

## SIDE EFFECTS INSECTICIDAL TREATMENTS ON SIX MAIN PREDATORS COMMONLY FOUND IN COTTON-FIELDS

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### ABSTRACT

The aim of this study is to run periodical survey (every 6 days) of these predators during the whole cotton-season in order to evaluate the side effects of tested compounds on these biological factors. The present work revealed that the population densities of tested predators differed significantly from one season to another and the most abundant predator prevailing cotton fields is the true spider followed by *Orius spp.*, while *C. carnea* is the least one in this respect.

The results indicated that the side effects of tested compounds on the abundance of predators had occurred the percent reduction between 15.6 % ( due on *p. alfeirii*) and 78 % due on *scymnus spp* ) in First Season , whil in second Season the percent reduction had occurred between 28.33 % (*p. alfeirii*) and 75.79 % (*ch. carnea*)

On the other hand , the general ratio of percent reduction in total of six predators were 46.62 % and 52.09 % in both seasons .

### INTRODUCTION

The high quality of the Egyptian-cotton is well known all over the world. To maintain this high quality and safeguard the crop from damaging pests, great efforts should be done to control such pests. Insecticides are the most powerful tool available for controlling pests. The very widespread use of insecticides for pest control is largely a result of their convenience, simplicity, effectiveness, flexibility, and economy.

In recent years there has been a slight but noticeable increase in pesticide applications on cotton in Egypt. Experience in other cotton growing regions of the world has shown that insecticides on their own have singularly failed to control the wide range of pests which attack cotton (Critechley, 1994).

The modern approach to pest control is to "Select" from a variety of techniques the combination of control options that is best suited to a particular circumstance. This approach, which is highly flexible has gained much support among entomologists in the last 30 years and is referred to as Integrated Pest Management (IPM).

Entomophagous and phytophagous insects are major agents in the biological control of pests. In general, predators have the advantage over parasitoid in that each individual consumed number of prey during its life-time and unlike parasitoids; the immature stages have the activity for searching and consuming prey pest species. Among the most effective predators commonly found in cotton-fields are: true spider mites, *Coccinella undecimpunctata* (Reiche), *Scymnus spp.*, *Paederus alfeirii* (Koch), *Chrysoperla carnea* (Steph) and *Orius spp.*

## MATERIALS AND METHODS

For conducting the present study, three successive sprays of insecticides (recommended to control bollworms, Table (1) were evaluated against non target insects such as certain predators.

Direct counts of these predators in cotton fields were carried out weekly during two successive cotton seasons. The prevailing predacious species taken into consideration are *C. undecimpunctata*, *Scymnus* spp., *P. alfeirii*, *Ch. carnea* and *Orius* spp., and true spiders (Table 2). Samples of 25 cotton plants from each plot were investigated to determine the abundance of these predacious species according to Hafez technique (1960). The cotton plants samples were chosen at random from both diagonals of the inner square of each plot.

The same survey was carried out in pheromone treated which considered untreated control.

**Table (1):** Represents all tested insecticides and biocides as well as their type of formulation and their recommended dose/field.

Tested compound	Chemical group	Type of formulation	Dosage gm a.i./fed.
Curacron	Organophosphate	E.C. 72%	375 ml.
Larvin	Oxime carbamate	Fl. 37.5%	500 gm.
Sumalpha	Synthetic pyr.	E.C. 20%	75 ml.
Dipel-2x		6.4% B.t.*	200 gm.
Biofly		3x10 <sup>7</sup> conidio spores/ml	200 ml.

B.t = *Bacillus thuringensis* 32,000 I.U. of potency/mg.

## RESULTS AND DISCUSSION

### 1. Side effects of insecticidal treatments on true spiders:

Data presents in Table (2 - 5) and illustrated in Figures (1 and 2) clearly indicated that the total number of spider (adults and nymphs) reached 369 and 348 spiders/25 cotton plants in pheromone treated area (considered untreated area) during first and second cotton-seasons, respectively. The percentages of these predators are 34.9 and 35.9 with respect to the total numbers of predators during the 1<sup>st</sup> and 2<sup>nd</sup> cotton season, respectively (Tables 3 and 5). The highest population density of spider mites (2 individuals) was recorded on August 19<sup>th</sup> during the 1<sup>st</sup> cotton-season, while the highest population reached 40 spiders/25 plants was recorded on August 20 during the second cotton-season (Figures 1 and 2).

