

Seasonal occurrence of spiders (Araneida) in open and green house fields of cucumber and pepper in Egypt

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ABSTRACT

Spiders found in open and green houses fields of two vegetables (cucumber and pepper) were studied during the cultivation season 2007 and 2008 at Giza region. The obtained data proved that the number of collected spiders associated with cucumber in green house were nine families. Five families of insect pests were recorded and only one mite family, Tetranychidae. Considering the population of the collected spiders and their associated insect and mite pests, the highest total number of these spiders on cucumber plants was recorded during January and then decreased reaching to the lowest population during June. The highest population of insect pests was determined during April while the lowest level of the population was recorded during February. June was the month showed the highest abundance of the spider mites while the lowest population was noticed during January and February. The same spider families were recorded in green houses and in the open field of cucumber and the number of collected individuals were clearly lower than those of green house. April had the highest number of spiders which rapidly decreased reaching to the lowest abundance during May.

Key Words: Spiders, Seasonal Occurrence, Cucumber, Pepper, Tetranychidae, Insects.

INTRODUCTION

Greenhouses system is one of the protected cultivation types used to produce vegetables and flowers. Plastic covers protect plants from adverse weather condition and increase their resistance to attack (Benoit and Ceustermans, 1992) and (Mohamed, 2001). The protected cultivation system started in Egypt during the 80th of the last decade. Greenhouse area is estimated at present time about 38000 feddan giving high production per unit area, which is usually 10-20 times that of the open field (Guney and Celik, 1986). Protected cultivation growers prefer these appreciation systems for high productivity, yield marketable for export and with rewarding market price for local consumption owing to high quality level of the yield (Hegab, 1980 and Nagy, 1987). The vegetable hybrid, high humidity, warm temperature, high fertilization tender plants, and closed system represent the pest problems in the greenhouses to invasion and infestation of protected vegetable crops. Cucumber crops (*Cucumis satives*) and pepper crops (*Capsicum annuum*) are the important vegetable crops for economic visibility studies. Insect and mites are the main groups of pests, which attack plants causing many types of damage. Many investigators studied the insects and animal pests attacked greenhouse vegetable crops as Manley (1983), Hassan (1983), Ter-Simonyan and Blinova (1989), Veire and Tirry (1998), Bulut *et al.* (2000), Mohamed (2001) and Saad (2002). They stated that vegetables under protected cultivation attacked by numerous insects and mites caused serious damage and high yield was lost. Pests can build very rapidly under greenhouse conditions so IPM strategies based on past seasons pest levels often involve "preventative"

introductions of biological control agents even before the pest has been detected. Many biological control agents (e.g. whitefly and aphid parasites, and predatory mites) are very good at finding their host at low densities and will take too long to provide control if their introduction is delayed until host populations are higher. Other pests such as spider mite descend onto the crop over a period of time and must be treated with "curative releases" of biological control agents as soon as the pests are detected. Releases must be continued until the biocontrol agents are well established on all infested plants. The cultivated area from cucumber and pepper plants increased during the last two decades especially in winter plantation, in both open and protected plantation, to cover needs for local consumption and for exporting to the foreign markets. Spiders are the most abundant predators in agricultural system. They are generalist predators that constitute one of the most numerous groups of the animal kingdom, with more than 30.000 species (Nyffeler *et al.*, 1992). Workers did not give enough attention to spiders, which are believed to be highly beneficial arthropods in biological control aspects (Tawfik, 1993). Therefore the present study was to contribute towards a better knowledge about the main pests, insects and spiders which found in cucumber and pepper greenhouses. There are two species of thrips that are common pests in greenhouse vegetable crops, the western flower thrips (*Franliniella occidentalis*), and the onion thrips (*Thrips tabaci*). Thrips feed by opening wounds on the plant surface and sucking out the contents of the plant cells, the feeding results in small whitish streaks on the leaves and fruit and can cause distortions in the young developing fruit. The two-spotted spider mite (*Tetranychus urticae*) is a common pest of a number of greenhouse crops (Howard *et al.*, 1994, Portree, 1996).

