EVALUATION OF SOME INSECTICIDAL SEQUENCES ON COTTON BOLLWORMS, COTTON YIELD, AND SOME NATURAL ENEMIES

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ABSTRACT

The efficiency of carbaryl, chlorpyrifos and alpha-cypermethrin in different alternative sequences was evaluated against *Pectmophora gossypiella* (saunders) and *Earias insulana* (Boisd.) with respect to their predators and cotton-yield. The data revealed that, the infestation of cotton fields with both bollworms in both successive seasons started with few numbers of 1st and 2nd instar larvae on late July, but increased gradually till the end of each seasons. Insecticidal treatments if being done at the proper time in a protective control programme are the most effective agents for controlling both cotton bollworms. Alpha-cypermethrin in three successive sprays was the best sequences in controlling bollworms, but it was not preferable to control the pests generally. From the obtained results, synthetic pyrethroid was the most effective against bollworms followed by the carbamate compound while the O.P insecticide was the least effective one in this respect generally, the schedule chlorpyrifos-alpha-cypermethrin-carbaryl is considered the most preferable treatment for controlling bollworms infestations. With respect to the effects of the previous insecticidal-sequences on cotton-yield, the data showed in general that all tested treatments reduced the incidence of bollworms infestation on cotton, it decreased the percentage of loss in cotton yield and exhibited good protection. Moreover, the results also showed a high correlation between percentage of boll infestation along season and yield loss. The data also revealed that Alph-cypermethrin in 3 successive sprays showed the highest effect induced 4.38% losses in cotton yield, while the schedule including carbary-alpha-cypermethrin-chlorpyrifos was the least effective as it induced 17.1% losses in cotton yield compared with 69.8% for control. As for the side effects of the insecticidal sequences on the prevailing predators, the data showed that based on the reduction percent (%R), all tested insecticides significantly reduced the population densities of

all tested predators. Based on the general mean of reduction of the sequence in which alph-cypermethrin applied in 3 successive sprays was the most destructive treatment (74.6% reduction) against *Chrysopa carnea*. However, the other tested treatments exhibited reduction percent in population density of *Chrysopa carnea* ranged between 47.2 – 65.7%. The data also revealed that all tested treatment, in general, were very destructive to *Coccinella* spp, and *Scymnus* sp.

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.

Cotton bollworms, pectionophora gossypiella and earias insulana are considered the most serious pests attacking cotton plants during flowering and watering stages and cause great losses of cotton yield and quality. **Menally and Mullins (1996)** indicated that the loss amount caused by P.gossypiella to cotton arises to one million kentar annually in Egypt.

Despite these impressive creadentials, much use of insecticides has been ecologically unsound, leading to such disadvantages as insect resistance, outbreaks of secondary pests, adverse effects on non target organisms and objectionable pesticide residue (**Smith, *et al.*, 1998**). Selective pesticides, that can be used to control pests without adversely affecting natural enemies, are needed for modern pest management (**Saba, 1991**).

The present work is an attempt to evaluate of some insecticidal sequences on cotton bollworms, cotton yield as well as their prevailing predators.

MATERIALS AND METHODS

1. Cotton bollworms:

A field strain from each of pink bollworm, *pectinophora gossypiella* (saunders) and spiny bollworm, *Earias insulana* (Boisd.) was originally collected from infested bolls in cotton plantation in the farm of Sakha Agricultural Research Station, Kafr El-Sheikh governorate, Egypt.

2. Insecticides:

All tested insecticides used in this study were in formulated forms.

<u>**a. Carbaryl:**</u> 1- naphthy methyl carbamate. It was supplies by Aventis Co. (85% w.p.)

b. **Chlorpyrifos**: o, o-diethy o-3,5,6-tri-chloro–2–pyridy phosphorothioate. It was supplied by Dow Afro Sciences (48% EC)
c. Alpha-cypermethrin : (S)-α-cyano–3–phenoxy benzy (1R, 3R)–3–(2,2–dichloro–venyl)– 2,2 – dimethyl cyclopropane caboxylate and (R)-α-cyano–3–phenoxy benzyl (1S, 3S)–3– (2,2 – dichlorvenyl)– 2,2–dimethyl cycloproboxylate. It was supplied by FMC Co. (10% EC).

3. Design of field experiments:

The effect of different insecticides in 6 rotations against the pink bollworm, *P. gossypiella* (Saunders) and spiny bollworm *E. insulana* (Boisd.) infesting cotton plants during two successive seasons in 2003 and 2004 was studied to select the best sequence. The first experiment was carried out at Sakha Research Station, Kafr El-Sheikh in 2003 season, where 6 treatments were used, while in 2004 cotton-season all previous treatments were treated in addition to 3 more treatments. The area was arranged in a complete randomized block design with four replicates for each treatment. Each replicate was 1/100 feddan Tested compounds were sprayed using CP3 sprayer at a rate of 200 liter/Fadden All treatments were done when the percent of bollworms infestation exceeded 3% the date of sprayings on July 20, August 3 and 18 in 1^{st}, 2^{nd} and 3^{rd} sprays respectively in 2003, 2004 cotton seasons. Table (1), summarized the different sequential treatments and schedule of treatments. The interval between any two successive applications was two weeks.

