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Occurrence of Jumping Spiders (*Araneae: Salticidae*) in Alfalfa Agroecosystems, in Western Saudi Arabia

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ABSTRACT.The seasonal occurrence of soil and foliage-dwelling salticid spiders was studied in an alfalfa agroecosystem in western Saudi Arabia in 1990-1991. Six of the collected species were new to the scientific world and were described and identified. Six other salticids are reported for the first time existing in alfalfa agroecosystems in western Saudi Arabia. The salticid spiders dwelled on foliage more than in the soil. Three peaks were observed throughout the season during October, January, and August, with a pronounced peak during August. The aestivation period occurred during December. Based on their numbers, continued presence and veracious feeding behavior in the alfalfa agroecosystem, they show great potential as promising candidates for controlling major pests and thus to be included in an integrated pest management (IPM) program.

Introduction

The interest in the potential of spiders and other arthropod predators in suppressing injurious insect pest outbreaks is growing and well documented by many workers (Chiverton 1986, Riechert and Bishop 1990, Bishop 1990, Bishop and Riechert 1990, Sterling *et al.* 1992, Nyffeler *et al.* 1992, Nyffeler and Breene 1992, Kumar *et al.* 1996b). These araneids are among the most important polyphagous macroarthropod predators that have a significant impact on population dynamics of many polyphagous and saprophagous invertebrates (Eckschmitt *et al.* 1997). Their role in agroecosystems has been the subject of numerous studies (reviewed by Nyffeler and Benz 1987). Numerous studies have shown by thorough investigations on different domains of agroecosystems and a varieties of insect pest interactions. These include many insect pests (Lal 1990), potential lepidopterans, homopterans dipterans pests (Pasquet 1984). for example in rice fields against rice hoppers and rice leaf folders (Kumar and Velusamy 1995,

1996a, Willey *et al.* 1992)., in winter wheat (Nyffeler and Breene 1992), in alfalfa fields (Naslinosh and Salam 1993) and against sugar cane pests (Vennila and Easwramoorthy 1997).

Within the Arancids the salticids are the largest faimily of spiders, having unique eyes, coloration, acute vision and mediated predatory behavior. These are more pronounced than in any other spider group (Jackson and Pollard 1996). They are very adept and agile at stalking predators using a variety of capture tactics including camouflage (Bear and Hassan 1997). There are only a few studies and published works on the spider fauna of Saudi Arabia. These include field surveys conducted by Jocque (1981). Faragalla and Taher (1987 and 1989)., Taher and Faragalla (1990)., and Prosziiyske (1989 and 1990).

Prozsnyske's (1993) documented information, strengthened our view of the special zoogeographic characteristics of the Saudi Arabian Salticidae. However this did not include palacarctic (*Eurosiberian*) elements and thus has only a very insignificant relationship with mediterranean fauna.

The objective of the present work was to generate information on the main species of the predominant salticids that dwell basically in alfalfa agroecosystems. To determine if the salticid complex (*Araneida*) is more abundant as foliage-dwelling than soil-dwelling predators, field studies were undertaken in an alfalfa agroecosystem in western Saudi Arabia. This information should be pivotal in the design of any future integrated pest management (IPM) programs, as the salticids play an important role as biocontrol agents by their voracious feeding habits, primarily on injurious insect pests.

Materials and Methods

The study was conducted at King Abdull Aziz University Research Farm, which belongs to the College of Meteorology, Environmental Studies and Arid Land Agriculture at Hada AI-Shain locality, 125 km North of the city of Jeddah. Data was collected from October 1990 - September 1991.

Sampling Methods

To measure the seasonal variations in the population of the salticid complex, the alfalfa agroecosystem was sampled weekly using two sampling methods. One hundred random sweeps (4 x 25) were taken weekly by hitting the alfalfa foliage horizontally with a 30 cm sweeping net. All sweeps were made while walking diagonally across the alfalfa crop, ensuring that the upper 3rd of the plant canopy was disturbed.

Twelve pitfall traps were installed randomly in the alfalfa field. Each trap was made by taping a wide-mouth funnel into a 1/2 litre size wide-mouth glass jar, and burying it in the soil so that the top of the funnel was even with the soil surface. Approximately, 150 ml of 70% alcohol was placed in each trap to act as a killing and preserving agent. These traps were visited weekly during the study period, at which time the glass jars were removed and new replacement jars installed in the same pits. The recovered catch was carried back to the laboratory for further studies. All specimens from both sampling methods were transferred into 70% ethyl alcohol, sorted and identified in the laboratory.

Daily maximum air temperature and the percentage of relative humidity were obtained from the weather station at King Abdull Aziz University Research Farm and represented by the pronounced peaks only. Weekly averages were calculated and compared with monthly averages of the fluctuation dynamics of salticid complex.

Statistical Methods

The Chi-square (X^2) test was used to compare the differences in monthly average numbers collected between the soil and foliage-dweller species of salticids in the alfalfa agroecosystem.

