

**FIELD EVALUATION OF SOME INSECTICIDES AGAINST *Spodoptera littoralis* AND INSECT PREDATOR *Coccinella* spp. IN COTTON FIELDS**

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**ABSTRACT**

*The Egyptian cotton leafworm is considered the major pest that causes great damage to cotton plants as well as other vegetable crops in Egypt. This study was planned to evaluate the efficacy of emamectin benzoate, indoxacarb and lufenuron compounds against the cotton leafworm, *Spodoptera littoralis* and its natural predator *Coccinella* spp. during the two successive seasons of 2017 and 2018.*

*The obtained results indicated that lufenuron compound was the most against the cotton leafworm followed by emamectin benzoate during the two experimental seasons; while the indoxacarb was the lowest toxic on *Coccinella* spp.*

*Conclusively, it could be recommended to use lufenuron and indoxacarb insecticides to control the cotton leafworm in cotton fields with relatively low effect on natural predator.*

**Keywords:** Cotton leafworm – *Coccinella* spp.- insecticides.

**INTRODUCTION**

The Egyptian cotton leafworm, *Spodoptera Littoralis* (Boisd.) (Lepidoptera: Noctuidae) is an economically important polyphagous pest, that causes considerable destruction to numerous important crops in Egypt (Rawi *et al.*, 2011 and Kandil *et al.*, 2003). Chemical insecticides are the most effective control means for this pest, but this approach has become less attractive due to its side effects in natural balance between pests and their natural enemies (Gamil *et al.*, 2011). The ultimate aim of recent studies focuses on evaluation of various insecticides to control the cotton leafworm without affecting its natural predators.

On the other hand, many researchers in the field of insect control found that the lufenuron showed high efficiency against *S.littoralis* (El-Sheikh and Amir, 2011). Also, the decreasing of pesticides application allow to build up the population of predators such as *Coccinella* spp. And *Chrysoperla sinica* (Tabozada *et al.*, 2015).

Therefore, present study aimed to evaluate the toxic effect of two insecticides and one insect growth regulator on cotton leafworm and ladybird beetles in cotton field.

## **MATERIALS AND METHODS**

Field experiments were carried out in Sharkia Governorate, Egypt during cotton growing seasons of 2017 and 2018. To evaluate the efficiency of two insecticides and one insect growth regulator (IGR) against *S.littoralis* and its side effects on the predator, *Coccinella* spp.

The experiment area about 1.5 feddans cultivated with cotton plants divided into 3 treatments as well (untreated), each treatment presented by three replicates each was 1/20 feddan, the experimental plots were arranged as completely randomized design. Cotton plants sprayed with tested compounds at recommended rates using Knapsack motor sprayer (solo) (20 liters water). Randomly twenty five cotton plants of each replicate were inspected actually in the field, the numbers of *S. littoralis* larvae and *Coccinella* individuals were counted and recorded just before and after one day (initial kill), 7 and 10 days (residual effect) of spraying with insecticides (emamectin benzoate and indoxacarb), while the treatment of lufenuron was inspected after three days (initial kill), 7 and 10 days (residual effect). The reduction percentages of pest and *coccinella* spp. were calculated according to Henderson and Tilton (1955) equation.

### ***Statistical analysis:***

All obtained results were statistically analyzed as one way completely randomized ANOVA to determine the significance of differences between means according to Little and Hills (1975) using COSTAT Statistical Software Program (2005).

## **RESULTS AND DISCUSSION**

### **1- *Efficiency of the tested insecticides against larvae of cotton leafworm, S. littoralis:***

Data given in Tables (1 and 2) summarize the efficiency of the tested insecticides against *S. littoralis* on cotton plants during 2017 and 2018

seasons. All investigated compounds were found to reduce *S. littoralis* population in treated plots comparing to that of control.

**1.1- Season of 2017:**

Results in Table (1), the highest reduction percentage of initial kill was 92.57% recorded for emamectin benzoate after 24 hr of spraying followed by 79.17% recorded for lufenuron after 3 days; while the lowest initial effect of 78.00% was recorded for indoxacarb.

In the same trend, the highest residual effect of 90.08% was recorded for emamectin benzoate at 7 days post treatment followed by 82.87% and 74.67% for lufenuron and indoxacarb, respectively. Additionally, after 10 days, lufenuron was still effective and recorded the highest residual effect of 96.47% followed by emamectin benzoate with 71.71%; while indoxacarb recorded the lowest residual effect of 67.13%.

Regarding to the reduction percentages of residual effect, the results cleared significant difference among treatments, where the highest ( $P \leq 0.05$ ) mean of 89.67% was calculated for lufenuron compound; while indoxacarb recorded the mean of 70.95%. In the same trend, the obtained results cleared high significant differences ( $P \leq 0.05$ ) between the annual mean of reduction percentage during 2017 season.

