

SEASONAL ABUNDANCE AND DAILY ACTIVITY PATTERNS OF SPIDER FAUNA IN SOME VEGETABLE CROPS IN MENOUEFIYA GOVERNORATE, EGYPT

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Abstract

Diversity, Seasonal abundance and diurnal-nocturnal activity of spider population under 8 vegetable crops were studied in an agro-ecosystem in Menoufyia governorate, Southern part of Nile Delta, Egypt. A Total of 516 individuals were caught using pit-fall traps during the study period. Six species belonging to six families were identified. Lycosidae was the dominant family (86.42%) of the populations, followed by Philodromidae, Linyphiidae. and Gnaphosidae, while Theridiidae and Salticidae were clearly the rare families in occurrence. *Thanatus albini* (Philodromidae) was the dominant species (5.43%). The peak of activity (19 ind/hr) and higher values of diversity (9 species) were recorded in summer, while the lowest were in winter. 0.08 ind/hr and 3 species, respectively. *Lycorma ferox* (Lycosidae) is active only in night-time as well as *Setaphis subtilis* (Gnaphosidae) which showed majority of activity (75%) in night-time against 25% in daytime.

Erigon dentipalpis (Linyphiidae) and *Sanatus albini* are completely active in daytime, Lycosidae (except *Lycorma ferox*), Linyphiidae (except *Erigon dentipalpis*) showed majority of activity in daytime (91.10, 84.21%, respectively). The 3 different daytime parts (the early, mid day and the later one third) showed similar values of activity, diversity, as well as the nocturnal activity in summer, while winter recorded the lowest values and notable fluctuations between night and daytime. The high abundance of spiders in August seems to be a result of a combination of 3 factors, dense vegetation cover, high temperature and enough relative humidity.

INTRODUCTION

Spiders are found in many vegetable and field crops in Egypt with notable density (Ghabbour and Mikhail, 1993; Hussein, 1993). Study and analysis of their activities, as predators, are important to maximize their role in biological control.

Nyffeler et al. (1992), in their ecological studies in an insecticide free cotton

field, indicated that spiders were the dominant arthropod predators, representing 70.15% of observed predation cases. Diurnal-nocturnal activity in their normal occurrence places is an important ecological aspect of study especially when related with some economic crops. Herrero and Valerio (1986) studied the variation in the daily activity patterns of some spider species in Costa Rica. They reported that hourly variation was significant with a constant pattern throughout the study period. Costa (1995) studied ecology and daily activity of two species of the family Lycosidae in south of Uruguay using pit-fall traps. He reported that high abundance was recorded in summer. Flatz (1988) studied seasonal dynamics, abundance and diversity of ground spiders in Austria. Ortega et al. (1992) studied the daily pattern of locomotor activity in some spiders of the family Lycosidae under normal natural LD cycle, and constant light conditions (DD, LL), using photo-electrical cells. They reported that the natural LD cycle is an important factor for the locomotor activity rhythm.

The present study aims to investigate the daily activity rhythms of spiders in Egyptian vegetable fields. The study was carried out in Menoufiya governorate, (at the southern part of the Nile Delta, about 70 km north of Cairo).

MATERIALS AND METHODS

Active population density of spider fauna was measured under some vegetable plantations for one year (Dec. 1995-Nov. 1996), for potatoes (*Solanum tuberosum*: Solanaceae) and carrot (*Daucus carota*: Umbelliferae) in winter, taro (*Colocassia esculenta*: Araceae) and onion (*Allium cepa*: Alliaceae) in spring. In summer, sweet potato (*Ipomoea batatas*: Convolvulaceae) and egg-plant (*Solanum melongena*: Solanaceae). Cabbage (*Brassica oleracea* var capitata: Cruciferae) and pepper (*Capsicum annum*: Solanaceae) in autumn.

Site description: This study was conducted in Menoufiya governorate, Nile Delta, in farms in close neighbourhood to Shebein El Kom city. The soil is highly fertile grade with clay texture (SWRI, 1967). Fields of these crops are so near to each other, extremely homogeneous in soil physical and chemical properties, agricultural practices and meteorological conditions, can be considered all as one site of experimentation.