Concerning the total counts of spider mites in cotton fields in treated area, the data recorded 259 and 219 spiders/25 plants during first and second seasons, respectively (Tables 4 and 6). Thus significant reduction in spider mite population had occurred and amounted to 29.81 and 37.07 % during both cotton-seasons, respectively (Table 2).

The foreign results agreed with the finding of many investigators who reported the severe adverse effects of pesticides on predators (Abou El-Ghar et al., 1985 and Abbas abd El-Deeb, 1996). The current results agreed fully with Nassef (1995) who found that the highest abundance of spider mites occurred during June and July. Aref (1997) found that the insecticides significantly reduce the population densities of all tested predators including

true spiders. Also, Abo-Sholoua (2001) found that the true spiders were the most abundant species in cotton fields.

Table (2): Total numbers of six main predators commonly found in cotton fields during two successive cotton-seasons as well as their percent of reductions resulted from insecticidal treatments.

Main predators	Total count of each predators/25 cotton plants				Percentage of reduction due to insecticidal treatment	
	Untreated area		Treated area		1 <sup>st</sup>	2 <sup>nd</sup>
	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>		
True spiders	369	348	259	219	29.81	37.07
<i>C. undecimpunctata</i>	88	104	48	55	45.54	47.12
<i>Scymnus</i> spp	200	254	44	97	78.0	61.81
<i>P. alfeirii</i>	109	60	92	43	15.60	28.33
<i>Ch. carnea</i>	43	95	24	23	44.19	75.79
<i>Orius</i> spp	249	109	93	41	66.66	62.39
<b>Total count</b>	1058	970	550	478	46.62	52.09

## 2. Side effects of insecticidal treatments on *Coccinella undecimpunctata*:

Data presented in Tables (3 and 5) and illustrated in Figures (3 and 4) clearly indicated that this predators is commonly found in cotton-fields but relatively in small numbers which accounted 88 and 104 individuals per 25 cotton-plants in the untreated area during 1<sup>st</sup> and 2<sup>nd</sup> cotton-seasons, respectively. The percentages of *C. undecimpunctata* are 8.3 and 10.7% with respect to those total counts of all predators during both cotton- seasons, respectively.

Results in Tables (3 and 5) and illustrate in Figures (3 and 4) indicated that the abundance of *C. undecimpunctata* was so low during June and reached the highest peaks during July and August followed by drastic during September in both seasons. The highest peak was found on August 31 (12 individual per 25 cotton plants) during 1<sup>st</sup> cotton-season, while the peak occurred on July (17 individual per 25 cotton plants) in 2<sup>nd</sup> season.

Concerning the side effects of tested compounds on the abundance of *C. undecimpunctata*, the data clearly show that a drastic drop in the predator numbers had occurred and the total numbers are: 48 and 55 individuals/25 cotton plants for both cotton-seasons, respectively (Tables 4 and 6), indicating reduction in *C. undecimpunctata* total counts due to insecticidal-treatments by 45.45 and 47.12 % in 1<sup>st</sup> and 2<sup>nd</sup> seasons, respectively (Table 2).

In general, the current results agreed with the previous finding of many investigators. Hassan *et al.*, (1960) and Hafez *et al.*, (1975) found that *C. undecimpunctata* was commonly found in cotton growth season. Moreover, Abbas and El-Deeb (1996) mentioned that the population density of *C. undecimpunctata* was high in July, then decreased gradually until the end of the season.

