Evaluation of Certain Insect Growth Regulators and some Insecticides against The Cotton Leaworm and Bollworms in Field Cotton and Their Effect on Yield

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ABSTRACT

The present study was carried out during the season of 2013 to evaluate two insect growth regulators (IGRs) and two organophosphorous insecticides against the cotton leafworm *Spodoptera litorallis* (Boisd) as well as three pyrethroids against the cotton bollworms (the pink and spiny bollworms) in El-Beheira Governorate. In addition to, effect of these tested compounds on cotton yield was studied.

The results in general revealed that the IGRs had general means of infestation reduction percentages of cotton leafworm ranged between 87.4 % (Dimifron) and 85.6 % (Deflox) ,while, the organophosphorous insecticides as Nasr-Phos gave 84.7 % and Adwuprof gave 83.9%. Alfa-Power as a synthetic pyrethroid gave higher reduction of cotton bollworm with higher percentage increase of cotton yield (84.4 and 118.1 %, in respect) followed by Pest-Pox and Nasr-Thrin as follow.

INTRODUCTION

In Egypt, the cotton crop occupies the most important place among agriculture strategy. The cotton production suffers from the injury of numerous pests during the different stages of its development especially, cotton leafworm, *Spodoptera litorallis* (Boisd) and cotton bollworms; pink bollworm, *Pectinophora gossypiella* (Saund.) & spiny bollworm *Earias insulana* (Boisd.) which attack cotton in fruiting stage. These pests cause a severe reduction of yield and quality, losses extended to oil content in the seeds (Amin and Gergis, 2006). The intensive application of pesticides may lead to drastic effect on the natural enemies, besides the higher expense and hazard to health and environment, so that, the present study was conducted to evaluate certain insecticides on some cotton pests. The Insect growth regulators (IGR's) compounds; Diflubenzuron in two trad names (Deflox $ Dimifron) for the control of cotton leafworm, in addition to, profenofos as Nasr-Phos & Adwuprof as organophorous compounds are evaluated. The insecticides of alpha-cypermethrin (Pest-Pox), cypermethrin (Nasr-Thrin) and alfa-cypermethrin (Alfa-Power) were used against cotton bollworms, in addition to evaluate their effect on cotton yield.

MATERIALS AND METHODS

- Pesticides used

The tested pesticides and their applied rates are presented in Table (1).

Table 1. The tested pesticides and their application rates which used in this study

Pesticides	Rate of application / feddan
Diflubenzuron 25% WP (Dimifron)	250 gm
Diflubenzuron 48% SC (Deflox)	125 cm^3
Profenofos 72 % EC (Nasr-Phos)	750 cm^3
Profenofos 72 % EC (Adwuprof)	750 cm^3
Alpha-Cypermethrin10 % EC (Pest-Pox)	250 cm^3
Cypermethrin 25 % EC (Nasr-Thrin)	250 cm^3
Alfa-Cypermethrin 10 % EC (Alfa-Power)	250 cm^3

- Experiment

For the cotton leafworm; an area was ¼ feddan (1050m^2) for each treatment which divided into four replicates (262.5 m^2 for each replicate), in addition to an untreated check. An area for the cotton bollworm was half feddan which equally divided among the evaluated treatments. The field experiments were carried out at the Abo-Homos center, El-Bheira Governorate during season of 2013.

-Sampling:

- The cotton leafworm (CLW) *Spodoptera litorallis* (Boisd.)

Randomly 25 cotton plants were chosen to count the CLW larvae in the early morning before and after treatment. Examination was performed after 24 hours of the conventional compounds and three days for (IGR's) in order to calculate the initial reduction effect (I.R.E.) Moreover, the latent reduction effect (L.R.E.) was carried out after 7 and 10 days of application. The

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percentage reduction of infestation was recorded according to Henderson and Tilton (1955). Insecticides application was started on July, 7, 2013 and sprayed using the back motor (80 liter/ treatment).

-The cotton bollworm:

Weekly samples of 25green bolls were collected just before spray and 7 & 14 days after each spray and they were externally and internally inspected. The numbers of larvae in green bolls were calculated to compare the efficacy of the tested insecticides with the untreated check.

The spraying was starting on August, 15, 2013 and the three sprays for each insecticide were done and the consequent spray was carried out two weeks after the previous one. In all treatments the back motor was used with 80 liter of spraying preparation / feddan/treatment.

Computer programs IRRISTAT and Duncan's Multiple Range tests were used to compare the average numbers of mites and/or insects according to the method of Snedecor and Cochran (1967).

- Determination of cotton yield

In each treatment ripened open bolls from twenty five cotton plants were collected to determine the cotton yield / plant, from which, the total yield / feddan was relatively calculated.