MATERIAL AND METHODS

The present study was carried out at Dokki location for protected cultivation, Giza governorate during the 2007 and 2008 seasons. This study is a preliminary survey of the main pests infested vegetable crops under protected cultivation system (Plastic greenhouses). Four greenhouses were chosen to carry out this investigation. Area of traditional plastic greenhouse is 540 m² with 60 m long, 9 m wide, and 3.25 m high (Aly, 1993). Plastic greenhouse unit consists of five rows, each row is 1 m wide and 60 m long, and the distance between two seedling in the row is 50 cm and the total of seedling in the row reached 240 plants, (1200 plants/greenhouse). One of the two greenhouses was cultivated with pepper and the other with cucumber. Agricultural practices were standard for the greenhouse.

The sampling methods:

Survey and taxonomy of spiders, insects and animal pests in vegetable plants, cucumber and pepper, under protected cultivation was carried out to evaluate the role of the spiders and the economic importance of the pests in greenhouses and compare this with those outside the greenhouse during the planting season 2007/2008. The samples were collected from leaves biweekly, the study period started from January 2007 to June 2008. The sample size was 25 cucumber leaves and 50 pepper leaves from each plastic greenhouse, which examined in stand plants, picked and put in paper bags to examine in lab. with stereomicroscope to identify the stages and to classify the different pests, date of occurrence of each pest species. For spiders; collections were carried out at random in the cucumber and pepper greenhouses. Collecting methods were beating net (plant shaking) and hand sorting of live ground species. Samples were carried out every 15 days intervals. For shaking plants specimens were individually picked up in plastic vials (2×5 cm), while larger ones kept in vial (3×6 cm) and transferred to the laboratory for counting and identification. For the ground species, hand sorting was used to pick the individuals found in area of

1 m diameter around each plant and individually kept in plastic vials of 3×6 cm. The population for each spider and pest were calculated in tables. Individual species were picked, separated and preserved in ethanol (70 %) for identification.

RESULTS AND DISCUSSION

This investigation depends on the study of some ecological aspects of the key pests on vegetable crops of cucumber and pepper under protected cultivation. This work was carried out at Dokki location of protected cultivation, Giza Governorate during two seasons. This study includes survey of the main pests invested vegetable crops under greenhouse condition. The important pests appeared as serious pests in greenhouses are whitefly *Bemisia tabaci*, Aphids *Aphis gossypii*, Thrips *Thrips tabaci*, two spotted spider mite *Tetranychus urticae* and cotton leaf worm *Spodoptera littoralis* caused a sever damage on the vegetable crops.

The results of these studies could be declared as follows:-
Abundance and distribution of the different spiders, insects and mites

I- Cucumber leaves
a- In green house

This survey is considered an essential work in studying the ecological aspects records of spiders, animal pests and insects that attacked cucumber plants under greenhouses. In Table (1), the number of collected spiders associated with cucumber in green house were nine families as follows: Oecobiidae, Philodromidae, Lycosidae, Titanoecidae, Gnaphosidae, Agelenidae, Salticidae, Theridiidae, and Linyphiidae. On the other hand, the insect families in this study were represented by Aleyrodidae, Aphididae, Thripidae, Noctuidae and Gryllidae. However, the mite family Tetranychidae was the only recorded family in this study. Considering the population of the collected spiders and their associated insect and mite pests, the highest total number of these spiders on cucumber plants was recorded during January 48 spider individuals followed by 35 spider in February and this number decreased reaching to the lowest population during June (9 different spider species). On the other hand, the highest population of insect pests was determined during April (687 insects) while the lower level of the population was recorded during February (6 individuals only). However, June was the month which showed the highest abundance of the spider mites, i.e. 3150 different tetranychid stages, while the lowest population was noticed during the early season, i.e.3 and 4 spider mites during January and February, respectively.

