

DETECTING THE PREDATORY INSECTS ASSOCIATED WITH THE COTTON APHID, *Aphis gossypii* GLOV. WITH SPECIAL REFERENCES TO THE EFFICIENCY OF THE PREDATOR *Coccinella undecimpunctata* L. AT KAFR EL-SHEIKH REGION

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ABSTRACT

This experiment was carried out at the Farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during the two successive seasons 2006 and 2007 to evaluate the role of insect predators of *Aphis gossypii* Glov. in cotton fields. The following predators were considered during the current research: *Coccinella undecimpunctata* (L.), *Cydonia vicina isis*, *Cydonia vicina nilotica*, *Scymnus interruptus*, *Paederus alfieri*, *Chrysoperla carnea*, *Syrphus* spp. and *Orius* spp.

Results indicated that *P. alfieri* was recorded with the highest numbers followed by *C. undecimpunctata*., *Syrphus* spp., *Sc. interruptus*, *Orius* sp. and *Ch. carnea* (1452, 1256, 1181, 1141, 1135, 1059 indiv/60 leaves). The associated predators were more in 2006 season than 2007 season.

Population fluctuation of the cotton aphid, *A. gossypii* and the predator *C. undecimpunctata* were monitored on cotton plants during the two successive cotton seasons 2006 and 2007. The average number of the collected aphids in the second season were higher than those obtained during the first season; 29760 and 28755 indiv./20 plants, respectively.

Some biological aspects of *C. undecimpunctata* were also studied as reared on *A. gossypii*. The larval stage of *C. undecimpunctata* was completed in four instars that collectively lasted 9.40 days. Adult female longevity averaged 59.00 days. However, the male longevity took a shorter period (49.60 days). One female deposited 441.59 eggs during the oviposition period with a daily average of 11.56 egg/female. The preoviposition period took 8.8 days, oviposition 38.20 days, and the post oviposition 5.60 days

INTRODUCTION

The cotton is very important crop in the agricultural map of Egypt. Cotton exports are one of the major sources of foreign currency to the Egyptian natural income. Thus, the natural enemies of these pests have been greatly negatively affected. The aphid may become extremely abundant and do a considerable damage to a wide variety of many host plants, field crops, vegetable crops, fruits, trees and weeds (El-Gohary, 2010). Two phenomena of damage results from aphid infestation. The first: a great number of their species are known as vectors of plant pathogenic agents. The second: the aphids secrete abundant honey dew on which sooty mold grows (Mousa, 2009). Biological investigation on the predator *C. undecimpunctata* during two stages (larval and adult), is important to make full use of natural enemies

insect predators are widely distributed and considered as important natural enemies of pest management programmes as they prey on a range of pests including aphids (Salem, 2002). Coccinellids are the most important as biological control agents. A limited number of studies have investigated the biology and ecology of those species that attack beneficial lady beetles (Ramadan, 2010).

MATERIALS AND METHODS

The present investigation was carried out at the Experimental Farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during the two successive cotton seasons; 2006 and 2007.

Seeds of cotton variety 86 were sown on March 15th and 20th in the two seasons of study (2006 and 2007). Weekly samples of 20 seedlings were taken from 29th and 24th of April till the 27th and 28th of May during the two seasons, respectively. Then chosen 60 leaves (20 plants x 3 leaves per plant) were taken from the lower, middle and upper parts of the plant). They were randomly chosen from 3rd and 5th of June till the end of the growing season (7th of October). Counts of aphids and predators on the selected samples were carried out directly in the field with the aid of a hand lens. Considered normal agricultural practices were carried out without any insecticidal treatments throughout the whole growing seasons.