Unidentified specimens were categorized, stored in separate vials of 70% alcohol, and sent to Dr. J. Prosznyski of Zalklad Zoologii WSRP, UL. Prusa 12, 08100, Siedlce, Poland. In addition to the main study and our experimental field, some other alfalfa agroecosystems in neighbouring areas to Hada AI-Sham location (Fig. 1) were sampled intermittently. But only by random sweeps using the same standard sweep net in order to collect more specimens of the salticid species as recommended by the taxonomist. However, these collected specimens were not added to the actual data recovered from our alfalfa agroecosystem.

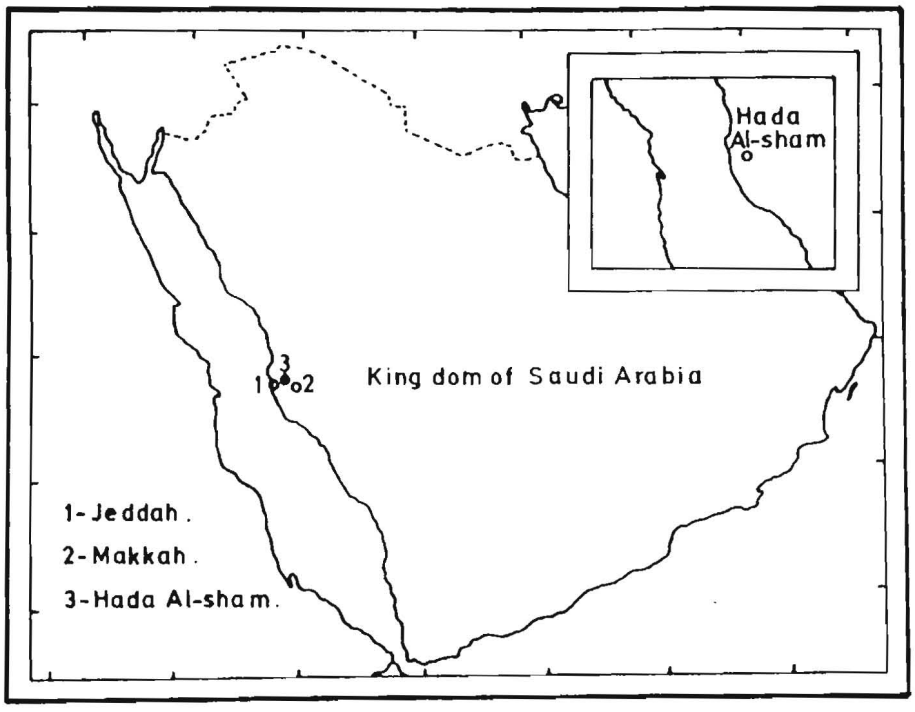

Fig. 1: General map of Saudi Arabia showing the locality of Hada Al-Sham.

Results and Discussion

Data obtained from this field study showed that there were differences in densities between soil-and foliage-dwellers throughout the season. Three generation peaks of foliage-dwelling salticid spiders were observed throughout the season in the alfalfa agroecosystem (Table 2, Fig. 2). Table 2 showed the weekly average and standard deviation of foliage and soil-dwellers salticid, however, Fig. 2 represented the monthly data of both groups respectively. They occurred during October, January, and August (Fig. 2) corresponding to average ambient temperatures of 31^{o}C, 22^{o}C and 35^{o}C respectively and an average RH of 52%, 49% and 54% respectively. The highest peak occurred during August.

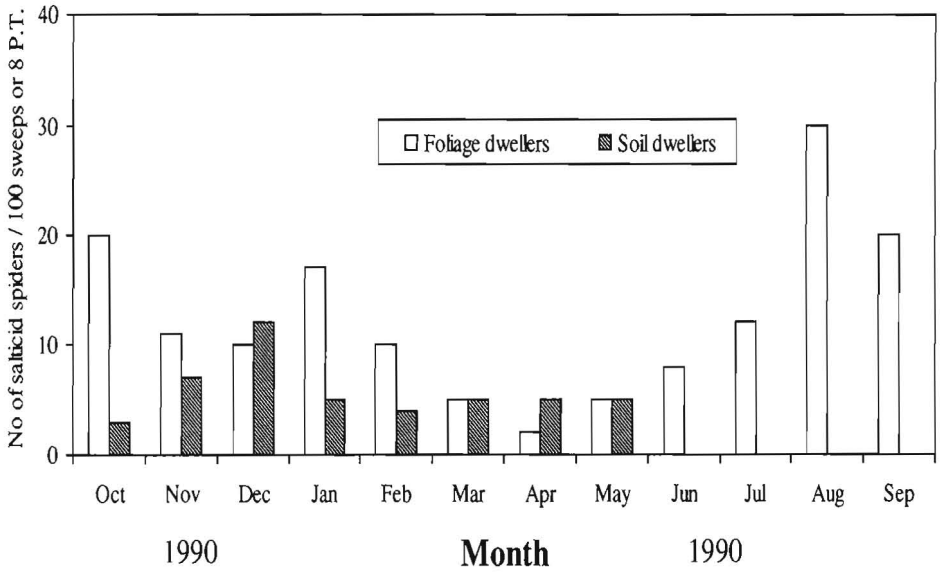

Fig. 2: Seasonal variation in density of salticid spiders on foliage and in soil, Hada Al-Sham, western Saudi Arabia, 1990-1991.