Table (1): Represents the different sequential treatments during 2003 and 2004 cotton seasons

S. No.	Sequence of treatment	Seasons of application
1	Carbaryl + Chlorpyrifos + Alpha	2003, 2004 seasons
2	Chlorpyrifos + Carbaryl + Alpha	2003, 2004 seasons
3	Alpha + Carbaryl + Chlorpyrifos	2003, 2004 seasons
4	Carbaryl + Alpha + Chlorpyrifos	2003, 2004 seasons
5	Chlorpyrifos + Alpha + Carbaryl	2003, 2004 seasons
6	Alpha + Chlorpyrifos + Carbaryl	2003, 2004 seasons
7	Carbaryl (three spray)	2004 seasons
8	Chlorpyrifos (three spray)	2004 seasons
9	Alpha (three spray)	2004 seasons
10	Untreated	2003, 2004 seasons

S= Sequence, Alpha = Alpha-cypermethrin

3. a. Determination of bollworm infestation:

For assessing the infestation by the pink and spiny bollworm, 100 green bolls were collected weekly at random from both diagonals of the inner square area of each plot according to the method of **Shaaban and Radwan (1974)**. Inspection was stared from 20 July and continued till September 1 of each-season. 100 full sized middle-aged bolls were picked up weekly from each plot for estimating the percent of infestation of both pink and spiny bollworms. Samples of bolls were taken to the laboratory and were examined for the actual presence of pink and spiny bollworms.

3. b. The loss of cotton yield caused by bollworms infestation:

To determine the loss of cotton yield 100 cotton plants in each treatment were inspected after seed cotton had already been picked. Empty capsules and unopened green or dry bolls still on the plants were counted, the number of sound and infested bolls was determined. The degree of infestation in each boll was recorded. The percentage of loss in cotton yield was calculated according lo the following formula **(Kamel, 1958)**.

$$\text{Loss \%} = \frac{T - o}{T}$$

Where:

T: Theoretical open bolls = A + B + C + D + E

O: Observed open bolls = A + 2/3 B+ 1/3 C

A: Non infested open bolls.

B: Bolls with one infested Locule

C: bolls with two infested Locule

D: Infested green bolls

E: Infested dry bolls.

4. Side effects of insecticidal sequences (used for controlling bollworm) on some natural enemies :

The most prevailing predacious species such as *Coccinella* spp.; *orius* spp.; *Paederus alfierii* and true spiders were investigated to determine the abundance of these predaceious species according to **Hafez Technique (1960)**. Samples of 10 cotton plants from each plot (40 plants/treatment) were chosen at random from both diagonals of the inner square area of each plot at the same time. The percent reduction was calculated according to **Handerson and Tilton (1955)**.

Statistical analysis was made to show if there are significant differences between treatments or not according to **Duncan (1955)**.

5. Statistical analysis of the data:

The absolute figures of the pests were transformed by using ($\sqrt{X} \pm 1$) to have normal distribution of the population. The percent reduction of sucking pests and boll worms infestation was calculated according to **Handerson and Tilton** equation (1955). AC Computer Programe (IRRI State) was used for estimating the simple correlation coefficient between treatments.

RESULTS AND DISCUSSION

1. Evaluation of some insecticidal sequences for controlling cotton bollworms :

The average numbers of bollworms larvae per 100 green bolls during 2003 and 2004 cotton seasons are presented in Table (2). It is quite clear that the infestation with both insects in two successive seasons started with few number of 1st and 2nd instar larvae from late July, and increased gradually till the end of each season. It should be mentioned that the average percentage bollworms infestation was higher in 2004 than 2003 season.

Comparing between the efficiency of tested insecticidal sequences against both bollworms, the data presented in Table (3) revealed that repetitive spraying of alpha-cypermethrin in three successive sprays (sequence 9) was the best insecticidal treatment induced 67.4% reduction of larval population, while the sequence number five (% red. = 62.6%) came in the second order without significant difference with the treatment of spraying carbaryl 3 times sequence number seven (% red. = 59.1%). On contrary, sequence number (4) was the least effective sequence with percent reduction of 41.3%.

Comparing between the different insecticidal sequences against bollworms infestation, the potency of these sequences could be arranged. Descendingly as the following sequence number: 9 (67.4%); 5 (62.6%); 7 (59.1%); 6 (55.3%); 8 (54.7); 2 (51.5%); 3 (49.2%); 1 (47.3%) and 4 (41.3%) reduction in larval population (Table 3).

From the practical point of view, it is advisable to avoid using repetitive spraying of the same compound three times to minimize the selection pressure and the rate of developing resistance strain to such compound. Thus for selecting the proper compounds to be used in sequences, one should be aware of:

- Such compounds have different mode of action.
- They belong to different chemical groups.
- Have no positive cross-resistance between each other.

Reviewing the previous results, it is quite fair to conclude that insecticidal treatments if being done al the proper time (within a protective control programme) considered the most effective agents for controlling both cotton bollworms. Although the application of alpha-cypenmethrin in three successive sprays resulted in protecting the yield efficiently, but form, the practical point of view it is preferable to avoid insecticidal repetition to minimize the risk of developing resistant strains. The forementioned results, confirmed the results that synthetic pyrethroids were the most effective insecticides against bollworms followed by O.P. compounds, while carbamate insecticides were the least effective ones in this respect.