The biological aspects of the predator, *C. undecimpunctata* was carried out in the laboratory of Economic Entomology Department, Faculty of Agriculture, Kafr El-sheikh University during season 2011. Feeding capacity of larvae and adults was studied under laboratory conditions (26-31°C and 65-75% RH). Twenty newly hatched larvae of predators were introduced singly into 10 cm Petri dishes provided with filter paper in their bottoms to facilitate the movement of predatory larvae. Each dish was supplied with 20 individuals of *A. gossypii* at every day. Daily inspection was carried out in order to remove remains of devoured aphids, and the alive aphids were counted and discarded. Then, a new group of aphids were introduced into dishes to reach 50 individuals of aphid as the predatory larval instars progressed to reach a maximum of 100 individual of the prey. In the same time, pieces of fresh cotton leaves were cleaned and daily introduced into the dishes for aphid feeding. The daily number of eaten aphids by each predatory larvae were computed until pupation. Then, mean numbers of consumed aphids by each larval instar and the total larval period was calculated by the same method. The predation capacity of the adults *C. undecimpunctata* on the prey, *A. gossypii* was estimated. An experiment was carried out using newly emerged adults from pupae of the previous experiment. Adults were divided into three categories. The 1st category constituted of five females, the 2nd of five males, whereas the 3rd of five couples. In the first two group males and females were introduced individually into Petri-dishes as previously described with larval stage to calculate longevity of both sexes, whereas the 3rd group was used to study the pre- ovi- post-oviposition period each female. To estimate the mean number of deposited eggs per adult female of *C.*

undecimpunctata, each adult was provided daily with 100 aphids until its death and the daily consumed aphids were calculated, during pre-ovi post-oviposition periods, moreover, the total eggs laid per female was counted.

RESULTS AND DISCUSSION

Insect predators of *Aphis gossypii* in cotton fields:

As shown in Table (1), the insect predators found associated with *A. gossypii* were *Coccinella undecimpunctata*, *Cydonia vicina isis*, *Cydonia vicina nilotica*, *Scymnus interruptus*, *Paederus alfieri*, *Chrysoperla carnea*, *Syrphus* spp. and *Orius* spp. The collected numbers (Table 1) indicated highly numbers for *P. alfieri* that was the most abundant throughout 2006 cotton season (1452 individual/60 leaves). Also, *C. undecimpunctata* in season 2006 (1256 indiv.). *Syrphus* spp. was recorded as 1181 indiv./60 leaves, *Orius* spp. as 1141 indiv./60 leaves, *Sc. interruptus* as 1135 individuals/60 leaves, *Ch. carnea* (1059 indiv./60 leaves) followed closely by both *Cy. vicina isis* and *Cy. vicina nilotica* were detected in the lowest numbers (950-770 indiv./60 leaves). The results agree with those obtained by El-Mezayyen and Abou-Attia (1996), Salem (2002), in the same time Abd Rabou (2008) proved that the highest population of *A. gossypii* coincided with the highest peak of predators.

Table (1):Numbers and means of insect predators occurred when preyed upon *A. gossypii* in cotton field during the two successive seasons 2006 and 2007.

Predatory species	Collected individuals/60 leaves				% Occurrence	
	2006		2007		2006	2007
	No.	mean	No.	mean		
<i>C. undecimpunctata</i>	1256 d	52.33	1123 d	46.80	14.05	15.38
<i>Cy. vicina isis</i>	950 b	39.58	649 b	27.04	10.62	9.50
<i>Cy. vicina nilotica</i>	770 a	32.08	533 a	22.21	8.61	7.30
<i>Sc. interruptus</i>	1135 c	47.29	1166 d	48.58	12.69	15.90
<i>P. alfieri</i>	1452 ef	60.50	895 c	37.29	16.24	12.26
<i>Ch. carnea</i>	1059 f	62.88	1100 d	45.83	11.84	15.70
<i>Syrphus</i> spp.	1181 de	56.71	725 b	30.26	13.21	9.93
<i>Orius</i> spp.	1141 c	41.54	1109 d	46.00	12.76	15.19
Total	8942	372.6	7298	304.08		

Means followed by a common letter are not significantly different at the 5% level by Duncan's multiple range test (1955)

In the second season, 2007 (Table 1), the collected numbers indicted that *Sc. interruptus* (1166 indiv./60 leaves) (48.58), was the most abundant. Then, *C. undecimpunctata* (1123 individual/60 leaves) with mean 46.79 then, *Orius* sp. was recorded (1109 indiv./60 leaves), (46.00). where *Ch. carnea* recorded (1100 indiv./60 leaves), (45.83). Followed by *Syrphus* spp. ,*Cy. vicina isis*, *Cy. vicina nilotica* and (726, 649, 533 indiv./60 leaves) (30, 26, 27.04, 22, 21), respectively.

