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Pitfall Trapping of Salticidae (Araneae) in the Negev Desert

PRÓSZYNSKI J.

*Muzeum i Instytut Zoologii PAN
ul. Wilcza 64, 00-679 Warszawa, POLAND*

LUBIN Y.

*Blaustein Institute for Desert Research, Ben Gurion University
Sede Boqer Campus, 89443 ISRAEL*

RIASSUNTO

Trappole a caduta sono state utilizzate per campionare i ragni epigei in una serie di habitat localizzati lungo un gradiente di piovosità nel deserto del Negev in Israele. Meno del 5% degli esemplari raccolti appartengono ai *Salticidi*. Tuttavia il numero di specie di questa famiglia è relativamente alto. Le 25 specie di *Salticidi* catturate rappresentano il 10% del totale delle specie di ragni rilevate in un anno di campionamento. Cinque specie non trovate nelle trappole sono state rilevate per mezzo di sporadiche raccolte a mano negli stessi habitat. Alcune specie, ad es. *Mogrus neglectus*, sono comuni nella vegetazione ma raramente cadono nelle trappole. Il maggior numero di individui per intensità di trappolamento si riscontra sui siti più umidi (c. 200 mm annui di pioggia). Questo risultato è coerente con le osservazioni che più della metà delle specie del Negev si trovano anche nella regione mediterranea e sembrano appartenere ad una fauna più mesofila.

Parole chiave: Ragni, Salticidae, Deserto del Negev, Trappole a caduta.

ABSTRACT

Pitfall trapping was used to sample ground-dwelling spiders in a range of habitats along a rainfall gradient in the Negev desert of Israel. Less than 5% of the individuals collected belong to the Salticidae. Nonetheless, the fauna of salticids in the Negev samples is relatively rich in number of species. A total of 25 salticid species occurred in the traps, representing almost 10% of all species of spiders recorded in one year of trapping. Five species were found by sporadic collecting by and in the same habitats, but did not occur in the traps. Some species, e.g. *Mogrus neglectus*, occurred commonly on vegetation but were rarely caught in pitfall traps. The greatest number of individuals per trapping effort occurred in the wettest site (c. 200 mm annual rainfall). This is consistent with the observation that more than half of Negev species are also found in the Mediterranean region and may belong to a more mesic fauna.

Key words: Spiders, Salticidae, Negev desert, Pitfall traps.

Deserts are a difficult environment for collecting *Salticidae*. Some species appear to be active only during certain hours of the day, e.g. in the early morning, others are restricted seasonally or to specific habitats (personal observations). During the breeding season, silk nests of some species may occur in abundance on shrubs (e.g. *Mogrus neglectus* in the Negev desert). However, these conspicuous nests are the exception: generally salticids occur only sparsely in desert environments. It was therefore rather surprising to find that pitfall trapping in the Negev desert yielded relatively rich material. We would like to call attention to the possibilities provided by this method. We discuss also the zoogeographical character of the salticid fauna of the Negev.

Salticidae were collected as part of a study of the ecology, systematics and zoogeography of selected families of spiders in Israel (*Gnaphosidae* and *Salticidae* being the first to be identified) by Yael Lubin and Gershom Levy. Pitfall traps were used to sample ground-active spiders in a wide range of habitats across a rainfall gradient in the Negev desert. The trapping was done over a period of three years. The salticid specimens were identified to the species level by Jerzy Prószyński. Additional specimens from this desert environment were collected by G. Levy, B. Roth and V. Roth, and T. Prószyński. We also had available specimens collected for behavioral work by R. R. JACKSON in May 1993.