Generally, the application of insecticidal sequence such as chloipyrifos-alpha-cypermethrin-carbaiyl was preferable for controlling bollworms infestation. However, insecticides are the sole remedy that one can trust particularly in case of insect out break. Moreover, the application of insecticides as protecting agents at the beginning of July or before the formation of bolls was generally preferable.

These results agreed with the previous finding of **Watson *et al.* (1981) and Bramhankar *et al.* (1990)** who showed that all treatments of pyrethroids alternated with conventional insecticides provided significantly better results than conventional insecticides (endosulfan, carbaryl and triazophos). Moreover, alternative use of synthetic pyrethroids with conventional insecticides was more cheaply from the economic point of view and gave the most effective level of control (**Mourad *el al*, 1991; Jha *et al*, 1995 and Singh and Cupta, 1993**).

In addition, **Khurana and Verma, 1991; El-Hamaky *et al*, 1993; Sharaf, 2003 and El-Basyouni 2003** reported that synthetic pyrethroids considered the most efficient compounds and were superior to me other types of insecticides during the two seasons Our results also revealed that any given compound if bemg applied in the first or second or third spray resulted in different values of percent reductions of bollworms. in term of figures, carbaryl for instance if being applied in different sprays resulted in average percent reduction of 49.2, 53.3 and 59.0% for the first, 2nd and 3rd spray, respectively (Table 4). This might be due to the fact thaty all tested compounds either applied in the first, second or third spray faced different numbers of bollworms in the pre-spray counts. Moreover, in spite of each sequence (treatment) is consisted of three main insecticides belonging to 3 different chemical groups, but the network (% reduction of bollworms) differed between the different sequences. This means that any given insecticide (within any sequence) will affect the network of the whole treatment (sequence).

Considering the previous facts, the question raised in mind are there any kind of interactions (i.e. accumulative effect, additive effect, synergistic effect, antagonistic effect ...etc.) between the successions of special groups of insecticides.

In the current work, three insecticides were used mainly carbaryl (carbamate) chlorpyrifos (O.P) and alpba-cypermethrin (pyrethrord) to be used in 3 successive sprays. Thus, nine sequences will be got and each insecticide will be used either in the first, second and third spray.

It is a fact that the most proper sequence is the treatment which include spraying the most proper insecticide in the first spray followed by the most proper compound in the second spray and finally include the most proper insecticide in the 3rd spray. Taking the average of percent reduction of bollworms as a good parameter for evaluating the potency of insecticides, it could be easily to compare between the efficiency of a given compound when being applied in the first, second or third spray. Renewing the data presented in Table (4). One can notice that the separate application of each of the three insecticides in the first spray caused different percent reductions of: 57.3, 56.3 and 49.2% for alpha-cypermethrin, chlorpyrifos and carbaryl, respectively. Accordingly, the results revealed that it is not preferable to use carbaryl in the first spray. Moreover, hence there is no significant difference between the potency of chlorpyrifos and alpha-cypennetnrin as their percent reductions of bollworms are 56.3% and 57.3%, respectively. Thus, it is preferable to use chlorpyrifos in the first spray instead of alpha-cypermcthrin, which is also recommended to be used in the second spray to suppress the population density of sucking pests and to avoid the repetition of the pyrethroid compound.

Table (2): Number of bollworm larvae/100 cotton green bolls during 2003 and 2004 cotton seasons.

S. No.	Sequence			Season	After 1[st] spray			After 2[nd] spray			After 3[rd] spray		
	1[st]	2[nd]	3[rd]		Before spray	Week after		Before spray	Week after		Before spray	Week after	
						1 w	2 w		1 w	2		1 w	2 w
1	Carbaryl	Chlorpyrifos	Alpha	2003	2	2	1	1	-	1	1	2	1
				2004	3	4	2	2	3	2	2	6	16
2	Chlorpyrifos	Carbaryl	Alpha	2003	3	5	5	5	2	1	1	1	2
				2004	2	7	4	4	3	3	4	2	
3	Alpha	Carbaryl	Chlorpyrifos	2003	1	1	1	1	1	-	-	1	1
				2004	3	6	3	3	1	3	3	2	12
4	Carbaryl	Alpha	Chlorpyrifos	2003	2	2	1	1	2	-	-	1	3
				2004	1	2	-	-	1	1	1	5	4
5	Chlorpyrifos	Alpha	Carbaryl	2003	4	7	8	8	1	-	-	-	1
				2004	3	10	8	8	3	3	3	2	-
6	Alpha	Chlorpyrifos	Carbaryl	2003	4	5	4	4	-	1	1	-	-
				2004	3	4	2	2	2	2	2	4	-
7	Carbaryl	Carbaryl	Carbaryl	2004	6	10	4	4	5	3	3	4	2
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	2004	4	6	3	3	1	1	2	-	
9	Alpha	Alpha	Alpha	2004	2	5	4	4	4	5	5	2	-
10	Control			2003	3	6	9	9	9	9	9	13	21
				2004	3	12	9	9	16	15	15	32	30

S= Sequence, W= Week, Alpha= Alpha-cypermethrin

Table (3): Average number and % reduction of bollworm larvae/100 cotton green bolls during two cotton seasons