Table (3): Weekly numbers of tested predators in untreated cotton plants at Kafr El-sheikh region, during the first season

Date of inspection	No. of predators/25 cotton plants						Total
	true spiders	<i>C. und.</i>	<i>Scymnus</i> spp	<i>P. alfeirii</i>	<i>Ch. carnea</i>	<i>Orius</i> spp	
21/5	2	-	-	-	-	-	2
27/5	3	1	-	-	1	-	5
2/6	5	1	1	1	-	1	9
8/6	11	2	2	3	1	5	24
14/6	14	3	2	7	-	12	38
20/6	18	2	5	8	2	13	48
26/6	21	3	4	11	2	17	58
2/7	19	3	2	16	5	12	57
8/7	18	2	1	11	-	9	41
14/7	22	7	6	7	2	6	50
20/7	16	11	3	11	3	9	53
26/7	21	9	9	5	1	7	52
1/8	13	6	21	11	3	8	62
7/8	14	5	26	7	-	20	72
13/8	29	3	33	3	-	28	96
19/8	42	3	29	3	2	37	116
25/8	39	7	21	4	3	36	110
31/8	26	12	15	-	1	13	67
6/9	8	3	8	1	3	7	30
12/9	9	4	6	-	5	5	29
18/9	9	1	3	-	8	2	23
24/9	10	-	3	-	1	2	16
<b>Total</b>	<b>369</b>	<b>88</b>	<b>200</b>	<b>109</b>	<b>43</b>	<b>249</b>	<b>1058</b>
<b>%</b>	<b>34.9</b>	<b>8.3</b>	<b>18.9</b>	<b>10.3</b>	<b>4.1</b>	<b>23.5</b>	<b>100</b>

Table (4): Weekly numbers of tested predators in insecticidal treated cotton plants at Kafr El-sheikh region, during the first season

Date of inspection	No. of predators/25 cotton plants						Total
	true spiders	<i>C. und.</i>	<i>Scymnus</i> spp	<i>P. alfeirii</i>	<i>Ch. carnea</i>	<i>Orius</i> spp	
21/5	3	-	-	-	-	-	3
27/5	2	1	-	-	-	-	3
2/6	4	2	2	1	1	1	11
8/6	12	1	1	2	-	3	16
14/6	15	1	2	6	1	9	34
20/6	18	3	3	8	2	12	46
26/6	25	2	4	10	1	16	58
2/7	17	2	5	14	1	11	50
8/7	13	3	2	12	3	8	41
14/7	21	6	5	9	6	6	53
20/7	19	8	3	5	3	8	46
26/7	26	11	8	11	1	5	62
1/8	10	1	3	6	1	1	22
7/8	8	1	2	2	-	-	13
13/8	7	2	1	1	-	-	11
19/8	7	2	-	-	1	1	11
25/8	11	1	1	1	-	-	14
31/8	10	-	-	1	1	-	12
6/9	13	-	2	2	-	-	17
12/9	6	1	-	-	1	1	8
18/9	8	-	-	1	1	1	12
24/9	4	-	-	-	-	-	4
<b>Total</b>	<b>259</b>	<b>48</b>	<b>44</b>	<b>92</b>	<b>24</b>	<b>83</b>	<b>550</b>
<b>%</b>	<b>47.1</b>	<b>8.7</b>	<b>8</b>	<b>16.7</b>	<b>4.4</b>	<b>15.1</b>	<b>100</b>

**Table (5): Weekly numbers of tested predators in untreated cotton plants at Kafr El-sheikh region, during the second season**

Date of inspection	No. of predators/25 cotton plants						Total
	true spiders	<i>C. und.</i>	<i>Scymnus</i> spp	<i>P. alfeirii</i>	<i>Ch. carnea</i>	<i>Orius</i> spp	
22/5	4	1	-	1	-	-	6
28/5	7	1	-	1	1	-	10
3/6	11	1	2	-	1	1	16
9/6	11	3	1	3	2	3	23
15/6	16	3	1	7	12	12	40
21/6	21	5	3	10	4	3	46
27/6	22	11	10	4	7	1	55
3/7	25	8	12	3	5	1	54
9/7	13	8	23	1	5	2	52
15/7	9	3	28	2	3	1	46
21/7	13	9	18	5	4	2	51
27/7	15	17	31	9	6	5	83
2/8	15	13	42	3	9	11	93
8/8	19	6	21	3	10	13	72
14/8	27	5	20	2	6	14	74
20/8	40	3	12	1	5	21	83
26/8	23	3	16	2	1	8	53
1/9	20	-	7	-	4	7	39
7/9	17	-	3	-	12	3	35
13/9	8	2	3	1	6	-	20
19/9	9	1	1	1	3	1	16
25/9	3	1	-	-	-	-	4
<b>Total</b>	<b>348</b>	<b>104</b>	<b>254</b>	<b>60</b>	<b>95</b>	<b>109</b>	<b>970</b>
<b>%</b>	<b>35.9</b>	<b>10.7</b>	<b>26.2</b>	<b>6.2</b>	<b>9.8</b>	<b>11.2</b>	<b>100</b>