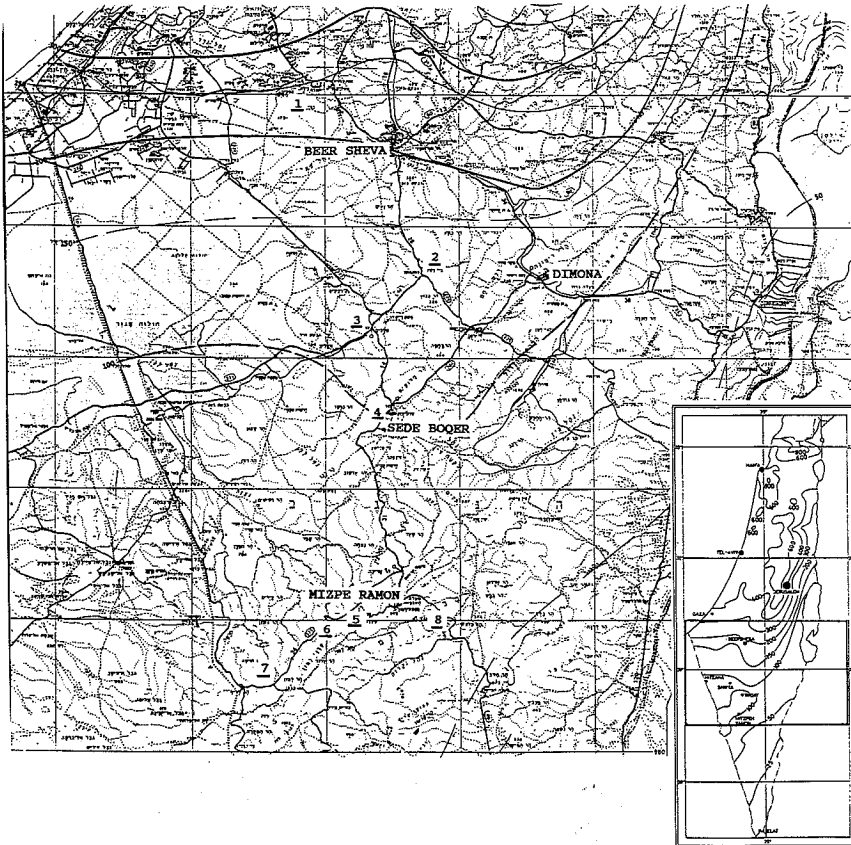
Methods

Pitfall trapping was done over a period of three days and three nights each month. The trapping sites are listed in Table I together with some characteristics of each site. The sites were located along a rainfall gradient from 200 mm in the north (Park Sayeret Shaked) to less than 60 mm in the south (Nahal Ramon - in the large erosional cirque of Mahatesh Ramon). (Fig 1)

The substrata sampled were diverse and can be divided roughly into **hard** and **soft** substrata. The former included the wadis of Park Sayeret Shaked, the Halukim and Hatira ridges, Nahal Nizzana, Ma'ale Ramon and Borot Loz, where traps were placed both on rocky slopes with scattered perennial vegetation and in the sandy-loessial wadi bottoms where vegetation was often dense. The loessial plains of Nahal Sekher and Sede Zin are also included in the 'hard substratum' category. The

Illustrations

- 1 Location of the collecting area on the background of a map of types of vegetation in Israel (simplified)
- 2 Landscape of Zin Wadi, from Sede Boqer (phot. Yael Lubin)
- 3 A line of pitfall traps near Sede Boqer (phot. Yael Lubin)
- 4 Stabilized sands, Beer Mashabbim near Beer Sheva (phot. Yael Lubin)
- 5 Rocky slope and vegetated wadi - Halukim Ridge near Sede Boqer
- 6 Loessial plain Sede Zin near Sede Boqer (phot. Yael Lubin)
- 7 More extreme desert conditions - Machtesh Ramon near Mizpe Ramon (phot. Yael Lubin)



soft substrata were sampled at three locations in the Be'er Masha'bbim sand dunes, from relatively exposed dunes to dunes stabilized by perennial vegetation, and at four sites in the sandy and gravel floodplain of Nahal Ramon in the Ramon erosional cirque.

At each trapping site, 30-50 pitfall traps were placed in each habitat (e.g., in wadis, 30 traps on either slope and 30 in the wadi bottom). The traps were plastic containers (10 cm deep x 10 cm opening diameter) inserted into the ground such that the opening was level with the surface. No preservative was used; spiders were collected each morning for three consecutive days and all other organisms trapped were released. This was necessary as some sites were within Nature Reserve boundaries.

Results

The 25 species of *Salticidae* collected by pitfall trapping are listed by trapping site in Table I and by season in Table III. Pitfall trap results are compared with incidental collecting in Table II.

Typically more males (42%) than females (14.5%) were collected in the pitfall traps. This pattern is found in pitfall trapping of most ground-dwelling spiders and may be due to greater mobility of males during the breeding season. No attempt was made to identify juvenile salticids which constituted 44% of the total number of specimens of salticids captured in the traps (N = 567, all sites combined).