S. No.	Sequence			Av. No. and % reduction	After 1st spray			After 2nd spray			After 3rd spray			Mean of percent reduction
	1st	2nd	3rd		B. spray	Week after		B. spray	Week after		B. spray	Week after		
						1 w	2 w		1 w	2 w		1 w	2 w	
1	Carbaryl	Chlorpyrifos	Alpha	A.N	2.5	3.0	1.5	1.5	1.5	1.5	1.5	4.0	8.5	
				%R		60.0	80.0		92.8	25.0		42.2	0.0	47.3 cd
2	Chlorpyrifos	Carbaryl	Alpha	A.N	2.5	6.0	4.5	4.5	2.5	2.0	2.0	2.5	2.0	
				%R		20.0	40.0		96.0	66.7		33.3	52.9	51.5 bcd
3	Alpha	Carbaryl	Chlorpyrifos	A.N	2.0	3.5	2.0	2.0	1.0	1.5	1.5	1.5	6.5	
				%R		41.7	66.7		96.4	43.8		46.7	0.0	49.2 cd
4	Carbaryl	Alpha	Chlorpyrifos	A.N	1.5	2.0	0.5	0.5	1.5	0.5	0.5	3.0	3.5	
				%R		55.6	88.9		78.4	25.0		0.0	0.0	41.3 d
5	Chlorpyrifos	Alpha	Carbaryl	A.N	3.5	8.5	8.0	8.0	2.0	1.5	1.5	1.0	0.5	
				%R		19.0	23.8		98.2	85.9		64.4	84.3	62.6 ab
6	Alpha	Chlorpyrifos	Carbaryl	A.N	3.5	4.5	3.0	3.0	1.0	1.5	1.5	2.0	-	
				%R		57.1	66.7		97.6	62.5		28.9	100	55.3 bc
7	Carbaryl	Carbaryl	Carbaryl	A.N	6.0	10.0	4.0	4.0	5.0	3.0	3.0	4.0	2.0	
				%R		44.4	77.8		91.0	43.8		28.9	68.6	59.1 abc
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	A.N	2.0	5.0	4.0	4.0	4.0	5.0	5.0	2.0	-	
				%R		16.7	33.3		92.8	63.0		78.7	100	54.7 bc
9	Alpha	Alpha	Alpha	A.N	4.0	6.0	3.0	3.0	1.0	1.0	1.0	2.0	-	
				%R		50.0	75.0		97.6	75.0		6.7	100	67.4 a
10	Control			A.N	3.0	9.0	9.0	9.0	12.5	12.0	12.0	22.5	25.5	
				%R		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

S= Sequence, W= Week, A.N. = Average number, Alpha= Alpha-cypermethrin, %R = Percent reduction.

Table (4): Percent of reduction of bollworms for the different sequences showing the number of sequences and the compounds applied in the different sprays.

No. of Sequence as well as mean % reduction of bollworms in case of using each of the 3 insecticides in the first spray					
Carbaryl		Chlorpyrifos		Alpha-cypermethrin	
S. No.	Mean % red.	S. No.	Mean % red.	S. No.	Mean % red.
1	47.3	2	51.5	3	79.2
4	41.3	5	62.6	6	55.3
7	59.1	8	54.7	9	67.4
Average	49.2		56.3		57.3
No. of Sequence as well as mean % reduction of bollworms in case of using each of the 3 insecticides in the second spray					
2	51.5	1	47.3	4	41.3
3	49.2	6	55.3	5	62.6
7	59.1	8	54.7	9	67.4
Average	53.3		52.4		57.1
No. of Sequence as well as mean % reduction of bollworms in case of using each of the 3 insecticides in the third spray					
5	62.6	3	49.2	1	47.3
6	55.3	4	41.3	2	51.5
7	59.1	8	54.7	9	67.4
Average	59.0		48.4		55.4

S= Sequence

Accordingly, it is quite fair to conclude and recommend that the most proper sequence will include spraying the O.P compound (chlorpyrifos), followed by the pyrethroid compound (alpha-cypermethrin) and carbaryl (the carbamate compound), in the first, 2nd and 3rd sprays, respectively.

It is of great interest to mention that this result agreed fully and coincided with the average of cotton yields during both cotton seasons which ranged between 33.92-36.25 kg/kirate which reflect the percent of protection which ranged between 85.98-88.5% (Tables 5 and 6).

The current results are in good harmony with the previous finding of **Aref (2002)** who found thai the pyrethroid compound sumalpha is the most potent compound followed by Coracrone (O.P) while the carbamate compound larvin is the least effective one in this respect. This result agreed fully with many investigators who stated that synthetic pyrethroids proved to be highly effective in reducing bollworm incidence **(Gupta, *et al.*, 1990; Khidr *et al.*, 1996., Mourad *et al.*, 1991; Khurana and Verma, 1991; Sharaf, 2003 and El-Basyouni, 2003).**

2. Evaluation of some insecticidal sequences on cotton yield:

In the current study we will use the cotton yield (kg/kirate) as a direct and simple parameter for comparing between the efficiency of the different treatments. The percent protection of each treatment with respect to control treatment was also calculated and the data are presented in Tables 44 and 45.

Concerning the cotton yield during 2003 cotton-season, the data presented in Table (5), clearly revealed high correlation benveen percentage of boll infestation along the season and yield loss, hi term of figures, the percent losses of yield are: 16.7, 14.4, 16.3, 18.2, 9.2, 10.1 and 65.6 for the following sequence 1, 2, 3, 4, 5, 6 and 10 respectively. On the other hand, the insecticidal treatments induced good protection.