RESULTS AND DISCUSSION

-Effect of IGRs and Organophorous insecticides on cotton leafworm

- Effect of IGRs

The results in Table (2), showed that the IGRs are highly effective to reduce the cotton leafworm and the two evaluated compounds were not significantly differed. The cotton leafworm values were 169.75, 173.25 and 961.5 larvae /25 leaves after 3 days, 121.25, 130.5 and 944.75 larvae /25 leaves after 7 days and 104, 110 and 939.5 larvae /25 leaves after 10 days for Dimifron® & Deflox® and check treatments, respectively.

On the other hand, Dimifron® gave initial reduction effect as 83.9 %, latent reduction effect as 89.1 % followed by Deflox® which gave 82,2% & 87.3%, respectively.

In general, the overall mean numbers were 131.66&137.91 larvae /25 leaves) for Dimifron®& Deflox®, respectively in comparison to untreated Check (948.58 larvae /25 leaves). On the other hand, the overall mean reduction values were 87.4 % & 85.6, in respect.

Table 2. Effect of IGRs application on the cotton leafworm

Inspection dates	Replicates	Treatments					
		Dimifron®		Deflox®		Untreated Check	
		N.B.S*	N.A.S**	N.B.S	N.A.S	N.B.S	N.A.S
3 Days	1	807	173	777	191	617	920
	2	435	134	564	169	485	821
	3	869	219	628	189	698	1002
	4	868	153	722	144	915	1103
	Means numbers	—	169.75 b	—	173.25 b	—	961.5 a
	I.R.E.****	—	83.9	—	82.2	—	—
7 Days	1	807	119	777	179	617	820
	2	435	81	564	113	485	795
	3	869	129	628	99	698	931
	4	868	156	722	131	915	1233
	Means numbers	—	121.25 b	—	130.5 b	—	944.75 a
	Reduction%	—	88.3	—	86.3	—	—
10 Days	1	807	110	777	117	617	875
	2	435	74	564	105	485	782
	3	869	113	628	119	698	955
	4	868	119	722	99	915	1146
	Means numbers	—	104 b	—	110 b	—	939.5 a
	Reduction%	—	89.9	—	88.3	—	—
Overall Means Numbers		—	131.66b	—	137.91b		948.58a
L.R.E***		—	89.1	—	87.3	—	—
Overall mean of Reduction %		—	87.4	—	85.6	—	—

*N.B.S =Number Before Spray ** N.A.S =Number After Spray

*** L.R.E =Latent Reduction % Effect **** I.R.E= Initial Reduction % Effect

The above mentioned results were in agreement with Abo-Elghar *et. al*. (1980) where they reported the diflubenzuron exhibited an inhibitory activity in suppressing the number of deposited egg-masses, Ibrahim *et al.* (2000) when they tested diflubenzuron and pyriproxyfen against the cotton leafworm. Nedal (2012), reported that the occurrence of lipid peroxidation due to IGRs treatment in the larval tissues in *S.littoralis* larvae enhanced different antioxidant defensive system to overcome its effect. So that, Zidan, (2013) showed that, the IGRs exhibited distinguished high preventive effect on reducing fecundity of *S.littoralis, Bemisia tabaci* indirectly.

- Effect of Organophorous insecticides

The illustrated data in Table (3) showed that there are no significant differences between the means values of cotton leaf worm between the treatments which amounted to 130.50 & 157.5 larvae /25 leaves for the Insecticide of Nasr-Phos® &Adwuprof®, in respect after 24 hours of application but still less than untreated check (961.5 larvae /25 leaves), the same trend was detected after 7 & 10 days which amounted (112.25, 153 & 113.5, 152.25 larvae /25 leaves, respectively) in comparison to untreated check 944.75 &939.5, in respect).

On the other hand, the initial reduction effect was recorded as 83.7 % & 83.2 for Adwuprof® & Nasr-Phos®, respectively, while, the latent reduction effect was 84.06 & 85.4, in respect.

In general, the overall mean numbers were 118.75& 154.25 larvae /25 leaves for the insecticides of Nasr-Phos® & Adwuprof®, respectively in comparison to untreated check 948.58 larvae /25 leaves, and the overall mean reduction amounted as 84.7 &83.9, in respect.

The obtained results are agreed with Mohamed *et. al.* (2011) where they indicated that Profenofos and Pyriproxyfen is highly effective in controlling larvae of cotton leaf worm on cotton plants followed by ,Spinosad. Reda *et.al.* (2013) also indicated that Profenofos, Pyriproxyfen and Spinosad are the most effective in larval mortality, on pupation stage, pupal weights.

-Effect of the pyrethroids on cotton bollworm

The results in Table,4, exhibited that after the first spray, there are no significant differences between the means of the infested bolls between the treatments, but still less than untreated check (11.87 bolls/25 bolls) where the values were as follow: 1.25, 1.62 and 2,0 bolls/25bolls for Alfa-Power, Pest-Pox and Nasr-Thrin.