Table (1): The mean population of the collected spiders and associated pests on cucumber in green

Sampling dates	Spider families									Insect families					Mites
	Oecobiidae	Philodromidae	Lycosidae	Titanoecidae	Gnaphosidae	Agelenidae	Salticidae	Theridiidae	Linyphiidae	Aleyrodidae	Aphididae	Thripidae	Noctuidae	Gryllidae	Tetranychidae
Jan.	16	1	8	6	5	3	2	0	7	3	1	16	0	1	3
	48									21					
Feb.	4	0	4	22	3	0	2	0	0	4	1	1	0	0	4
	35									6					
March	6	0	3	2	1	5	2	1	0	15	50	73	5	2	19
	19									145					
April	0	0	0	5	3	0	0	7	4	6	237	429	15	0	243
	19									687					
May	0	0	0	2	1	0	2	4	2	7	205	15	25	1	75.
	11									253					
June	0	0	0	0	2	2	0	5	0	8	544	19	13	1	3150
	9									585					

houses during 2007 and 2008 seasons.

b- In open field

In Table (2), the same spider families recorded in green houses also recorded in the open field of cucumber and the data revealed that the number of collected individuals was clearly lower than those of green house and April had the highest number of spiders (23 individuals) which rapidly decreased reaching to the lower level of abundance during May (6 spiders only). Regarding the population of the different insect pests associated with cucumber plants in the open field, the populations begin with low number in the early season (5 individuals) during January and the number slowly reached to its peak before the harvesting time (June) recording 374 insect. On the other hand, the two spotted spider mite, *T. urticae* as phytophagous mite have the same trend of insects abundance and recoded the highest level of abundance before ending the crop (June), i.e. 500 different mite stages.

Table (2): The mean population of the collected spiders and associated pests on cucumber in open field during 2007 and 2008 seasons.

Sampling dates	Spider families									Insect families					Mites
	Oecobiidae	Philodromidae	Lycosidae	Titanocidae	Gnaphosidae	Agelenidae	Salticidae	Theridiidae	Linyphiidae	Aleyrodidae	Aphididae	Thripidae	Noctuidae	Cryllidae	
Jan.	1	0	2	4	0	0	0	0	0	0	1	0	0	4	0
	7									5					
Feb.	3	0	5	3	3	1	1	2	0	1	2	1	0	2	1
	18									6					
March	1	0	0	3	0	4	0	3	5	7	30	45	2	8	10
	16									92					
April	3	0	0	6	0	0	1	1	12	4	100	85	10	11	180
	23									210					
May	2	0	0	0	2	0	0	2	0	4	120	8	20	7	300
	6									159					
June	0	0	0	0	2	5	1	3	1	3	350	10	9	2	500
	12									374					

II- Pepper leaves

a- In green house

As shown in Table (3) the population of spiders began in the early season of pepper with low number, 11 individuals, and gradually increased reaching to the highest population during the mid of cultivation season (April), 32 individuals, and returned to decreasing once again reaching to the lower abundance during May (11 spiders). Considering the population of the different insect pests associated with pepper leaves in green house, the insects had a moderate number during the different sampling dates but the population was very high before crop harvesting, 409 individuals during June. However, the spider mites did not appear before April, but the mites appeared after that reaching to their peak during the last sample during June (716 mites).

b- In open field

Considering the population of the spiders associated with pepper plant leaves, the number was low in comparison with that occur in green house recording the highest level of abundance during April (17 individuals) but the lower population was noticed during May and June (5 individuals for both). On the other hand, the insect population on pepper in the open field was clearly observed during the late season months, May and June, when 132 and 127 different insects were respectively recorded. However, the phytophagous mite, *Tetranychus urticae* population, firstly appeared during March and then the population gradually increased reaching to their highest level during June, 500 individuals, Table (4).

Table (3): The mean population of the collected spiders and associated pests on pepper in green houses during 2007 and 2008 seasons.