With respect to the cotton yield during 2004 cotton season, the data presented in Table (6), showed the same effect on the cotton yield loss, alpha-opermethrin in 3 successive sprays induced the highest effect 4.38% losses in cotton yield, while the following sequences; 7, 5 and 9 caused almost the same percent of yield losses which ranged between 8.0-9%. On the other hand, the other treatments could be arranged descendingly according to the percentage of yield losses as follow: sequences 8 (chlorpyrifos in 3 successive sprays) (15.0%); sequences 2 (15.13%); 3 (15.27%); 1 (16.13%) and 4 (17.1%). However, it could be concluded, in general, that the tested treatments induced good protection.

Table (5): The average yield of cotton (Kirate), percentage loss and percentage protection for the different treatments during 2003 cotton season

S. No.	Treatments – No of sprays in order: 1st	2nd	3rd	A	B	C
1	Carbaryl	Chlorpyrifos	Alpha	19.51 c	16.7	74.54
2	Chlorpyrifos	Carbaryl	Alpha	26.72 b	14.4	78.05
3	Alpha	Carbaryl	Chlorpyrifos	22.3 bc	16.3	75.15
4	Carbaryl	Alpha	Chlorpyrifos	19.51 c	18.2	72.3
5	Chlorpyrifos	Alpha	Carbaryl	33.92 a	9.2	85.98
6	Alpha	Chlorpyrifos	Carbaryl	28.59 b	10.1	84.6
7	Control			9.2 d	65.6	0.0

S. No. = Sequence number, Alpha= Alpha-cypermethrin, A = Average of cotton yield (Kg/kirate), B = % of yield losses, C = % protection with respect to control. Means followed by a commom are not significantly at the 5% level by Duncan (1955).

These current results are in agreement with **Feshawi** ***el at.*****, 1991 and El-Feel** ***et al.*****, 1991** who found that a high correlation between percentage of boll infestation along the season and yield loss. Moreover, **Singh and Lakra (1990)** compared between untreated cotton plots and plots treated with synthetic pyrethroids. Fenvalerate and cypermethrin at 30 and 40 g a.i/ha and carbaryl at 0.8 and 1.0 g a.i/ha were effective against P. gossypiella with regard to locule damage, seed cotton yield and number of diapausing larvae. The cost-benefit ratio for fenvalerate, cypermethrin, fenitrothion and carbary were 1: 8.85 1: 13.6, 1:4.3 and 1: 5.7, respectively. **Butter** ***et al.*** **(1990)** reported that cotton treated with Alfamethrin (alpha-cypermethrin) at 0.025 kg a.i/ha had the lowest percentage damage by P. gossypiella and Earias spp., while cypermethrin at 0.05 kg a.i/ha resulted in the highest yields. **Khidr** ***et al.*** **(1996)** mentioned that insecticidal application reduced the incidence of bollworms infestation on cotton and decreased the percentage loss in cotton yield.

Table (6): The average yield of cotton (Kirate), percentage of loss and percentage of protection for the different treatments during 2004 cotton season

Seq.	Treatments			A	B	C
	No of sprays in order					
No.	1st	2nd	3rd			
1	Carbaryl	Chlorpyrifos	Alpha	19.85 ef	16.13	76.89
2	Chlorpyrifos	Carbaryl	Alpha	25.02 d	15.13	78.32
3	Alpha	Carbaryl	Chlorpyrifos	24.55 d	15.27	78.12
4	Carbaryl	Alpha	Chlorpyrifos	18.3 f	17.1	75.5
5	Chlorpyrifos	Alpha	Carbaryl	36.25 ab	8.0	88.5
6	Alpha	Chlorpyrifos	Carbaryl	30.08 c	9.0	87.1
7	Carbaryl	Carbaryl	Carbaryl	34.55 b	8.94	87.19
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	21.35 e	15.0	78.51
9	Alpha	Alpha	Alpha	37.95 a	4.38	93.72
10	Control			56 g	69.8	0.0

Seq. No. = Sequence number, Alpha= Alpha-cypermethrin, A = Average of cotton yield (Kg/kirate), B = % of yield losses, C = % protection with respect to control. Means followed by a commom are not significantly at the 5% level by Duncan (1955).

3. Evaluation of some insecticidal sequences on some predators :

3. a. Evaluation of some insecticidal sequences on *Chrysopa carnea*

Data presented in Table (7) clearly indicate that, according to the general mean of percent reduction of the whole treatment (average of 3 sprays of each sequence), alpha-cypermethrin applied in 3 successive sprays was the most destructive treatment (74. 6% reduction) against *Chrysopa cornea.* Concerning the other tested insecticidal sequences, the data presented in Table (7) revealed that, these treatment exhibited percent reduction in population density of *Chrysopa carnea* ranged between 47.2-65.7%. The foregoing results are in agreement with the results of Song and Chen (2000) found that the highest mortality of natural enemies of the pest was 94,5; 87,1; 70.1 and 61,3% for endosulfan, thiodicarb, methomyl and deltamethrin, respectively. Moreover, **Ma, *et al.* (2000)** mentioned that control was very destructive of coccinellides, chrysopids, Araneae and Hemiptera.