More species of *Salticidae* were collected from traps in the Halukim and Hatira ridges (17 spp.) than from other sites. However, trapping efforts were not equal at all sites and both the number of trapping sessions and the number of traps must be taken into account in comparing abundances in different areas. In Table IV, we show the average number of individuals of salticids trapped at each site per trap-month (i.e., per trap and per three-day trapping period). The lowest number of salticids (0.0013 per trap-month) was in Nahal Ramon, the southernmost site, where rainfall is sporadic and averages only 60 mm annually. The highest number (0.05 spiders per trap-month) was found in the northern Negev at a rainfall of c. 200 mm annually. At sites in between these two extremes, abundances were between 0.01 and 0.03 spiders per trap-month, but did not show any particular pattern in relation to either latitude or elevation.

Table I - Results of pitfall trapping of *Salticidae* in various desert environments of the Negev (only adult spiders are included). Trapping sites are separated by geographical position, substratum, elevation and rainfall (see Fig. 1).

- 1 - Rocky slopes (Park Sayered Shaked; 130m elevation, 200mm annual rainfall)
- 2 - Sand dunes (Be'er Mash'abbim; 360m elevation, 120mm annual rainfall)
- 3 - Loessial plains (Nahal Sekher, 370 m elevation; Sede Zin, 500 m elevation, 90-100 mm annual rainfall)
- 4 - Rocky slopes and wadis, North (Halukim Ridge, Hatira Ridge, 550m elevation; 90mm annual rainfall)
- 5 - Rocky slopes and wadis, South (Nahal Nizzana, Ma'ale Ramon, Borot Loz, 850-900m elevation; c. 100mm annual rainfall)
- 6 - Sandy wadis (Makhtesh Ramon, Nahal Ramon, c. 350m elevation; c. 60mm annual rainfall).

Species from the Negev	1	2	3	4	5	6
<i>Aelurillus aeruginosus</i>	-	20	27	18	-	1
<i>Aelurillus</i> "black clypeus"	-	-	-	124	6	1
<i>Chalcoscirtus</i> sp. 1	-	-	-	6	2	-
<i>Chalcoscirtus infimus</i> ?	-	-	-	-	1	-
Gen. n. sp. n.	-	3	-	1	-	-
<i>Euoplrys gambosa</i>	2	3	2	1	3	-
<i>Evarcha</i> sp. n.	-	-	-	4	1	-
<i>Heliophanus decoratus</i>	-	-	-	1	-	-
<i>Heliophanus encifer</i>	-	-	-	1	-	-
<i>Langona redii</i>	-	-	-	27	2	-
<i>Leptorchestes berolinensis</i>	-	1	-	1	1	-
<i>Menemerus illigeri</i>	-	3	-	-	-	-
<i>Menemerus taeniatus</i>	-	1	-	-	-	-
<i>Mogrus neglectus</i>	-	4	3	4	-	-
<i>Neaetha oculata</i>	-	1	-	-	-	-
<i>Pellenes maderianus</i>	1	-	-	1	-	-
<i>Pellenes</i> sp. n.	-	3	1	-	-	-
<i>Pellenes simoni</i>	3	1	3	38	-	-
<i>Phlegra</i> sp. light	-	-	-	2	-	-
<i>Phlegra fulvastra</i> (?)	-	-	-	2	-	-
<i>Salticus tricinctus</i>	-	-	-	1	-	-
<i>Synageles dalmaticus</i>	-	1	-	-	-	-
<i>Thyene imperialis</i>	-	-	3	4	1	-
<i>Yllenus salsicola</i>	-	2	-	-	-	-
<i>Yllenus squamifer</i>	-	6	-	3	-	-
Total specimens	6	49	39	239	17	2

Table II - Comparison of number of adult specimens collected in the Negev by trapping and found incidentally.

- 1 - Total number of specimens by pitfall trapping
 2 - Specimens collected incidentally from the Negev