**Table (1):** Reduction of *S. littoralis* larvae in cotton fields treated with the tested insecticides during season of 2017

Treatments		Pre-count	Initial kill		Residual effect		Residual mean of % reduction	Annual mean % of reduction
			1 day	3 days	7 days	10 days		
<b>Emamectin benzouat</b>	No	219.0	17.67		23.33	62.33		
	%		92.57		90.08	71.71	84.39 <sup>a</sup>	84.79 <sup>a</sup>
<b>Lufenuron</b>	No	218.0		48.33	40.33	8.33		
	%			79.17	82.87	96.47	89.67 <sup>a</sup>	86.17 <sup>a</sup>
<b>Indoxacarb</b>	No	218.0	47.00		58.33	73.67		
	%		78.94		74.67	67.13	70.95 <sup>b</sup>	73.61 <sup>b</sup>
<b>Control</b>	No	201.0	206.67	214.0	217.0	220.0		
<b>LSD 0.05</b>							<b>7.53</b>	<b>1.62</b>

a,b Means are bearing different letters, different significantly ( $P \leq 0.05$ ).

**Table (2):** Percentages of *S. littoralis* in cotton fields treated with the tested insecticides during season of 2018.

Treatments		Pre-count	Initial kill		Residual effect		Residual mean of % reduction	Annual mean % of reduction
			1 day	3 days	7 days	10 days		
<b>Emamectin benzoate</b>	No	182.67	18.67		22.33	37.33		
	%		91.50		89.45	80.60	85.03 <sup>b</sup>	87.18 <sup>a</sup>
<b>Lufenuron</b>	No	160.67		27.00	22.33	17.33		
	%			85.10	89.20	91.04	90.12 <sup>a</sup>	88.45 <sup>a</sup>
<b>Indoxcarb</b>	No	161.67	33.67		42.67	53.67		
	%		80.29		77.47	73.11	74.96 <sup>c</sup>	76.73 <sup>b</sup>
<b>Control</b>	No	162.67		181.67	190.67	195.67		
	%		171.33					
<b>LSD 0.05</b>							<b>1.67</b>	<b>1.39</b>

a,b,c Means are bearing different letters, different significantly ( $P \leq 0.05$ ).

The highest significantly ( $P \leq 0.05$ ) annual mean reduction of 86.17% was recorded with lufenuron followed by 84.79 and 73.61% for emamectin benzoate and indoxcarb, respectively. The obtained results found in agreement with that of Abdu-Allah (2010) who noted that emamectin benzoate is one of the best bio-insecticides in controlling cotton leafworm, *S. littoralis* larvae infestations in cotton fields.

### 1.2- Season of 2018:

Data in Table (2) cleared that emamectin benzoate was the most effective as reduction percentage of initial kill recorded the highest percentage of 91.50% after 24hr of treatment followed by 85.10% for lufenuron after 3 days; while indoxcarb recorded the lowest initial effect.

Additionally, after 7 days, the highest reduction percentage of 89.45% was recorded on cotton plants treated with emamectin benzoate; while the lowest percentage of 77.47% was recorded in indoxcarb. Also, after 10 days, the highest reduction percentages of residual effect were 41.04, 80.60 and 73.11% for lufenuron, emamectin benzoate and indoxcarb, respectively (Table 2).

In regard to the mean of residual reduction percentages, data represented in Table (2) cleared highly significant differences between treatments. The highest mean effect significantly ( $P \leq 0.05$ ) of 90.12% was recorded with lufenuron; while the lowest effect of 74.96% was recorded for indoxcarb.

Concerning to the annual mean of reduction percentages during the season of 2018, the obtained results in Tables (2) cleared highly significant differences ( $P \leq 0.05$ ) between tested pesticides. The highest mean of 88.45% was recorded for lufenuron followed by 87.18% and 76.73% for emamectin benzoate and indoxcarb, respectively. This result was confirmed by Al-Shannaf and Ammar (2011) who found that the radical compound (emamectin benzoate) gave the highest initial reduction percentage and gave the best tool of integrated control of *S. littoralis* and *Helicoverpa armigera* followed by the mixture of chlorpyrifos and Consult and Dursban only on peanut fields. Also, they added that the highest mean residual reduction percentage was recorded with radical compound.

**2- Efficiency of the tested insecticides against the lady beetels, *Coccinella* spp. under field conditions:**

To evaluate the efficacy of emamectin benzoate, indoxacarb and lufenuron compounds against *Coccinella* spp., these field trials were carried out during the two successive seasons of 2017 and 2018 as shown in Tables (3 and 4).

**2.1- Season of 2017:**

As tabulated in Table (3), results cleared that during the season 2017 emamectin benzoate was the most effective on the reduction percentage of initial kill where it recorded 80.49% followed by 73.61% and 67.92% for indoxacarb and lufenuron, respectively.

**Table (3):** Percentages of *Coccinella* spp. in cotton fields treated with the tested insecticides during season of 2017.