The encountered predatory species in the current study were the same species recorded by Abou El-Hagag (1998) and Salem (2002). The occurrence of the predator *Ch. carnea* was 15.81 during season 2006 while

in the 2007 season, the predatory *Sc. interruptus* was the most occurred species in the cotton fields.

Cotton aphid *Aphis gossypii*:

Population fluctuations of the cotton aphid, *A. gossypii* and their predators were monitored on the cotton plants during two successive cotton seasons 2006 and 2007 (Table 2), the numbers of the collected aphids in the second season were higher than those of the first one; (1240.00 and 1198.12 indiv./20 plants), respectively. In 2006 cotton season (Table 2), the aphid was initially recorded on cotton plants on 29 April (92 indiv /20 plants). By that date, the aphid population density progressively increased to reach a maximum of (11552 indiv./60 leaves) on August. The numbers steadily decreased by late season.

In 2007 cotton season (Table 2), the aphid was initially recorded on cotton plants on 24 April (28 indiv./20 seedling). By that date, the aphid population density increased to August (12037.00 indiv./60 leaves), the numbers decreased throughout on September.

Similar results were obtained by Salem (2002) and Abo Shaeshae (2001), Hassanein *et al.* (1995), Khalifa (2005) and Mesbah (2007).

Population of the associated predators are presented in Table (2). The highly numbers increased during August (375, 374 indiv / 20 plants). In 2006 and 2007, respectively. While the numbers decreased in the first week of October. These results may be due to the difference in inviromental conditions and / or weather factors.

Table (2):Monthly population fluctuations of *A. gossypii*, *C. undecimpunctata* and weather factors (temperature, RH and wind velocity) in cotton field during the two successive seasons 2006 and 2007

Sampling date	<i>A. gossypii</i>	<i>C. undecimpunctata</i>	Weather factors		
			Temp. °C	R.H.%	W.V (km/day)
Season 2006					
29/4	92	6	18.35	59.14	101.28
May	844	119	20.41	64.17	112.35
June	2706	159	23.13	59.37	114.93
July	6637	289	24.54	76.57	83.02
August	11552	375	26.55	73.94	70.53
September	6925	295	24.73	67.85	73.06
7/10	0	13	22.36	67.36	70.86
Total	28756.00	1256.00	-	-	-
Mean	1198.20	52.33	-	-	-
Season 2007					
24/4	28	3	17.17	62.78	107.71
30/4	40	6	14.69	54.50	101.57
May	1393	89	20.53	61.21	107.03
June	3642	202	30.78	68.66	121.61
July	8121	312	26.32	69.76	88.45
August	12037	374	26.22	78.64	77.46
September	4499	129	23.40	65.03	70.64
7/10	0	8	22.28	68.57	75.71
Total	29760.00	1123	-	-	-
Mean	1240.00	46.79	-	-	-

Data presented in Table (3) showed that during the two successive seasons, in season 2006 highly significant between *A. gossypii* and *C. undecimpunctata*, temperature, and was significant between *A. gossypii*, relative humidity and wind velocity. The predatory complex showed highly significant positive correlation with *A. gossypii* population. These correlation values between cotton aphid in 2007 season, were highly positive with either of *C. undecimpunctata*, temperature and relative humidity, but significant with the wind velocity, and also highly significant between *C. undecimpunctata*, temperature and relative humidity but was not significant between *C. undecimpunctata* and wind velocity. Similar results differences were obtained by Salem (2002) who reported highly significant between *A. gossypii* and *C. undecimpunctata*.