**Table (6): Weekly numbers of tested predators in insecticidal treated cotton plants at Kafr El-sheikh region, during the second season**

Date of inspection	No. of predators/25 cotton plants						Total
	true spiders	<i>C. und.</i>	<i>Scymnus</i> spp	<i>P. alfeirii</i>	<i>Ch. carnea</i>	<i>Orius</i> spp	
22/5	1	1	-	1	-	-	3
28/5	3	-	1	-	1	-	5
3/6	6	1	1	-	1	1	10
9/6	10	2	-	1	1	2	16
15/6	11	2	1	3	1	6	24
21/6	17	3	4	7	3	10	44
27/6	24	9	9	7	5	4	59
3/7	28	7	18	5	2	1	61
9/7	17	8	23	1	3	1	53
15/7	16	4	21	4	1	2	48
21/7	9	9	14	6	-	-	35
27/7	8	1	-	1	-	1	11
2/8	5	2	-	1	1	2	11
8/8	13	1	2	-	-	3	19
14/8	7	-	1	1	1	1	11
20/8	6	1	-	1	1	-	9
26/8	7	2	-	2	-	-	11
1/9	8	-	1	3	1	1	12
7/9	11	1	1	3	-	2	16
13/9	7	1	-	-	-	2	10
19/9	3	-	-	-	1	-	4
25/9	2	-	-	-	-	-	2
<b>Total</b>	<b>219</b>	<b>55</b>	<b>97</b>	<b>43</b>	<b>23</b>	<b>41</b>	<b>478</b>
<b>%</b>	<b>45.8</b>	<b>11.5</b>	<b>20.3</b>	<b>9.0</b>	<b>7.8</b>	<b>8.6</b>	<b>100</b>

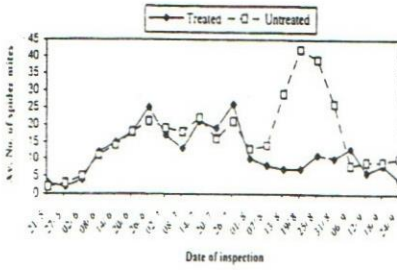


Fig. (1): Population fluctuation of true spider mites on untreated and treated cotton plants during the first cotton season.

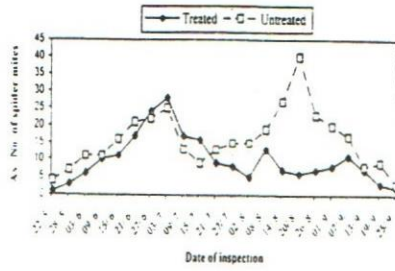


Fig. (2): Population fluctuation of true spider mites on untreated and treated cotton plants during the second cotton season.

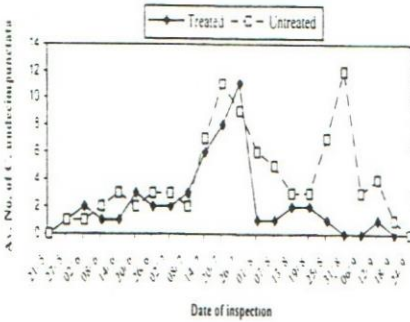


Fig. (3): Population fluctuation of *C. undecimpunctata* on untreated and treated cotton plants during the first cotton season.

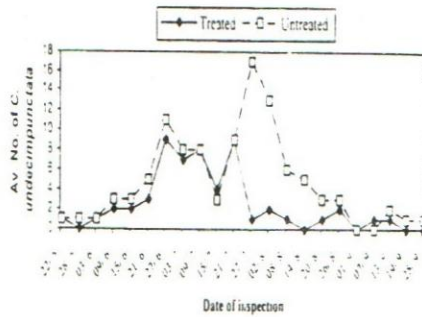


Fig. (4): Population fluctuation of *C. undecimpunctata* on untreated and treated cotton plants during the second cotton season.