Sampling Methods: The 24 hours of daytime duration were divided into 4 periods. The first (4 hours) one the third of daytime beginning from sunrise (P1), the second one (4 hours), P2 extended to 8 hours after sunrise, the third one was the

last part of daytime (4 hours) P3, which ended with sunset. P4 was the duration of all night from sunset to next sunrise.

Five pit-fall traps according to Southwood (1987) were applied during each of the former periods all along the duration of each crop in the field, one every 15 day intervals. The obtained spiders were preserved, subjected to identification. Flatz (1988) in his ecological study in Austria, compared efficiency of two methods of spider sampling, the pit-fall traps and the portable suction sampler funnel.

RESULTS AND DISCUSSION

A total of 516 spider individuals were caught during the year (Dec. 1995-Nov. 1996) using pit-fall traps, Table 1. The peak of active density was in August (153 individuals) in cabbage and sweet potato, while the lowest density was in January (2 individuals only) in potatoes and carrot plantations. Flatz (1988) reported that there were two levels of abundance of ground spiders in Austria, high in July & August and low in April and June. In the present study, the obtained spiders belong to 6 families: Lycosidae, Gnaphosidae, Philodromidae, Linyphiida, Theridiidae and Salticidae. Six species of these families were identified.

Flatz (1988) reported that family structure is different according to sampling method, either in pit-fall traps or suction sampler. Large spiders with high mobility being more present in the pitfalls.

A comparison of day and night active spider density in August, shows that the 3 parts of daylight time in August (first, middle and later one third) approximately have nearly similar values (40, 47 and 46 individuals). Rate of active spiders is 11.08 ind/hr in daytime against 1.67 ind/hr in night time.

The peak of active population density in August, Fig 1-a was followed by rather high values in September (199 individuals). There was another lower peak in April (60 individuals). The lowest density was in January, with slightly higher values in December and February (7), while 9 individuals were in November.

No nocturnal activity was recorded during December, February and November. Figs. 1 b & 2 show that summer season recorded the highest values of active population density (232 individuals), followed by autumn, spring and winter (154, 114 and 16 individuals, respectively). Rate of active spiders/hours (ind/hr) in summer, was 16.50 ind/hr in daytime and 2.83 in night-time, while autumn recorded 11.83

Table. 1. Breakdown of spider fauna as males (M), subadult males (SM), females (F), subadult females (SF) and juvenils (J) in the different periods of the daytime during months of the study.

	P ₁					P ₂					P ₃					P ₄					Total	
	M	SM	F	SF	J	M	SM	F	SF	J	M	SM	F	SF	J	M	SM	F	SF	J		
Dec. 1995	-	-	-	1	2	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	7
Jan.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2
Feb.	-	-	-	-	-	1	2	-	-	3	-	-	-	-	1	-	-	-	-	-	-	7
Mar.	-	-	1	-	2	3	-	3	1	13	-	-	-	-	-	-	-	-	-	-	1	26
Apr.	8	2	7	-	2	9	-	2	-	3	11	1	3	-	7	3	-	1	-	1	60	
May	4	-	1	1	3	2	-	1	-	-	6	2	1	3	1	-	-	1	1	1	28	
Jun.	6	-	2	1	1	5	2	1	1	2	4	-	1	1	-	3	-	2	-	1	33	
Jul.	2	1	1	-	-	5	2	5	1	5	8	-	2	1	5	6	-	2	-	-	46	
Aug.	19	-	9	-	12	23	-	16	-	8	25	1	15	-	5	12	-	6	-	2	153	
Sep.	18	-	9	-	5	33	-	11	-	10	15	-	5	-	6	5	-	2	-	-	119	
Oct.	3	-	1	-	2	5	1	2	-	1	3	-	2	-	1	-	-	2	-	3	26	
Nov. 1996	-	-	-	-	-	1	-	-	-	5	1	-	-	-	2	-	-	-	-	-	9	
Total	61	3	31	3	29	88	7	41	3	52	74	4	29	5	29	29	-	17	1	10	516	