3. b. Evaluation of some insecticidal sequences on *Coccinella spp.*:

The drastic drop in the population density of *Coccinella spp.* in Table (8) occurred as a consequent result of spraying insecticides for controlling cotton bollworms. However, the sequences, 3; 4 and 9 were exhibited the most effective induced 93.6, 92.1 and 90.3% reduction of population density of *Coccmella spp.*, respectively.

In general all tested treatments were very destructive to Coccinella spp. These results are in agreement with finding by **Abbas and EI-Deeb (1993)** who mentioned that due to insecticide treatments the numbers of predators/100 hills in treated plots were always lower compared with those in the control plots. In addition, **Salama *et al.* (2006)** indicated that the side effects of tested compounds on the general ratio of percent reduction in total of six predators were 46.62 and 52.09% in both season.

3. c. Evaluation of some insecticidal sequences on *Scymmus sp.*:

Data presented in Table (9) represent the number and percent reduction of Scymnus sp. during 2004 cotton season. Based on the general mean of percent reduction of insecticidal treatments, all treatments were very destructive and reduced the population density of Scymnus sp. with a value of more than 65.1% reduction except the sequence include spraying chlorpyrifos in three successive sprays which considered the lowest effective treatment (48.3% reduction). The foregoing results are in agreement with finding by **Kostandy (1995)** who showed that the population density of the predators decreased considerably in the fields treated with insecticides. Moreover, **Al-Beltagy *et al* (1999)** found low abundance of *Onus sp.; C. carnnea; Coccinella spp.; P. alfierii; Scymnus sp.* and true spiders in field after insecticidal treatments.

3. d. Evaluation of some insecticidal sequences on true spiders:

The drastic drop in the population density of true spiders presented in Table (10) occurred as a consequent result of spraying insecticides for controlling cotton bollworms. However, the sequences, alpha-cypermethrin in three repetitive sprays and carbaryl in 3 successive sprays were the most destructive with percentages of reduction of 91.7 and 85.9%, respectively.

In general, all tested treatments were very harmful to true spider except, alpha-cypermethrin-carbaryl chlorpyrifos had a moderate effect causing 59.6% reduction in the population density of spider mites.

The current results agreed with findings of many investigators, **Abbas and El-Deeb (1993); Kostandy (1995); Al-Beltagy *et al.* (1999) and Salama *et al.* (2006)** mentioned that significant reduction in spider mite population had occurred and amounted to 29.81 and 37.07% during both seasons, respectively.

Table (7): Average number and percent reduction of *Chrysopa carnea*/20 cotton plant during 2004 cotton seasons

Sequence No.	Sequence			Av. No. and % reduction	After 1st spray			After 2nd spray			After 3rd spray			Mean of percent reduction
	1st	2nd	3rd		B. spray	Week after 1 w	Week after 2 w	B. spray	Week after 1 w	Week after 2 w	B. spray	Week after 1 w	Week after 2 w	
1	Carbaryl	Chlorpyrifos	Alpha	A.N	12	16	45.5	14.5	11	12	12	0.0	0.0	56.1 bcd
				%R		43.9	22.7		34.6	35.3		100	100	
2	Chlorpyrifos	Carbaryl	Alpha	A.N	15	19	17	17	10	16	16	2	0.0	55.0 bcd
				%R		46.7	27.5		49.3	26.5		80.0	100	
3	Alpha	Carbaryl	Chlorpyrifos	A.N	14	17	11	11	8	8.5	8.5	2	0.0	56.3 bcd
				%R		48.8	49.7		37.3	39.6		62.4	100	
4	Carbaryl	Alpha	Chlorpyrifos	A.N	13	20	15	15	7.5	7	7	1	0.0	60.3 bc
				%R		35.2	26.2		56.9	63.5		77.1	100	
5	Chlorpyrifos	Alpha	Carbaryl	A.N	15	18.5	16	16	10	6.5	6.5	0.0	0.0	65.7 ab
				%R		48.1	31.7		46.1	68.3		100	100	
6	Alpha	Chlorpyrifos	Carbaryl	A.N	13	19.5	9.5	9.5	8.5	6	6	2	0.0	47.2 d
				%R		63.2	53.2		22.9	50.7		46.7	100	
7	Carbaryl	Carbaryl	Carbaryl	A.N	14	21	14	14	8	10	10	5	0.0	48.1 cd
				%R		36.8	36.0		50.7	44.2		20	100	
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	A.N	16	22.5	18	12	12	12	0.0	0.0	0.0	59.9 bcd
				%R		40.8	28.0		42.5	47.9		100	100	
9	Alpha	Alpha	Alpha	A.N	12	13	7.5	7.5	4.0	2.0	2	0.0	0.0	74.6 a
				%R		54.4	60.0		54.0	79.2		100	100	
10	Control			A.N	16	38	25	25	29	32	32	20	10	0.0
				%R		0.0	0.0		0.0	0.0		0.0	0.0	

A.N. = Average number, %R = Percent reduction. Alpha= Alpha-cypermethrin, W= WeekMeans followed by a commom are not significantly at the 5% level by Duncan (1955).