Sampling dates	Spider families									Insect families					Mites
	Oecobiidae	Philodromidae	Lycosidae	Titanocidae	Gnaphosidae	Agelenidae	Salticidae	Theridiidae	Linyphiidae	Aleyrodidae	Aphididae	Thripidae	Noctuidae	Gryllidae	Tetranychidae
Jan.	6	0	0	1	1	3	0	0	0	1	36	0	0	4	0
	11									41					
Feb.	2	0	1	11	1	5	0	1	0	2	0	4	0	2	0
	21									8					
March	3	0	1	15	2	3	2	2	2	6	4	0	0	8	0
	30									18					
April	3	0	2	3	0	12	0	0	2	3	0	10	0	11	111
	32									24					
May	5	0	0	0	3	0	0	1	2	7	0	10	0	7	318
	11									24					
June	5	0	5	1	0	10	1	5	0	14	385	8	0	2	716
	27									409					

Table (4): The mean population of the collected spiders and associated pests on pepper in open field during 2007 and 2008 seasons

Sampling dates	Spider families									Insect families					Mites
	Oecobiidae	Philodromidae	Lycosidae	Titanocidae	Gnaphosidae	Agelenidae	Salticidae	Theridiidae	Linyphiidae	Aleyrodidae	Aphididae	Thripidae	Noctuidae	Gryllidae	Tetranychidae
Jan.	1	0	0	3	1	1	0	0	0	1	10	0	0	1	0
	6									12					
Feb.	2	0	0	6	3	4	0	3	0	1	1	2	0	1	0
	18									5					
March	1	0	1	2	0	0	0	0	0	4	1	0	0	0	36
	4									5					
April	2	0	0	0	1	9	1	0	4	2	3	9	0	11	85
	17									25					
May	1	0	0	0	2	2	0	0	0	20	100	5	0	7	190
	5									132					
June	0	0	0	0	2	3	0	0	0	20	100	5	0	2	500
	5									127					

Generally and According to analyzed data in Table (5) most of the collected spider families are negatively correlated with the aphid population during the tested seasons except the families Agelenidae and Theridiidae which expressed positive correlation with aphid abundance. On the other hand, the same trend occurred between the population of the two-spotted spider mite and the collected true spiders in addition to the spider family Gnaphosidae that positively correlated with the mites numbers. However, in this study, there was no significant differences between the tested hosts and also the kind of field (open and/ or glass house) and the population of the collected spiders on cucumber and pepper plants in tested seasons, Table (6). The beneficial role of the spiders might be interpreted by the low population of the pests when they appeared. Accordingly, conservation of these spiders species is crucial to keep the natural balance in different ecosystems, Hendawy and Abul-Fadl (2004).

Table (5): The correlation between the different spider families and the population of aphids and spider mites during 2007 and 2008 seasons

The pest	The spider family	The correlation (r)
Aphids	Oecobiidae	-0.279
	Philodromidae	-0.136
	Lycosidae	-0.1283
	Titanoecidae	-0.3378
	Gnaphosidae	-0.0323
	Agelenidae	0.077
	Salticidae	-0.023
	Theridiidae	0.722
	Linyphiidae	-0.082
Spider mite	Oecobiidae	-0.2141
	Philodromidae	-0.088
	Lycosidae	-0.145
	Titanoecidae	-0.275
	Gnaphosidae	0.050
	Agelenidae	0.015
	Salticidae	-0.192
	Theridiidae	0.448
	Linyphiidae	-0.137

Table (6): Effect of different hosts and the kind of field (open and glass) on the abundance of the different collected spiders during 2007 and 2008 seasons.