Species from the Negev	1	2
<i>Aelurillus aeruginosus</i>	66	-
<i>Aelurillus</i> "black clyp"	129	-
<i>Chalcoscirtus</i> sp. 1	8	4
<i>Chalcoscirtus infimus</i> ?	1	-
<i>Gen. n.</i> sp. n.	4	-
<i>Cyrba algerina</i> (Luc.)	-	2
<i>Euophrys gambosa</i>	11	1
<i>Evarcha nepos</i>	-	4
<i>Evarcha</i> sp. n.	5	-
<i>Heliophanus decoratus</i>	1	2
<i>Heliophanus encifer</i>	1	1
<i>Langona redii</i>	29	10
<i>Leptorchestes berolinensis</i>	3	-
<i>Menemerus illigeri</i>	3	-
<i>Menemerus taeniatus</i>	1	-
<i>Mogrus dumicola</i>	-	6
<i>Mogrus neglectus</i>	11	29
<i>Neaetha oculata</i>	1	-
<i>Pellenes maderianus</i>	2	-
<i>Pellenes</i> sp. n.	4	-
<i>Pellenes simoni</i>	45	-
<i>Phlegra</i> sp. "light"	2	1
<i>Phlegra fulvastra</i> (?)	2	1
<i>Pseudicius wadis</i>	-	2
<i>Salticus tricinctus</i>	1	-
<i>Synageles dalmaticus</i>	1	2
<i>Thyene imperialis</i>	8	10
<i>Yllenus salsicola</i>	2	-
<i>Yllenus squamifer</i>	6	-
Total specimens	345	75

Table III - Seasonal occurrence of the Negev Salticidae
(three year's material; only adults are recorded).

Species	Winter		Spring/ Summer		Summer/ Autumn	
	XI-II		III-VI		VII-X	
	M	F	M	F	M	F
<i>Aelurillus aeruginosus</i>	18	8	14	12	7	7
<i>Aelurillus</i> "black cl."	42	4	48	8	22	7
<i>Chalcoscirtus</i> sp. 1	-	-	5	4	-	1
<i>Chalcoscirtus infimus</i> ?	-	-	-	1	-	-
Gen. n. sp. n.	-	-	6	-	-	-
<i>Cyrba algerina</i>	-	-	-	1	-	1
<i>Euophrys gambosa</i>	-	-	3	7	-	1
<i>Evarcha</i> sp. n.	-	-	2	-	2	4
<i>Heliophanus decoratus</i>	-	-	-	1	-	-
<i>Heliophanus encifer</i>	-	-	1	-	-	-
<i>Langona redii</i>	-	-	18	2	13	-
<i>Leptorchestes</i> sp. n	-	-	-	1	-	1
<i>Menemerus illigeri</i>	-	-	2	-	1	-
<i>Menemerus taeniatus</i>	-	-	-	-	-	1
<i>Mogrus neglectus</i>	3	1	6	-	-	1
<i>Neaetha oculata</i>	-	-	1	-	-	-
<i>Pellenes maderianus</i>	-	1	-	1	-	-
<i>Pellenes</i> sp. n.	-	-	4	-	-	-
<i>Pellenes simoni</i>	1	1	14	6	17	7
<i>Phlegra</i> "light"	-	-	1	-	1	-
<i>Phlegra fulvastra</i> (?)	-	-	-1	-	1	-
<i>Salticus tricinctus</i>	-	-	-	1	-	-
<i>Synageles dalmaticus</i>	-	-	-	1	-	-
<i>Thyene imperialis</i>	1	1	5	1	-	-
<i>Yllenus salsicola</i>	-	-	1	-	1	-
<i>Yllenus squamifer</i>	2	-	1	4	-	2

Table IV - Average number of individuals of Salticidae collected per-trap per month at different sites in the Negev desert. Trapping sites are listed in order from north to south. The number of spiders includes juveniles that were not identified to species.

Trapping site	Total	Months	Traps	#/month/trap
Sayeret Shaked	27	6	90	0.05
Nahal Sekher	55	25	110	0.02
Be'er Mash'abim	67	27	150	0.0165
Haluqim Ridge	187	25	270	0.0277
Hatira Ridge	152	25	270	0.0225
Sede Zin	26	13	100	0.02
Nahal Nizzana	14	8	60	0.0292
Ma'ale Ramon	5	6	60	0.0139
Borot Loz	6	4	120	0.0125
Nahal Ramon	3	8	300	0.0013

Discussion

Pitfall trapping is a useful method of sampling some groups of ground-active spiders (UETZ & UNZICKER 1975). It is not a quantitative measure of abundance, because the traps catch only active spiders, and not those species that are primarily sit & wait predators. Nonetheless, pitfall-trapping provides a relative estimate of activity in the habitat.

Pitfall traps are expected to be less effective in sampling salticids, because the latter have such acute vision (FORSTER 1982). Furthermore, many salticid species occur on vegetation, even in desert environments, and these will not fall into traps. For example, adult females of *Mogrus neglectus* were found commonly on shrubs near Sede Boqer in the spring, but did not occur at all in the pitfall traps in this area. Perhaps indicative of the limitations of this method for salticid sampling is the fact that an additional 5 species of salticids were collected in the Negev during rather limited collecting by hand.