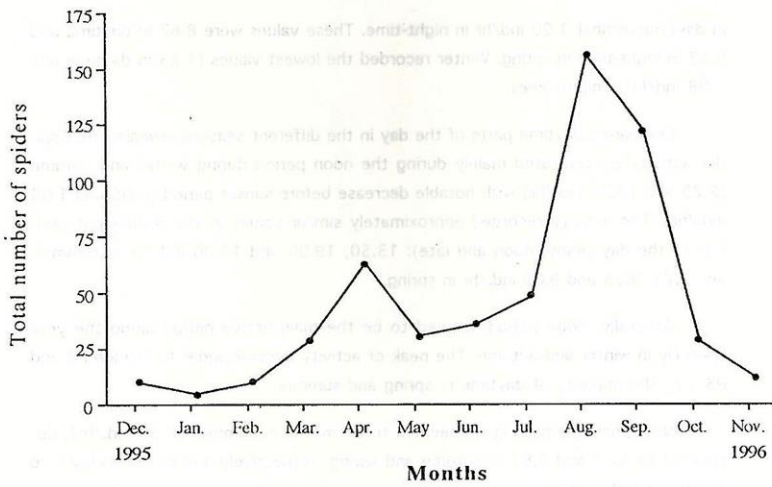


Fig. 1a. Monthly variation in active density of spiders throughout a year under the investigated vegetable crops.

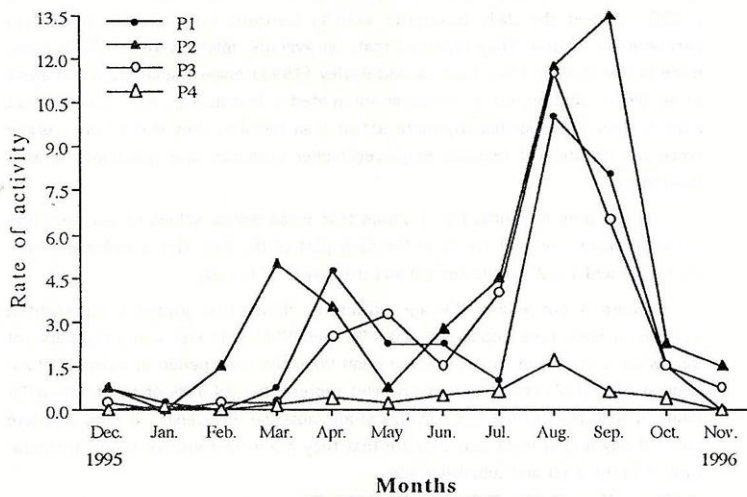


Fig. 1b. Rate of active density of spiders in the different daytime periods in months of study.

in daytime against 1.00 ind/hr in night-time. These values were 8.67 in daytime and 0.83 in night-time in spring. Winter recorded the lowest values (1.25 in daytime and 0.08 ind/hr in night-time).

Comparing daytime parts of the day in the different seasons revealed that spider activity concentrated mainly during the noon period during winter and autumn (2.25 and 17.25 ind./hr) with notable decrease before sunset period (0.08 and 1.00 ind./hr). The activity recorded approximately similar values in the 3 different periods of the day (early, noon and late): 13.50, 19.00 and 17.00 ind./hr in summer, and 7.75, 9.25 and 9.00 ind./hr in spring.

Generally, noon period seemed to be the main active period along the year specially in winter and autumn. The peak of activity became wider to include P2 and P3, i.e., the majority of daytime in spring and summer.

Nocturnal activity, Fig. 2, seemed to be mainly in summer (2.83 ind./hr), decreased to 1.00 and 0.83 in autumn and spring, respectively and became very rare (0.08 ind./hr) in winter.