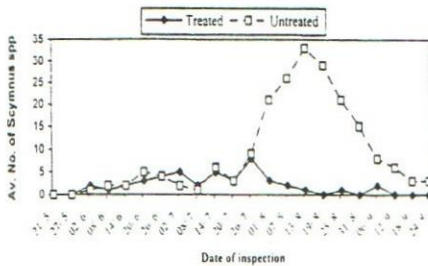


Fig. (5): Population fluctuation of *Scymnus* spp on untreated and treated cotton plants during the first cotton season.

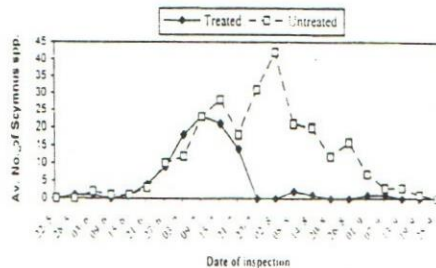


Fig.(6): Population fluctuation of *Scymnus* spp on untreated and treated cotton plants during the second cotton season.

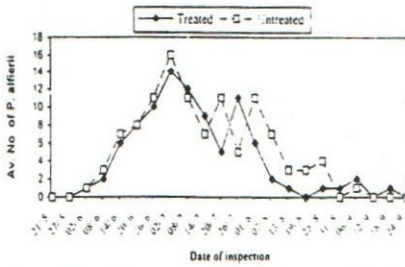


Fig. (7): Population fluctuation of *P. affierii* on untreated and treated cotton plants during the first cotton season.

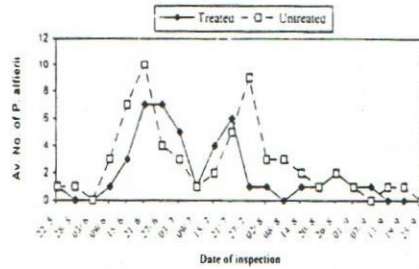


Fig. (8): Population fluctuation of *P. affierii* on untreated and treated cotton plants during the second cotton season.

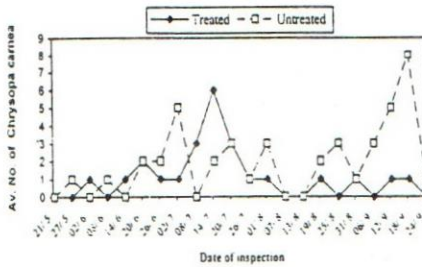


Fig. (9): Population fluctuation of *Chrysopa carnea* on untreated and treated cotton plants during the first cotton season.

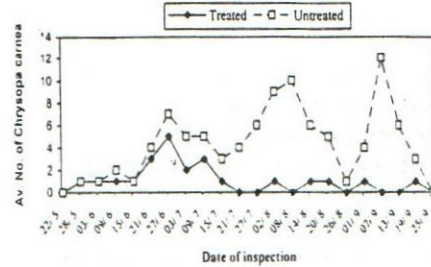


Fig.(10):Population fluctuation of *Chrysopa carnea* on untreated and treated cotton plants during the second cotton season.

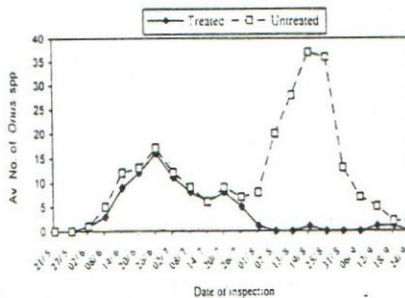


Fig. (11): Population fluctuation of *Orius* spp., on untreated and treated cotton plants during the first cotton season.

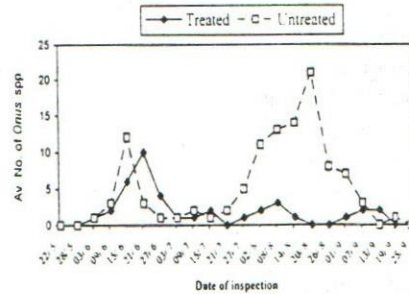


Fig.(12): Population fluctuation of *Orius* spp., on untreated and treated cotton plants during the second cotton season.