Table 3. Effect of Organophosporous compounds on the cotton leafworm

Inspection dates	Replicates	Treatments					
		Nasr-Phos®		Adwuprof®		Untreated Check	
		N.B.S*	N.A.S**	N.B.S	N.A.S	N.B.S	N.A.S
24 hours	1	428	119	569	130	617	920
	2	530	129	511	141	485	821
	3	538	139	877	179	698	1002
	4	686	135	763	180	915	1103
	Means numbers	—	130.5b	—	157.5b	—	961.5a
	I.R.E****	—	83.2	—	83.7	—	—
7 Days	1	428	88	569	115	617	820
	2	530	99	511	121	485	795
	3	538	113	877	189	698	931
	4	686	149	763	187	915	1233
	Means numbers	—	112.25b	—	153b	—	944.75a
	Reduction%	—	85.6	—	84.03	—	—
10 Days	1	428	84	569	109	617	875
	2	530	109	511	117	485	782
	3	538	122	877	192	698	955
	4	686	139	763	191	915	1146
	Means numbers	—	113.5b	—	152.25b	—	939.5a
	Reduction%	—	85.2	—	84.06	—	—
Overall Means Numbers		—	118.75b	—	154.25b		948.58a
L.R.E***		—	85.4	—	84.06	—	—
Overall average of Reduction %		—	84.7	—	83.9	—	—

*N.B.S =Number Before Spray ** N.A.S =Number After Spray

*** L.R.E =Latent Reduction % Effect **** I.R.E= Initial Reduction % Effect

Table 4. Numbers of infested bolls with bollworms before and after application of Pyrethroids

N. Spray	Inspections	Replicates	Treatments							
			Pest-Pox®		Nasr-Thrin®		Alfa-Power®		Untreated Check	
			N.B.S*	N.A.S**	N.B.S	N.A.S	N.B.S	N.A.S	N.B.S	N.A.S
1st Spray	1st inspection	1	3	1	2	2	3	1	3	10
		2	3	2	3	2	1	1	2	11
		3	2	1	2	2	3	1	3	12
		4	3	2	2	2	2	1	3	13
		Average	2.8	1.5	2.3	2	2.3	1	2.8	11.5
	2nd inspection	1	3	2	2	2	3	2	3	14
		2	3	2	3	2	1	1	2	10
		3	2	1	2	2	3	1	3	13
		4	3	2	2	2	2	2	3	12
		Average	2.8	1.8	2.3	2	2.3	1.5	2.8	12.3
General Means Numbers of Spray			—	1.62b	—	2b	—	1.25b	—	11.87a
2nd Spray	3rd inspection	1	2	2	2	2	2	1	3	12
		2	2	1	2	2	1	1	2	13
		3	1	1	2	2	1	1	3	13
		4	2	2	2	1	2	2	3	14
		Average	1.8	1.5	2	1.8	1.5	1.3	2.8	13
	4th inspection	1	2	2	2	2	2	1	3	15
		2	2	2	2	2	1	1	2	14
		3	1	1	2	2	1	1	3	13
		4	2	1	2	2	2	1	3	15
		Average	1.8	1.5	2	2	1.5	1	2.8	14.3
General Means Numbers of Spray			—	1.5bc	—	1.87b	—	1.12c	—	13.62a
3rd Spray	5th Inspection	1	2	2	2	2	1	1	3	14
		2	2	3	2	3	1	1	2	16
		3	1	1	2	2	1	1	3	15
		4	1	1	2	2	1	1	3	17
		Average	1.5	1.8	2	2.3	1	1	2.8	15.5
	6th Inspection	1	2	2	2	2	1	1	3	16
		2	2	2	2	3	1	1	2	17
		3	1	1	2	3	1	1	3	16
		4	1	1	2	2	1	1	3	18
		Average	1.5	1.5	2	2.5	1	1	2.8	15.5
General Means Numbers of Spray			—	1.62bc	—	2.37b	—	1c	—	16.12a
Overall Means Numbers for each Insecticide			—	1.58bc	—	2.08b	—	1.12c	—	13.87a

*N.B.S =Number Before Spray ** N.A.S =Number After Spray

The obtained data after second and third sprays showed Alfa-Power gave the least mean numbers of bolls 1.12 and 1.0 bolls/25 bolls, in respect in comparison to untreated check (13.62and 16.12,respectively), followed by the treatment of Pest-Pox (1.50 & 1.62, in respect), followed by Nasr-Thrin (1.87 & 2.37 bolls/25 bolls). In general, the overall means numbers were as 1.12, 1.58 and 2.08 bolls/25 bolls for the Alfa-Power, Pest-Pox and Nasr-Thrin, respectively.