Ghabbour⁽¹⁾ *et al.* mentioned that the sex ratio (total females : total males) in spider fauna in the same area ranged between 1:2.44 and 1:2.82. Schmitt *et al.* (1990) studied the daily locomotor activity patterns in 3 species of spiders (Araneae) in Austria. They reported that, on average, males were 3.5-12.7 times more active than females. Baatrup and Bayley (1993) made a quantitative analysis of spider locomotion, using computer-automated videotracking, and reported that male spiders were significantly more active than females, they walked on average twice the distance of females, employed higher velocities and spent less time in quiescence.

In the present study, Fig. 3 shows that mean annual values of sex ratio was 1:1.61 in night-time and 1:1.97 in the early part of the day. The ratio became wider, 1:2.11 and 1:2.23 in the second and third parts of the day.

Figure 4 concerning the age structure, shows that juveniles represented 17.54% in night-time population, 20.47% and 22.83% in late and early parts of day, while it increased to 27.233% in noon time, the main period of activity. Ghabbour *et al.* (1997) reported that juveniles represented 24.65% of the total spider fauna in such agro-ecosystems. In this study, absence of juveniles in early and late parts of day and at night may indicate that they are more sensitive to low temperature, than the adult and subadult stage.

(1) Unpublished data

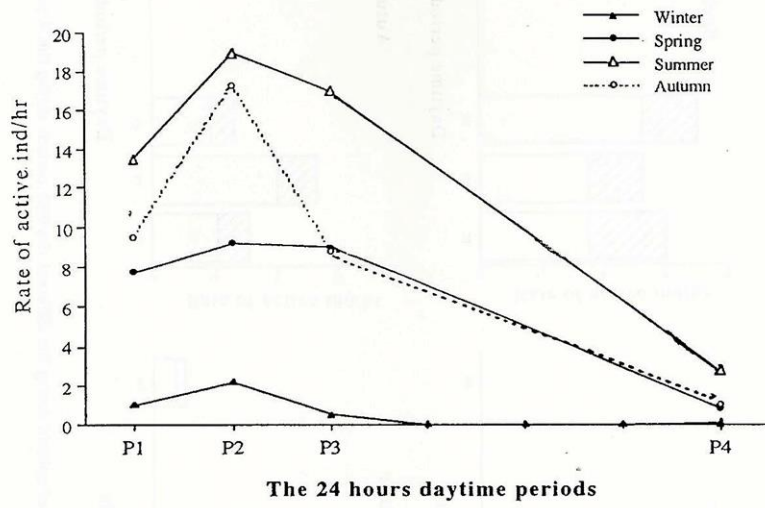


Fig. 2. Rate of activity of spiders at different daytime periods in different seasons of the year.

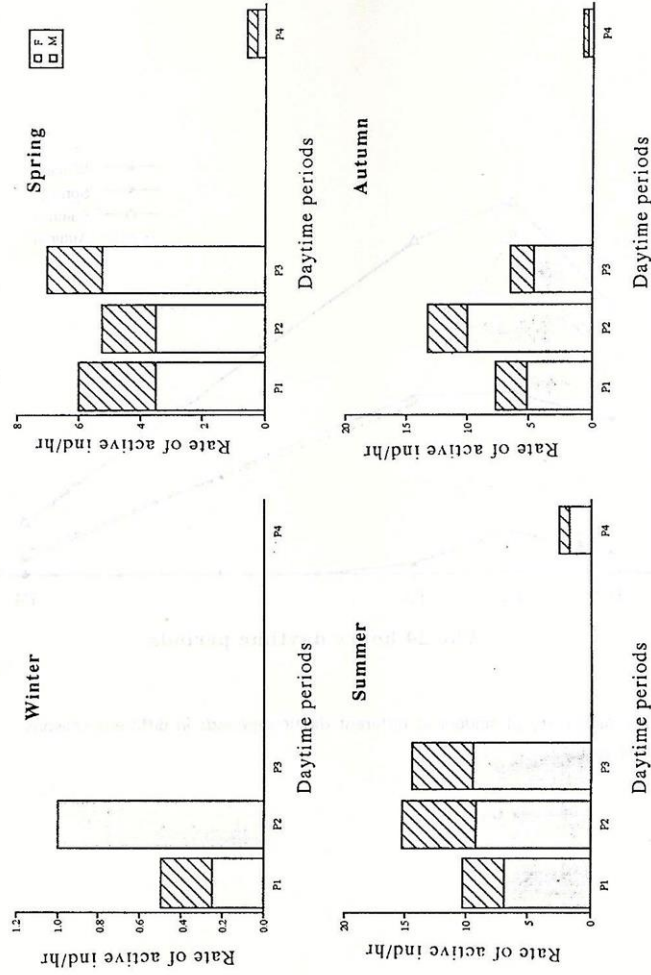


Fig. 3. Activity of Males and females of spiders during the different daytime periods during the 4 seasons.

