Salticidae). Other papers list some more families containing prey species but these were not found in this investigation (Tab. 2). Although abundant in the field, Linyphiidae and Theridiidae for example are not used as pompilid prey and have not been recorded in other studies, either (e.g. Field 1992). The reasons for this negative selection remains to be investigated. Apart from other factors, prey size is expected to be important in prey selection by spider wasps. This assumption is confirmed in several studies in the Palaearctic and Nearctic (e.g. Endo & Endo 1994, Field 1992, Kurczewski & Kurczewski 1973). Pompilids prey upon juvenile spiders of both genders. For example, *Pompilus cinereus* utilise nymphs of the second last or of the last stage of *Arctosa perita*. On the other hand, only adult females were taken as prey. Similar results were found for the pompilid species *Anoplius viaticus* by Karsai and Vajda (1991). In the case of adult hosts, active gender selection possibly arises, but evidence could not be given here. Different hunting strategies in different microhabitats obviously minimise interspecific competition between pompilid species. By this means prey partitioning takes place which is an important factor (apart from several others) for the coexistence of pompilids (Field 1992).

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