### 3. Side effects of insecticidal treatments on *Scymnus* spp.:

Data in Tables (3 and 5) and illustrated in Figures (5 and 6) revealed that *Scymnus* Spp. are commonly abundant during the growing cotton-season. The total number of these predators (adults and larvae) reached 200 and 254 individuals/25 cotton-plants in untreated area during both cotton-seasons, respectively. These counts represent 18.9 and 26.2 % of the total counts of all tested predators during the 1<sup>st</sup> and 2<sup>nd</sup> cotton-seasons, respectively. The data also revealed that this predator was more abundant during July, August and September in both cotton-season. The highest peak of the predator (33 individual/25 cotton plants) was recorded on August 13<sup>th</sup> the first, while reached 42 individual per 25 cotton plants on August 2<sup>nd</sup> the second (Figures 5 and 6). Data presented in Table (2) indicated that high reduction in *Scymnus* Spp., had occurred due to insecticidal treatments. In term of figures the total numbers of *Scymnus* Spp., are: 44 and 97 individuals/25 cotton plants during 1<sup>st</sup> and 2<sup>nd</sup> cotton-seasons, respectively (Tables 4 and 6). The percent reduction reached both cotton-seasons, respectively (Table 2). These results are confirmed by the previous findings of Hassan *et al.*, (1960), Azab *et al.*, (1965) and Habib (1976) who reported that *Scymnus* Spp. were common in cotton fields between April and September and their numbers started moderately during the 2<sup>nd</sup> week of June and was highly abundant in July and August.

### 4. Side effects of insecticidal treatment on *Paederus affeirii*:

Periodical surveys of *Paederus affeirii* were done in cotton fields and the data are presented in Tables (3 and 5) and were illustrated in Figures (7 and 8). It is quite clear that the total counts of *P. affeirii* adults, throughout the cotton season are: 109 and 60 individuals/25 cotton plants in untreated area during 1<sup>st</sup> and 2<sup>nd</sup> cotton-seasons, respectively. The data also revealed that this predator is more abundant in cotton fields during the first season than the second one. The total counts of this predator represent by 10.3 and 6.2 % with respect to the counts of all collected predators in the first and second cotton seasons, respectively. The data also revealed that the highest abundance of the predator (16 individual/25 cotton plants) was observed during July (the first season) while in the second cotton-season, the highest population (9 individual/25 cotton plants) was recorded on the end of July. With respect to the effects of insecticidal treatments, the data showed that the total number of this predator on treated cotton plant decreased significantly and reached 92 and 43 individuals/25 cotton plants during both seasons, respectively (Tables 4 and 6). The drastic drop in the population density of *P. affeirii* (Table 2) occurred as a consequent result of spraying insecticides for controlling cotton bollworms. However, these of reduction are 15.6 and 28.33 % in both seasons, respectively. The foregoing results are in agreement with the results of Ali (1998) who reported that the population density of *P. affeirii* was high in June, then decreased gradually until the end of the season. Nassef (1995) indicated that the population density of this predator was much higher during July and August.

### 5. Side effects of insecticidal treatments on *Chrysoperla carnea*:

Data presented in Tables (3 and 5) and Figures (9 and 10) revealed that the population density of *Chrysoperla carnea* adults and larvae



throughout the whole season in untreated area reached 43 and 95 individuals/25 cotton plants during both seasons, respectively. These counts represent 4.1 and 9.8 % of the total count of all recorded predators during both cotton-seasons, respectively. The highest population density (8 individual-/25 cotton plants) was observed on September 18<sup>th</sup>, the first season while the highest peak during the second cotton-season reached 12 individuals/25 cotton plants occurred on September 7<sup>th</sup> (Figures 10).

In case of treated area, the total counts of this predator (adult and larvae) are: 24 and 23 individual/25 cotton plants during both cotton-season, respectively. These figures indicated percentages reduction by 44.14 and 75.79 % (Table 2).

In general, the trend of our results agreed with those obtained by Abbas and El-Deeb (1996) who reported that the insecticidal application, reduced the number of *Chrysoperla carnea* predator in cotton fields. Nassef (1995) reported that, three peaks of *Chrysoperla carnea* population during the period extended from May to October.