The spider family	Main effects	F	P	L.S.D. at 0.05
Oecobiidae	Plant host	0.096	0.7601 ns	2.808
	Kind of field (open and glass)	4.1724	0.0545 ns	
	Interaction (Host x field)	0.0038	0.9513 ns	
Philodromidae	Plant host	1	0.3293 ns	0.1738
	Kind of field (open and glass)	1	0.3293 ns	
	Interaction (Host x field)	1	0.3293	
Lycosidae	Plant host	1.324	0.2635 ns	1.8132
	Kind of field (open and glass)	2.353	0.1407 ns	
	Interaction (Host x field)	-3.135	1 ns	
Titanoecidae	Plant host	0.11754	0.6806 ns	4.5774
	Kind of field (open and glass)	2.4242	0.1352 ns	
	Interaction (Host x field)	0.0014	0.9701 ns	
Gnaphosidae	Plant host	0.9184	0.3493 ns	1.0883
	Kind of field (open and glass)	0.9184	0.3493 ns	
	Interaction (Host x field)	2.5510	0.1259 ns	
Agelenidae	Plant host	4.2036	0.0537 ns	2.7131
	Kind of field (open and glass)	0.8045	0.3804 ns	
	Interaction (Host x field)	0.8046	0.3804 ns	
Salticidae	Plant host	3.6567	0.0703 ns	0.6363
	Kind of field (open and glass)	3.6567	0.0703 ns	
	Interaction (Host x field)	0.6716	0.4221 ns	
Theridiidae	Plant host	2.8571	0.1065 ns	1.6454
	Kind of field (open and glass)	1.6071	0.2195 ns	
	Interaction (Host x field)	0	1 ns	
Linyphiidae	Plant host	2.0861	0.1641 ns	2.5274
	Kind of field (open and glass)	0.0426	0.8386 ns	
	Interaction (Host x field)	0.2318	0.6354 ns	

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ARABIC SUMMARY

توزيع الموسمي للعنكب (Araneida) في الحقول المفتوحة وصوب الخيار و الفلفل في مصر

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تمت دراسة الآثار المترتبة على زراعة اثنتين من نباتات الخضر (الخيار والفلفل) في الحقول المفتوحة والصوب الزراعية وتوزيع الآفات الثاقبة الماصة وما يرتبط بها من العنكب خلال موسمي الزراعة ٢٠٠٧ و ٢٠٠٨ في منطقة الجيزة. واثبتت الدراسة ان عدد الفصائل العنكبوتية التي جمعت والمرتبطة بنباتات الخيار والفلفل داخل الصوب الزراعية كانت تسع فصائل عنكبوتية من ناحية اخرى مثلت الحشرات بخمس فصائل حشرية بينما فصيلة Tetranychidae صيلة الوحيدة التي جمعت من الاكاروسات في هذه الدراسة. بالنظر الي تعداد العنكب التي جمعت وما ارتبط بها من آفات حشرية و اكاروسية ، كان أعلى تعداد للعنكب على نباتات الخيار خلال شهر يناير ثم انخفض التعداد ليصل إلى أدنى مستوى في خلال شهر يونيه. ناحية أخرى كان أعلى تعداد للآفات الحشرية خلال شهر ابريل في حين أن أدنى مستوى في التعداد ظهر خلال شهر فبراير. ومع ذلك ظهر خلال شهر يونيه اعلى تعداد من الاكاروسات في حين أن اقل تعداد لها لوحظ خلال بداية الموسم عدد ٣ و ٤ افراد خلال الفترة من يناير الي فبراير على التوالي. وبالنسبة لنباتات الفلفل كان اقل تعداد للعنكب في بداية الموسم ثم تزايد الى ان يصل الي اعلى تعداد له خلال ابريل بالرغم من ان اعلى تعداد للحشرات والاكاروسات كان خلال شهر يونيه. وأظهرت البيانات أن الفصائل العنكبوتية التي سجلت في الصوب الزراعية هي نفسها التي سجلت في الحقول المفتوحة علي نباتات الخيار والفلفل. ايضا اظهرت البيانات أن تعداد للعنكب التي انخفض تعدادها بسرعة ليصل إلى اقل مستوى في شهر مايو.