Table (3):Correlation coefficients among populations of *A. gossypii* associated with *C. undecimpunctata* and three weather factors (temperature, relative humidity and wind velocity)

Considered correlations	"r" values	
	2006	2007
<i>A. gossypii</i> x <i>C. undecimpunctata</i>	2.954**	0.936**
<i>A. gossypii</i> x Temp. °C	0.639**	0.728**
<i>A. gossypii</i> x RH%	0.444*	0.722**
<i>A. gossypii</i> x Wind velocity (km/day)	-0.507*	-0.442*
<i>C. undecimpunctata</i> x Temp. °C	0.659**	0.773**
<i>C. undecimpunctata</i> x RH%	0.431*	0.759**
<i>C. undecimpunctata</i> x Wind velocity	-0.525**	-0.278

* Significant at P<0.05, ** significant at p<0.01

Feeding capacity of *Coccinella undecimpunctata* larvae:

Larvae fed on *A. gossypii* in Table (4), data showed that larval stage of *C. undecimpunctata* was completed in four instars that collectively lasted for 9.4 days. The first instar had the shortest duration (1.95 days), the duration of the second instar lasted (2.25 days) and the third instar was completed in 2.40 days. However, the fourth larval instar was completed in the longest period (2.8 days).

Table (4):Biological aspects an the feeding capacity of *C. undecimpunctata* larvae fed on *A. gossypii* under laboratory conditions (26-31°C and 65-75% RH).

Larval instars	Duration (days)	Consumed aphids		Daily consumed aphids (No.)
		No. ± SD	%	
1 st	1.95±1.23	37.40±24.16	11.35	19.27
2 nd	2.25±0.78	60.40±21.26	18.20	26.84
3 rd	2.40±0.50	99.75±22.85	30.07	41.56
4 th	2.80±1.01	133.65±50.29	40.29	47.73
Total	9.40	331.70		

Pupae 2.35±0.13

The first larval consumed 37.9 aphids (11.42% out of total consumed aphid), second consumed 60.4 aphids (18.20 %), third consumed 99.75 aphids (30.07%), the fourth larval instar consumed the largest aphid numbers 133.65

(40.29%). Daily consumed aphids were 19.27 and 26.84 individual in the first and second instars, respectively. Both third and fourth instars consumed 41.56 and 47.73 individual, respectively. Salem (2002) found that the larval predator fed on aphid number (323.00 individuals) which is similar to that recorded in this study (331.7 individuals).

Biological aspects and the feeding capacity of *C. undecimpunctata* adults:

Female longevity lasted 59.00 days. However, the male longevity took a shorter period (49.60 days) compared to that of the female (Table 5). The preoviposition period took 8.88 days, oviposition (38.20 days), post-oviposition (5.60 days).

Table (5): Feeding capacity of *C. undecimpunctata* adult stage fed on *A. gossypii* , with special reference to pre, ovi. and post oviposition. Durations and adult longevity.

Adult stage	Duration in (days)	Daily consumed aphid (No.)	Total consumed aphid (No.)	% of Consumed aphids	Daily no. of laid eggs	Total no. of eggs
Pre-oviposition	8.8±2.28	41.90±11.54	368.80±89.83	9.30		
Oviposition	38.20±4.09	75.00±8.60	2865±308.61	72.24	11.56±1.4	441.59±93.04
Post-oviposition	5.60±1.82	26.32±11.28	147.40±86.87	3.72		
Longevity (♀)	59.00±9.11	67.22±8.25	3965.81±714.44			
Longevity (♂)	49.60±2.88	60.24±7.71	3077.40±227.08			

One female deposited 441.59 eggs during the oviposition period with a daily average of 11.56 eggs/female. Daily average of consumed aphids was highest during oviposition period (74.54 individual), while the least was during post-oviposition period (26.31 individual), the longevity of the coccinellid females had 66.7 days, while that of male took 60.5 days. Ahmed (2000) obtained higher fecundity (976.7 eggs/female) than that recorded here in Salem (2002) obtained lower fecundity (421.05 eggs/female) than that recorded herein.