Salticids constituted a small fraction of the ground-active spiders collected in the traps. Overall, only 4.6% of 12,402 spiders collected at all sites were *Salticidae*. By comparison, CHEW (1961) found approximately 16% salticids among spiders collected on desert shrubs in Arizona. Nonetheless, the fauna of salticids in the Negev samples is relatively rich in number of species. About 10% of 113 species of spiders found during one year of trapping were *Salticidae*. A similar

species richness was found in the families *Thomisidae* and *Lycosidae*, while the *Gnaphosidae* represented about 30% of the species. The remaining 40% of the species were distributed among 21 families. The Negev salticid fauna is considerably more diverse than that of the shrub community studied by CHEW (1961), with only 4 species noted. This holds for each of the sampling sites of the Negev, with the exception of the northernmost (Park Sayeret Shaked) and southernmost (Machtesh Ramon) sites.

It is perhaps too early to attempt a zoogeographic analysis of the Negev fauna. The distributions of most species are incompletely known and the salticid fauna in neighboring countries, especially in North Africa and the Middle East, is poorly known or not at all. Some preliminary observations are presented here, principally with the aim of stimulating further work. Few of the Negev species were found to occur also in the Arabian Peninsula (PROSZYNSKI, 1993) and in Algeria (collection of R. BOSMANS, PROSZYNSKI, in prep.) (Table V).

There is more overlap with Mediterranean species; however, the Mediterranean fauna is relatively better known. We suspect a distinct difference to occur between the salticid fauna of the south-western and south-eastern Mediterranean regions, which calls for further attention. Finally, the Israeli fauna contains at least 10 species which appear to have more restricted or local distributions.

Two genera in the Israeli fauna, *Aelurillus* and *Phlegra*, revealed considerable morphological variation among specimens collected in different localities. This variation may be interpreted as indicating many species, separated by minor differences in the various diagnostic characters, or perhaps, more likely, few species each with a broad range of variation. Additional collecting from different populations and perhaps observations of courtship and mating behaviors are necessary to resolve this problem. A similar type of variation in *Salticidae* was described by E.M. ANDREEVA, based on her observation of *Sitticus anscobicus* in the mountain ranges of Tadjikistan (ANDREEVA, personal communication), and in the genus *Corythalia* in Central America (W. MADDISON, personal communication).

Table V - Zoogeographical relationships of the Negev Salticidae.

- 1 - Species known from the Negev
- 2 - Mutual occurrence in the Arabia Peninsula (pitfall traps, Prósznski, 1993)
- 3 - Mutual occurrence in Algeria (pitfall traps and incidentally collected - R. Bosmans collection, Prósznski in preparation)
- 4 - Mediterranean species
- 5 - Species widely distributed in Europe, Asia and/or Africa

1	2	3	4	5
<i>Aelurillus aeruginosus</i>				
<i>Aelurillus</i> black clyp				
<i>Chalcoscirtus</i> sp. 1				
<i>Europhrys</i> sp. 5				
<i>Langona redii</i> ?				
<i>Gen. n.</i> sp. n.				
<i>Mogrus dumicola</i>				
<i>Pellenes</i> sp. n.				
<i>Phlegra</i> light				
<i>Evarcha</i> sp. n.	X			
<i>Neaetha oculata</i>	X			
<i>Pseudicius wadis</i>	X			
<i>Euophrys gambosa</i>		X	X	
<i>Salticus tricinatus</i>		X	X (Middle Asia)	
<i>Chalcoscirtus infimus</i> ?			X	
<i>Menemerus illigeri</i>			X	
<i>Mogrus neglectus</i>			X (Eastern M.)	
<i>Heliophanus encifer</i>			X	
<i>Phlegra fulvastra</i> (?)			X (Sicily)	
<i>Yllenus squamifer</i>			X (W Medit.)	
<i>Yllenus salsicola</i>			X (SW Medit.)	
<i>Leptorchestes</i> sp. n.			X	X
<i>Menemerus taeniatus</i>			X	X
<i>Pellenes simoni</i>			X	X
<i>Synageles dalmaticus</i>			X	X
<i>Cyrba algerina</i>		X	X	X
<i>Heliophanus decoratus</i>			X	X
<i>Pellenes maderianus</i>			X	X
<i>Plexippus paykulli</i>			X	X
<i>Thyene imperialis</i>		X	X	

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