Table (8): Average number and percent reduction of *Coccinella spp.*/20 cotton plant during 2004 cotton seasons

Seq. No.	Sequence 1st	Sequence 2nd	Sequence 3rd	Av. No. and % reduction	After 1st spray B. spray	After 1st spray Week after 1 w	After 1st spray Week after 2 w	After 2nd spray B. spray	After 2nd spray Week after 1 w	After 2nd spray Week after 2 w	After 3rd spray B. spray	After 3rd spray Week after 1 w	After 3rd spray Week after 2 w	Mean of percent reduction
1	Carbaryl	Chlorpyrifos	Alpha	A.N	7.5	0.0	1.5	1.5	1.5	0.5	0.5	0.5	0.0	
				%R		100	85.0		20.0	81.0		73.7	100	76.6 b
2	Chlorpyrifos	Carbaryl	Alpha	A.N	9.0	2.0	3.0	3.0	0.5	1.0	1.0	0.0	0.0	
				%R		82.2	75.0		87.5	81.0		100	100	87.6 ab
3	Alpha	Carbaryl	Chlorpyrifos	A.N	9.5	1.0	2.0	2.0	0.0	0.5	0.5	0.0	0.0	
				%R		91.6	84.2		100	85.7		100	100	93.6 a
4	Carbaryl	Alpha	Chlorpyrifos	A.N	8.0	0.0	2.0	2.0	0.0	1.0	1.0	0.0	0.0	
				%R		100	81.3		100	71.4		100	100	92.1 a
5	Chlorpyrifos	Alpha	Carbaryl	A.N	10.0	2	4	4.0	1.5	1.5	1.5	0.0	0.0	
				%R		84.0	70.0		71.9	78.6		100	100	84.1 ab
6	Alpha	Chlorpyrifos	Carbaryl	A.N	11.0	1.5	3.5	3.5	1.0	1.0	1.0	0.0	0.5	
				%R		89.1	76.1		78.6	83.7		100	86.6	85.7 ab
7	Carbaryl	Carbaryl	Carbaryl	A.N	9.0	0.0	6	6.0	1.5	2	2.0	0.0	1.5	
				%R		100	50		81.3	85.7		100	80.9	83.1 ab
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	A.N	10.0	1.0	8.0	8.0	2	2.5	2.5	0.5	1.5	
				%R		92.0	40.0		81.3	82.1		85.7	84.7	77.6 b
9	Alpha	Alpha	Alpha	A.N	9.0	0.0	2.0	2.0	0.0	1.0	1.0	0.0	0.5	
				%R		100	83.3		100	71.4		100	87.3	90.3 ab
10	Control			A.N	12.0	15.0	16.0	16.0	12	28	28	38	110	
				%R		0.0	0.0		0.0	0.0		0.0	0.0	0.0

A.N. = Average number %R = Percent reduction. Alpha= Alpha-cypermethrin, W= Week
Means followed by a commom are not significantly at the 5% level by Duncan (1955).

Table (9): Average number and percent reduction of *Scymmus sp.*/20 cotton plant during 2004 cotton seasons

Sequence No.	Sequence			Av. No. and % reduction	After 1st spray			After 2nd spray			After 3rd spray			Mean of percent reduction
	1st	2nd	3rd		B. spray	Week after		B. spray	Week after		B. spray	Week after		
						1 w	2 w		1 w	2 w		1 w	2 w	
1	Carbaryl	Chlorpyrifos	Alpha	A.N	22	6	2	2	1.0	1.5	1.5	0.0	0.0	65.8 bc
				%R		70.5	89.3		26.7	8.3		100	100	
2	Chlorpyrifos	Carbaryl	Alpha	A.N	22	12	14	14	2	2.5	2.5	0.0	0.0	70.5 abc
				%R		40.9	24.8		79.0	78.2		100	100	
3	Alpha	Carbaryl	Chlorpyrifos	A.N	30	2	4	4	0.0	1.5	1.5	0.0	0.0	81.2 a
				%R		92.8	84.2		100	10		100	100	
4	Carbaryl	Alpha	Chlorpyrifos	A.N	26	6	2	2	1.0	0.5	0.5	0.0	0.0	77.0 ab
				%R		75.0	90.9		26.7	69.4		100	100	
5	Chlorpyrifos	Alpha	Carbaryl	A.N	34	10	10	10	2.0	1.5	1.5	0.0	2.0	64.3 b
				%R		68.1	65.2		70.0	81.7		100	0.0	
6	Alpha	Chlorpyrifos	Carbaryl	A.N	18	0.0	2	2	2.0	0.5	0.5	0.0	2.0	59.4 cd
				%R		100	86.9		0.0	69.4		100	0.0	
7	Carbaryl	Carbaryl	Carbaryl	A.N	34	0.0	6	6	0.0	1.0	1.0	0.0	2.0	78.1 a
				%R		100	79.1		100	89.6		100	0.0	
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	A.N	18	6	2	2	1.5	1.0	1.0	0.0	1.0	48.3 d
				%R		63.9	86.9		0.0	38.9		100	0.0	
9	Alpha	Alpha	Alpha	A.N	20	0.0	2	2	0.5	1.0	1.0	0.0	1.0	65.1 c
				%R		100	88.2		63.3	38.9		100	0.0	
10	Control			A.N	26	24	22	22	15	18.0	18	5	8	
				%R		0.0	0.0		0.0	0.0		0.0	0.0	

A.N. = Average number %R = Percent reduction. Alpha= Alpha-cypermethrin, W= Week
Means followed by a commom are not significantly at the 5% level by Duncan (1955).