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تتبع المفترسات الحشرية المرتبطة بمن القطن مع اهمية خاصة للكفاءة الافتراضية لأبو العيد ١١ نقطة في منطقة كفر الشيخ

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أجري هذا البحث في المزرعة البحثية بمحطة البحوث الزراعية بسخا - كفر الشيخ خلال موسمي ٢٠٠٦م ، ٢٠٠٧م لحصر وتقييم اثر أعداد و أنواع المفترسات الحشرية فى تقليل أعداد من القطن. وكذا الكفاءة الافتراضية للمفترس أبو العيد ١١ نقطة على آفة من القطن. تم حصر عدة مفترسات وهى أبو العيد ١١ نقطة و أبو العيد الأسود وأبو العيد السمنى وخنفساء الأسكمنس كذلك حشرة الرواغة وحشرة أسد المن. وكذلك بقعة الأوريس. وأوضحت النتائج وجود أعداد عالية منحشرة الرواغة وأبو العيد ١١ نقطة (١٤٥٢ ، ١٢٥٦ فرد) وكذا أعداد عالية لكل من ذبابة السرفس وبقعة الأوريس وخنفساء الأسكمنس وأسد المن (١١٨١ ، ١١٤١ ، ١١٣٥ ، ١٠٥٩) على التوالي بينما كان أقل تعداد لكل من أبو العيد الأسود وأبو العيد السمنى (٩٥٠ ، ٧٧٠ فرد) وذلك فى موسم ٢٠٠٦م. أما بالنسبة لموسم ٢٠٠٧م فيقل به تعداد المفترسات حيث ان أعلى نسبة كانت لخنفساء الأسكمنس وأبو العيد ١١ نقطة (١١٦٦ ، ١١٢٣ فرد) على التوالي. بينما فى

حشرات بقعة الأوريس وأسد المن والرواغة وأبوالعيد الأسود وأبوالعيد السمنى فكانت الأعداد (١١٠٩، ١١٠٠، ٨٩٥، ٧٢٥، ٦٤٩، ٥٣٣ فرد) على التوالي.

تعداد حشرات المن فى موسم ٢٠٠٦م إلى (٢٨٧٥٥ فرد) ووصل تعداد للمن فى أول يوليو وصل إلى أقصى تعداد له فى ٢٠ أغسطس وكان (٣٣٦٠ فردا) مقارنة بأعلى تعداد للمفترسات وكان (١٠٥ فرد) ثم تناقصت الأعداد تدريجيا حتى نهاية المحصول فى أوائل شهر أكتوبر.

بينما فى موسم ٢٠٠٧م وصل تعداد المن إلى (٢٩٧٦٠ فرد) وهو يزيد عن الموسم السابق له فى حين أن أعداد المفترسات قد قلت. فكان أقصى تعداد للمن فى هذا الموسم (٣٤٩٣ فرد) فى ٢٨ أغسطس وأيضا (٣١٨٣ فرد) فى ١٤ أغسطس وكان تعداد المفترسات فيها (١٠٥ فرد) وقد قلت أعداد المفترسات فى ٢٨ أغسطس كانت (٨٤ فرد) مفترس.

ومع دراسة بعض النواحي الحياتية والكفاءة الأفتراسية لأبوالعيد ١١ نقطة فعند تغذية المفترس معمليا على أفراد من القطن. أكتمل الطور اليرقى للمفترس فى خلال ٩.٤ يوما واستهلك فيها (٣٣١.٧ فردا) وبلغت فترة حياة الأنثى ٥٩ يوما استهلك خلالها (٣٩٣٥.٣ فرد) وبلغت جملة ما وضعته الأنثى ٤٤١.٩٢ بيضة خلال فترة حياتها وقد بلغت فترة حياة الذكر ٤٩.٦ يوما استهلك خلالها (٣٠٧٧.٤٠ فردا) من المن.

قام بتحكيم البحث

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