After the first spray, the pyrethroid of Pest-Pox gave the highest reduction as 86.9% followed by Alfa-Power 85.7 % and Nasr-Thrin 78.5% (Table,6), while, after the second and third spray the pyrethroid of Alfa-Power gave higher reduction (84 & 83.4 %, in respect), followed by Pest-Pox (82.1 & 82.7%, respectively) and Nasr-Thrin (81.2 & & 80.8 %, in respect). In general, the overall mean of reduction values were 84.4, 83.9 & 80.2 % for the pyrtethroids of Alfa-Power, Pest-Pox and Nasr-Thrin, respectively (Table, 5).

Table 5. Reduction percentage of infested bolls with bollworm after application with Pyrethroid

N. Spray	Inspections	Replicates	The percentage Reduction %		
			Insecticides		
			Pest-Pox®	Nasr-Thrin®	Alfa-Power®
1st Spray	1st inspection	1	90	70	90
		2	88	88	82
		3	87.5	75	91.7
		4	84.7	77	88.5
		M. Reduction%	87.6	77.5	88.05
	2nd inspection	1	86	79	86
		2	86.7	86.7	80
		3	88.5	77	92.3
		4	83.3	75	75
		M. Reduction%	86.1	79.4	83.3
General Means Reduction % of Spray			86.9	78.5	85.7
2nd Spray	3rd inspection	1	75	75	87.5
		2	92.5	85	85
		3	77	77	77
		4	79	89.5	79
		M. Reduction%	80.9	81.6	82.1
	4th inspection	1	80	80	90
		2	86	86	86
		3	77	77	77
		4	90	80	90
		M. Reduction%	83.3	80.8	85.8
General Means Numbers of Spray			82.1	81.2	84
3rd Spray	5th Inspection	1	79	79	79
		2	82	82	88
		3	80	80	80
		4	83	83	83
		M. Reduction%	81	81	82.5
	6th Inspection	1	82	82	82
		2	89	83.5	89
		3	82	73	82
		4	84	84	84
		M. Reduction%	84.3	80.6	84.3
General Means Reduction of Spray			82.7	80.8	83.4
Overall Mean of Reduction			83.9	80.2	84.4

Table 6. Effect of certain Pyrethroid on infestation and cotton yield

Insecticides	Cotton Yield	
	Weight /fdd. Kg (Kent.)	% * Increase
Pest-Pox®	1575 Kg (10 Kent.)	81.8 %
Nasr-Thrin®	1260 Kg (8 Kent.)	45.5 %
Alfa-Power®	1890 Kg (12 Kent.)	118.1 %
Untreated Check	866.25 Kg (5.5 Kent.)	—

* expressed as % of increase in proportion t the untreated check, according to Hussein *et al*. (2002).

-Effect of certain pyrethroid on cotton yield

The pyrethroid compounds asAlfa-Power® gave a high percentage increase of cotton yield in comparison to untreated check (118.1%) followed by Pest-Pox® (81.1%) and Nasr-Thrin (45.5%) (Table,6).

The obtained results are in agreement with Sanaa (2010) who reported that the seed cotton yield averaged 7.65kentar/Feddan (157kg/4200m2) for alpha-cypermethrin alone, 7.187 for alpha-cypermethrin/flufenoxuron mixture compared to3.427 for the untreated check

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الملخص العربي

تأثير بعض منظمات النمو الحشرية والمبيدات الكيماوية ضد دودة ورق القطن وديدان اللوز فى حقول القطن وتأ ثيرها على الإنتاجية

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إجريت الدراسة الحالية خلال موسم ٢٠١٣ بغرض تقييم مستحضرين من منظمات النمو الحشرية ومستحضرين من المبيدات الفوسفورية ضد دودة ورق القطن وثلاثة مركبات من مجموعة البيرثرويدات ضد ديدان اللوز (دودة اللوز القرنفلية والشوكية) وذلك فى محافظة البحيرة. بالإضافة إلى دراسة تأثير تلك المركبات على إنتاجية محصول القطن.

بصفة عامة أظهرت النتائج أن منظمات النمو الحشرية أعطت معدل خفض عالى لدودة ورق القطن وتراوحت مابين ٨٧.٦% (مركب ديميفرون)، ٨٥.٦ (مركب ديفلوكس)، بينما أعطت المركبات الفوسفورية مثل نصر فوس ٨٤,٧ %، مركب أدوبيروف ٨٣.٩ %. أعطى مركب ألفا باور كمركب بيروثرويدى نسبة خفض عالية لديدان اللوز مع زيادة مرتفعة فى المحصول (٨٤.٤ %، ١١٨.١%، على الترتيب) يليه مركب بست بوكس ثم مركب نصر ثرين.