Table (10): Average number and percent reduction of true spiders/20 cotton plant during 2004 cotton seasons

Sequence No.	Sequence			Av. No. and % reduction	After 1st spray			After 2nd spray			After 3rd spray			Mean of percent reduction
	1st	2nd	3rd		B. spray	Week after		B. spray	Week after		B. spray	Week after		
						1 w	2 w		1 w	2 w		1 w	2 w	
1	Carbaryl	Chlorpyrifos	Alpha	A.N	19	5.0	15.0	15.0	3.0	2.0	2.0	0.0	1.0	
				%R		65.9	50.4		65.0	86.7		100	53.8	70.3 cd
2	Chlorpyrifos	Carbaryl	Alpha	A.N	20	15.0	4.0	4.0	0.0	0.5	0.5	0.0	0.0	
				%R		67.6	87.4		100	75.7		100	100	88.5 ab
3	Alpha	Carbaryl	Chlorpyrifos	A.N	18	2.5	4.0	4.0	1.0	2.5	2.5	1.0	0.5	
				%R		82.0	86.0		56.3	0.0		52.0	81.5	59.6 d
4	Carbaryl	Alpha	Chlorpyrifos	A.N	18	3.5	8.0	8.0	0.5	1.0	1.0	0.0	0.0	
				%R		74.8	72.1		89.1	63.5		100	100	83.3 ab
5	Chlorpyrifos	Alpha	Carbaryl	A.N	20	8.0	14	14.0	1.5	1.5	1.5	0.0	1.0	
				%R		48.2	56.0		81.2	68.8		100	38.5	65.6 de
6	Alpha	Chlorpyrifos	Carbaryl	A.N	24	0.0	6.0	6.0	2.0	1.0	1.0	0.0	0.0	
				%R		100	84.3		41.7	51.4		100	100	79.6 bc
7	Carbaryl	Carbaryl	Carbaryl	A.N	22	4.0	5	5.0	0.5	0.5	0.5	0.0	0.0	
				%R		76.5	85.7		82.5	70.8		100	100	85.9 ab
8	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos	A.N	21	12	7.5	7.5	0.5	2.0	2.0	0.0	0.0	
				%R		26.0	77.6		88.3	22.2		100	100	
9	Alpha	Alpha	Alpha	A.N	18.5	0.0	4.0	4.0	0.0	0.5	0.5	0.0	0.0	
				%R		100	86.4		100	63.5		100	100	69.0 cd
10	Control			A.N	22	17	35	35	20	12	12	10	13.0	
				%R		0.0	0.0		0.0	0.0		0.0	0.0	91.7 a

A.N. = Average number %R = Percent reduction. Alpha= Alpha-cypermethrin, W= Week

Means followed by a commom are not significantly at the 5% level by Duncan (1955).

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الملخص العربي

تقيم بعض التباديل المختلفة لبعض المبيدات المختبرة ضد دودة ورق القطن والمحصول وعلى بعض الاعداء الحيوية

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تم التقيم الحقلى لثلاثة مبيدات (الكارباريل والكلوربيروفوس والفا- سيبرمثرين) وذلك فى تسع تتابعات مختلفة ضد ديدان اللوز القرنفلية والشوكية. لقد اوضحت النتائج ان الاصابة بديدان اللوز فى كلا الموسمين تبدأ فى اواخر شهر يوليو ثم تزداد تدريجيا حتى تصل لاقصاها فى نهاية الموسم وتعتبر المبيدات الحشرية من افضل الوسائل المستخدمة فى عملية المكافحة. اوضحت النتائج ان استخدام الالفا-سيبرمثرين فى ثلاث رشات متتالية هو افضل تتابع ولكنه لا يفضل من ناحية المكافحة تجنبا لظهور صفة المقاومة. تعتبر المبيدات البيرثرويدية من اكثر المركبات فاعلية ضد ديدان اللوز يليها مركبات الكارباميت بينما اقلها المركبات الفوسفورية العضوية. افضل تتابع فى برنامج مكافحة ديدان اللوز هو الكلوربيروفوس- الفا سيبرمثرين – الكارباريل.

اوضحت النتائج وجود علاقة وثيقة بين النسبة المئوية للاصابة طول الموسم ونسبة الفقد فى المحصول. كما اوضحت النتائج ان استخدام الالفا- سيبرمثرين فى ثلاث رشات متتالية قد احدث نسبة فقد فى المحصول قدرها ٤,٣٨% بينما الكارباريل - الفا سيبرمثرين – الكلوربيروفوس قد احدثت نسبة قدرها ١٧,١% وذلك بالمقارنة بالكنترول ٦٩,٨%.

تهدف هذه الدراسة ايضا الى تقيم تتابعات المبيدات الحشرية المستخدمة لمكافحة ديدان اللوز وتاثيرها على المفترسات وذلك بحساب النسبة المئوية للخفض. فقد احدث استخدام الفا سيبرمثرين فى ثلاث رشات متتالية خفض بنسبة ٧٤,٦% ضد اسد المن اما التتابعات الاخرى احدثت خفض فى اسد المن يتراوح بين ٤٧,٢-٦٥,٧%. عموما كل المركبات المختبرة احدثت خفض فى تعداد ابو العيد والاسكمنس.