#### **6. Side effects of insecticidal treatment on *Orius* Spp.:**

Data presented in Tables (3 and 4) and illustrated in Figures (11 and 12) revealed that the total population density (adults and nymphs) of *Orius* spp., reached 249 and 109 individual/25 cotton plants in untreated area during both cotton-seasons, respectively. These data indicated that *Orius* spp., occupied 23.5 and 11.2 % of the total counts of all collected predators during the two cotton-seasons, respectively. The highest peak of *Orius* spp. (37 individual/25 cotton plants) was recorded on August 19<sup>th</sup> of the first season, while it was (21 individual/25 cotton plants) on August 20 of the second cotton-season (Figures 12).

The total number of this predator decreased to 83 and 41 individual/25 cotton plants in insecticidal treated area during both seasons, respectively. The population densities of the predators in treated area of cotton plants (Table 2) decreased to 66.66 and 62.39% compared with their population densities on untreated cotton plants in both cotton seasons, respectively.

The current results agreed with those of Ali (1998) who concluded that the predaceous insect; *Orius* spp. may be susceptible to treatment of cotton pests by conventional insecticidal programs. Nassef (1995) reported that there are three peaks of *Orius* spp. commonly observed in June, July and September.

In general, on reviewing the previous results concerning the role of prevailing predators in cotton fields as well as the side effects of tested compounds on these predators, one can figure out the following main points:

- 1 The population densities of tested six predators different significantly from one season to another. However, the differences between the prevailing weather during these cottonseason might be behind the observed variation in the population densities of tested predators. Generally, number of predators was relatively higher in the first cotton season than that in the second cotton season.
2. The most abundant predator prevailing in cotton fields is the true spiders followed by *Orius* spp. while *C. carnea* is the least one in this respect.

However, El-Dakhkhni *et al.*, (1995) found 12 species of beneficial insects belonged to 9 families in 6 orders are common in cotton fields in Kafr El-Sheikh. Four species accounted for 68%, *Paederus alfeirii* (Koch), *Scymnus syriacus* (Mars), *Chrysoperla carnea* (Steph) and *S. interruptus* (Goeze).

3. The population density of all tested predators decreased remarkably during late June just after the first spray of tested insecticides (Figures 1-12). Farouk and Abd El-Galil (1993) indicated that, in cotton fields, the maximum densities of *Coccinella undecimpunctata* and *Scymnus interruptus* occurred during the second decade of August. However, the drastic drop in the population densities of predaceous arthropods had been observed by many investigators in different regions of Egypt (Fayed and Ibrahim, 1980; Hamed *et al.*, 1983; Abbas and El-Deeb, 1996 and Aref, 1997).

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### التأثيرات الجانبية للمبيدات المختبرة على ست أنواع من المفترسات شائعة التواجد بحقول القطن

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تمت هذه الدراسة بمزرعة البحوث الزراعية بسخا خلال موسمين قطن متتاليين وتم عمل حصر وتصنيف للمفترسات الشائعة التواجد بحقول القطن كل ست ايام لتقييم التأثيرات الجانبية للمبيدات الموصى بها على تلك المفترسات.

واوضحت النتائج ان الكثافة العددية للمفترسات الستة المختبرة بها اختلافات معنوية من موسم لآخر وان العناكب المفترسة اكثر الاعداد انتشارا وبينما كان أسد المن اقلهم تعداد. كما أوضحت النتائج أن التأثيرات الجانبية للمبيدات على تذبذب تعداد المفترسات أحدثت نسبة من الخفض فى تعدادها تراوحت بين ١٥,٦% ( الحشرة الرواعة ) و ٧٨% ( لحيشة الإسكمناس ) خلال الموسم الأول بينما فى الموسم الثانى كانت نسبة الخفض تتراوح بين ٢٨,٣٣% ( الحشرة الرواعة ) و ٧٥,٧٩% ( أسد المن ) بينما كان نسبة الخفض الكلى للتعداد خلال الموسم الأول ٤٦,٦٢% وبلغت ٥٢,٩% خلال الموسم الثانى .