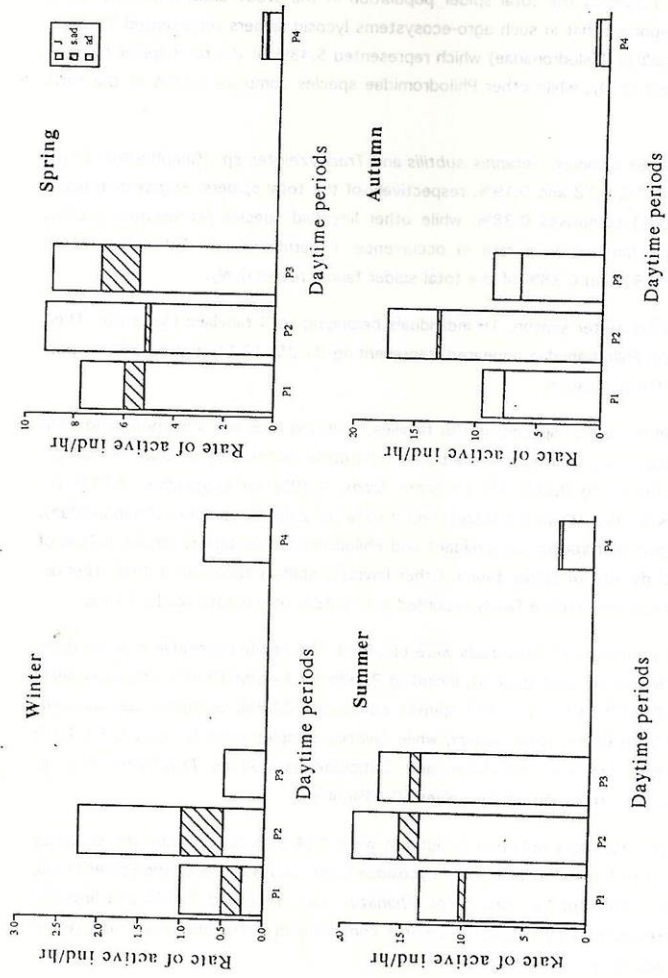


Fig. 4. Rate of activity of the different stages of age structure, adult (ad), sub-adult (s.ad) and juveniles (j) during the different daytime periods during the 4 seasons of the year.

Table 2 shows that the majority of spider fauna along the year was of the Lycosidae family (86.43%). The largest sized species *Lycorma ferox* (Lycosidae) represented 1.55% of the total spider population in the study area. Ghabbour et al. (1997) reported that in such agro-ecosystems lycosid spiders represented 79.06%. *Thanatus albini* (Philodromidae) which represented 5.43% of the total spider fauna in the present study, while other Philodromidae species comprise 0.58% of the total spiders.

Zelotes complex, *Setaphis subtilis* and *Trachyzelotes* sp. (Gnaphosidae) represented 1.16, 0.78 and 0.19%, respectively of the total spiders. *Erigon dentipalpis* (Linyphiidae) comprises 0.38%, while other linyphiid species represented 3.68%. Two other families were rare in occurrence, (Theridiidae and Salticidae) which comprise 0.97 and 0.38% of the total spider fauna, respectively.

During winter season, 16 individuals belonging to 3 families; Lycosidae, Theridiidae and Philodromidae appeared, representing 81.25, 12.50 and 6.25%, respectively of the population.