The sampling methods showed that salticid spiders dwell on foliage more than in soil as when numbers recovered were compared between both groups, it was found that salticid abundance was dominant on the foliage (Table 2). Salticid spider numbers decreased on foliage during December but increased in the soil. Thus indicating that the salticid spiders aestivate during cold weather in the soil crevices, corresponding to a temperature of 22°C and 35% RH. The salticids are well known as stalking spiders, having their own hunting behaviors. The acute vision, agility and strong muscles in the fore and hind legs predispose them as important foliage-dwelling predators on a variety of flying, sucking, immature insects as reported by Jackson and Willey (1994), Jackson and Pollard (1996), Riechert and Lawrence (1997).

The Chi-square (X^2) for the total period (all months) showed there was a significant difference in numbers between soil and foliage dwellers, Chi-square (X^2) = 54.693 and P<O. 00 1.

Six new species were identified (Table 1). In addition to the six new species, six other species were reported to exist in the alfalfa agroecosystem in western Saudi Arabia for the first time.

Table I: Salticid species recovered by pitfall traps and sweep nets at Hada AI-Sham locality, Western Saudi Arabia, 1990-1991.

Species	
Aelurillus faragallai n. sp*	Hada-AI-Sham
Langona pallida n. sp*	"
Yellenus arabicus n. sp*	"
Pellenes hadaensis n. sp*	"
Pellenes hedjazensis n. sp*	"
Menemerus arabicus n. sp*	Khulais valley
Bianor sp. probably *B. albobimaculatus*	"
Menemerus animatus O.P. Cambridge	"
Neaetha oculata Prosznyski	Hada-AI-Sham
Plexippus paykulli (Savigny & Audoium 1927)	Khulais valley
Stenaelurillus sp.	Hada AI-Sham
Thyene imperialis (Rossi 1846)	Khulais valley

* n. sp. = new species

The salticid spiders were found to be one of the most important spider groups and are potential candidates for mass rearing and augmentative release. Some lycosid spiders (Family : Lycosidae) were mass produced in the laboratory and fed on a third Lycosidae instar nymplid of *Nilaparvatar lugens*. Stal then fed them grubs of *Tribolium castlaneum* (Herbst) before releasing them against rice hoppers in the fields (Kumar and Velusamy 1995). Our study has shown that these new species of the salticid, in addition to the other collected species may have great potential in any endeavours for establishing a biological control program using polyphagous insectivorous predators like the salticids.

Table 2: Occurrence of salticid spiders (weekly mean + SD recovered by two methods in alfalfa agroecosystem, Hada Al-Sham, western Saudi Arabia, 1990-1991.

Salticid Complex	October	November	December	January	February	March	April	May	June	July	August	September
Foliage dwellers	05.00±02.00	02.75±01.71	02.75±00.96	04.75±00.96	02.75±01.78	03.00±02.00	00.50±00.58	01.25±00.50	02.00±01.41	03.00±01.16	07.75±01.71	05.00±02.16
Soil dwellers	00.60±00.89	02.00±01.41	03.00±00.81	03.00±00.82	01.00±00.71	01.00±00.00	01.25±00.50	01.00±00.71	00.00±00.00	00.00±00.00	00.00±00.00	00.00±00.00

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العناكب الوثابة (Araneae: Salticidae) وحدوثها في النظام البيئي الزراعي للبرسيم الحجازي بغرب المملكة العربية السعودية

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المستخلص: تمت دراسة الحدث الموسمي للعناكب الوثابة التي تقطن المجموع الخضري والتربة في النظام البيئي الزراعي للبرسيم الحجازي ، غرب المملكة العربية السعودية أثناء الفترة 1990 – 1991. كما تم توصيف وتعريف ست أنواع جديدة من العناكب الوثابة ، أضيفت إلى عالم العلوم والمعرفة . إضافة إلى ذلك تم تسجيل ست أنواع أخرى ، تسجل لأول مرة في النظام البيئي الزراعي للبرسيم في بيئة غرب المملكة العربية السعودية . واتضح من الدراسة ، أن معظم هذه العناكب تقطن المجموع الخضري أكثر مما تقطن التربة . وأظهرت هذه الدراسة ، حدوث ثلاثة قمم للكثافة العددية خلال الموسم أثناء شهور أكتوبر ، يناير ، وأغسطس ، بينما كانت أعلى قمة أثناء شهر أغسطس . أيضا أظهرت الدراسة أن فترة الكمون الحركي كانت أثناء شهر ديسمبر .

من ناحية أخرى ، أظهرت هذه العناكب ، اعتمادا على الكثافة العددية والتواجد المتواصل وسلوكها الشره في الأغتذاء ، انها يمكن اعتبارها من المرشحات الواعدة لاستخدامها في برامج المكافحة المتكاملة للتحكم في كثافة الآفات الرئيسية للبرسيم الحجازي في غرب المملكة العربية السعودية .