The number of species and/or families increased to 8 and 9 in spring and summer, respectively. Spring recorded 114 individuals distributed as 84.21% for Lycosidae (including 0.88% for *Lycorma ferox*, 4.39% for linyphiidae, 3.51% for *Thanatus albini* a (Philodromidae), and 2.63% for *Zelotes* complex (Gnaphosidae). Both *Erigon dentipalpis* (Linyphiidae) and Philodromidae spiders recorded 1.75% of the total density of spider fauna. Other linyphiid spiders recorded 4.39%. Theridiidae as a rare occurrence family recorded only 0.88% of the total spider fauna.

In summer, 232 individuals were obtained. The family Lycosidae is again dominant (88.36% of total spiders), including 2.16% for *Lycorma ferox*. *Thanatus albini* recorded 5.17% while linyphiid spiders comprised 2.59%. *Sutaphis subtilis* comprised 1.72% of the total spiders, while *Zelotes* complex recorded only 0.86. Each of the rare families; Theridiidae and Salticidae as well as *Trachyzelotes* sp. (Gnaphosidae) recorded similar values (0.43% only).

Total numbers obtained in autumn were 154 individuals, while the diversity decreased to 6 species. The family Lycosidae comprised 85.71% of the spider fauna, including 1.30% for *Lycorma ferox*. *Thanatus albini* recorded 7.79% and linyphiid spiders recorded 5.19%. Each of *Zelotes* complex and Theridiidae were rare, represented with only 0.65% of the spider fauna.

Table 2. Breakdown of the spider species divided as males (M), sub-adult males (SM), females (F), sub-adult females (SF) and juveniles (J) in the different periods of daytime during months of study.

	P ₁					P ₂					P ₃					P ₄					Total
	M	SM	F	SF	J	M	SM	F	SF	J	M	SM	F	SF	J	M	SM	F	SF	J	
<i>Lycosidae</i>	50	3	30	3	26	71	5	39	2	51	60	4	25	4	26	17	-	12	-	10	438
<i>Lycorma ferox</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	1	-	-	8
<i>Gnaphosidae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Zelotes complex</i>	-	-	-	-	-	-	-	1	-	-	2	-	-	1	1	1	-	-	-	-	6
<i>Setipis</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	4
<i>Trachyzelotes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
<i>Philodromidae</i>	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
<i>Thanatus albini</i>	7	-	-	-	1	11	-	-	-	-	6	-	2	1	-	-	-	-	-	-	28
<i>Linyphiidae</i>	3	-	-	-	-	2	1	1	1	1	4	-	3	-	-	1	-	1	1	-	19
<i>Erigen dentipalpis</i>	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
<i>Theridiidae</i>	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	5
<i>Salticidae</i>	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Total	61	3	31	3	29	89	6	41	3	52	72	4	30	5	29	28	-	17	1	12	516

Diurnal - Nocturnal activity among spider population

Table 2 shows that *Lycorma ferox* (Lycosidae) and *Trachyzelotes* sp. are active only in night time. Conversely, *Thanatus albini* (Philodromidae), *Erigon dentipalpis* (Linyphiidae) and Salticidae are active only in daytime.

Herrero (1986) reported that females of Theraphosidae family are nocturnal predators and reached the peak of activity between 20.30 and 0.30 hours. This may also be the case with other spider families.

Other lycosid spiders (except *Lycorma ferox*) were active mainly in daytime (91.10% against 8.90% in night time. Linyphiidae members (except *Erigon dentipalpis*) were also active in day (84.21%) although it was (15.79%) in night. *Zelotes* complex (Gnaphosidae) recorded also main activity in 83.33% daytime against 16.67% in night time. Theridiidae were also active in daytime (60%) against (40%) in night, while *Setaphis subtilis* (Gnaphosidae) was active mainly in night time (75%), and only (25%) in day-time.

In conclusion, the high population density of spiders in August seems to be a result of combination of 3 factors: the dense vegetation cover of the summer crops: (egg-plant and sweet potato) high temperature, and naturally high relative humidity during August (MAC, 1996), plus a higher rate of plant transpiration. Conversely, the low temperature may be the main reason for low densities of spiders in winter. Costa (1995) reported that rain and wind would affect spider locomotory activity. Flatz (1988) referred to winter mortality as the main reason of difference between high and low levels of spiders abundance in Austria. In the present study, it was clear that juvenile spiders at least, are not cold tolerant.

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كثافة التواجد الموسمي ونمط النشاط اليومي للعناكب في بعض زراعات الخضر بمحافظة المنوفية بمصر

عبد الخالق محمد حسين

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزه.

في جنوب دلتا مصر إختيرت ثمانية محاصيل من الخضر لدراسة الكثافة النشطة لعشائر العناكب المرتبطة بها وذلك علي مدى عام كامل (ديسمبر ٩٥ - نوفمبر ١٩٩٦) واستخدمت مصائد السقوط الأرضية طبقاً ل (Southwood, 1978). أوضحت الدراسة وجود ٦ عائلات بكثافات متباينة هي Lycosidae وهي السائدة بنسبة ٨٦,٤٢٪ من المجتمع الكلي للعناكب يليها عائلة Philodromidae ثم عائلة ال Linyphiidae، ال Gnaphosidae ثم عائلتين أخريين قليلتي الشيوع هما Theridiidae و Salticidae وقد قورنت الكثافات النشطة بين فترتي النهار والليل من ناحية، كما قورنت أيضاً بين أجزاء النهار (الفترة الضوئية) من ناحية أخرى، فقيست الكثافة النشطة في الثلث الأول من النهار (بعد الشروق) ثم الثلث الأوسط فالثلث الأخير (قبل غروب الشمس).

أظهرت الدراسة أن فصل الصيف هو أكثر المواسم ثراءً في الكثافة العددية والتنوع، بينما كان الشتاء هو أقل المواسم. وجاءت القيم في الربيع والخريف إنتقالية بين موسمي القمة والقلّة. كما أظهرت أن أكثر الأنواع شيوعاً هو *Thanatus albini* من عائلة ال Philodromidae.

عند دراسة التوقيت الزمني علي مدى النهار مرتبطاً بالكثافة النشطة أظهرت النتائج تقارب أرقام معدل النشاط (فرد / ساعة) في الصيف، بينما تتباعد هذه الأرقام في الخريف والشتاء بوضوح، وكان أكثر فترات النشاط النهاري هو الثلث الثاني من النهار في الشتاء والخريف، بينما كان الثلث الثاني والثالث خلال موسمي الصيف والربيع. كان أكثر المواسم من ناحية النشاط الليلي هو فصل الصيف يليه الخريف ثم الربيع فالشتاء.

كما أظهرت الدراسة أن الذكور تزيد ١,٩٧ - ٢,٢٢ مرة قدر كثافة ونشاط الإناث، وكان نشاط الإناث مركزاً في الفترة الأولى من النهار حيث تضيق النسبة الجنسية خلالها. كما أظهرت الأفراد الصغار ضمن التركيب العمري (Adult / Sub-adult/Juvenile) أنها لاتميل للنشاط خلال الثلث الأخير من النهار وطوال فترة الليل وربما يرجع ذلك لعدم قدرتها علي تحمل إنخفاض درجة الحرارة. وقد تميز النوع *Lycorma ferox* من عائلة *Lycosidae* بأنه ذو نشاط ليلي تماماً، بينما بقيت الأنواع لنفس العائلة تميز نشاطها الغالب (٩١,١٠٪) أثناء النهار والبقية منه أثناء الليل. كما تميز النوعين *Erigone dentipalpis* التابعين لعائلة *Linyphiidae* بأنهما ذو نشاط نهاري فقط أما النوع *Setaphis subtilis* التابع لعائلة *Gnaphosidae* فكان نشاطه الغالب (٧٥٪) أثناء الليل مقابل (٢٥٪) فقط أثناء النهار. كما أظهرت الدراسة أن العائلتين قليلتي الشيوع: كانت *Theridiidae* ذات نشاط ليلي ونهاري أما *Salticidae* فكانت ذات نشاط نهاري فقط.