Treatments		Pre-count	Initial kill		Residual effect		Residual mean of % reduction	Annual mean % of reduction
			1 day	3 days	7 days	10 days		
Emamactin benzuate	No	5.21	1.27		2.14	5.28		
	%		80.49		72.46	42.59	57.52 <sup>b</sup>	65.18 <sup>b</sup>
Lufenuron	No	4.28		1.74	1.84	1.61		
	%			67.92	71.48	78.72	75.10 <sup>b</sup>	72.20 <sup>a</sup>
Indoxacarb	No	4.24	1.40	3.28	3.28	3.65		
	%		73.61	48.15	48.15	50.94	58.55 <sup>c</sup>	57.57 <sup>c</sup>
Control	No	4.00	5.00	5.00	6.00	7.00		
L.S.D							<b>2.30</b>	<b>1.83</b>

a,b,c Means are bearing different letters, different significantly ( $P \leq 0.05$ ).

In the same trend, data in Table (3) revealed the highest residual significantly ( $P \leq 0.05$ ) effect of 72.46 and 71.48% were recorded for emamectin benzoate and lufenuron at 7 days post treatment followed by 48.15% recorded with indoxacarb as comparing with the control. Additionally, after 10 days, lufenuron was the most effective as it recorded the highest residual effect 78.72% followed by indoxacarb and emamectin benzoate which recorded 50.55 and 42.59%, respectively at the lowest residual effect.

Regarding residual mean of percent reduction, data represented in Table(3) cleared high significant differences ( $P \leq 0.05$ ) between treatments. The highest residual effect was 75.10% when cotton plant was sprayed with lufenuron followed by 58.55% and 57.52% for indoxacarb and emamectin benzoate, respectively.

In the same trend, the highly significant differences were found between the grand mean of reduction during 2017 season. The highest grand mean of 72.20% with lufenuron too, followed by 65.18% and 57.57% for emamectin benzoate and indoxacarb, respectively. the obtained data found agree with those of Caponero (2005) who found the primiphos-methyl and profenofos showed the highest effectiveness against some predator.

### **2.2- Season of 2018:**

Regarding to the reduction percentages of initial effect during season of 2018, the obtained data in Table (4) cleared that emamectin benzoate was more dangerous on the predator insect than other test insecticides recorded the highest significantly ( $P \leq 0.05$ ) of 76.30% after 24hr from treatment; while lufenuron recorded the lowest percentage of 69.27% after 3 days.

In the same trend, the results showed that highest residual significantly ( $P \leq 0.05$ ) effect of 72.18% was recorded for emamectin benzoate 7 days post treatment followed by 70.09 and 61.13% recorded with lufenuron and indoxacarb, respectively as comparing with the control. Also, lufenuron was more effective on *coccinella* spp. than other treatments, 10 days post treatment, as it recorded the highest residual effect 72.24% followed by emamectin benzoate and indoxacarb which recorded 66.94 and 55.34%, respectively.

Concerning to residual mean of percent reduction, data represented in Table (4) cleared high significant differences ( $P \leq 0.05$ ) between treatments. The highest residual significantly ( $P \leq 0.05$ ) effect was 71.00% when cotton

**Table (4):** Percentages of *Coccinella* spp. in cotton fields treated with the tested insecticides during season of 2018

Treatments		Pre-count	Initial kill		Residual effect		Residual mean of % reduction	Annual mean % of reduction
			1 day	3 days	7 days	10 days		
Emamectin benzoate	No	5.12	1.62		2.84	5.93		
	%		76.30		72.18	66.94	69.56 <sup>a</sup>	71.81 <sup>a</sup>
Lufenuron	No	3.18		1.63	1.90	2.05		
	%			69.27	70.09	72.24	71.00 <sup>a</sup>	70.53 <sup>a</sup>
Indoxcarb	No	4.27	1.69		3.32	4.43		
	%		70.19		61.13	55.34	58.24 <sup>b</sup>	62.22 <sup>b</sup>
Control	No		4.00	5.00	6.00	7.00		
L.S.D							1.71	1.77

a,b Means are bearing different letters, different significantly (  $P \leq 0.05$  ).

plant was sprayed with lufenuron followed by 69.56 and 58.24% for emamectin benzoate and indoxcarb, respectively.

Regarding to the annual mean reduction during 2018 season the obtained results in Table (4) cleared that the tested pesticides highly significantly affected the annual mean reduction. The highest annual mean effect of 71.81% was recorded for emamectin benzoate treatment followed by 70.53 and 62.22% recorded with lufenuron and indoxcarb, respectively. These results are in conformity with the findings of (El-Arnaouty *et al.*, 2010) who reported that emamectin benzoate were effective in controlling *Coccinella undecimpunctata*

**Conclusively**, it could be summarized that the IGR compound lufenuron was the most effective in controlling the cotton leafworm during the two experimented seasons; while the indoxcarb was the lowest toxic compound against the natural predator *Coccinella* spp. So, it could be recommended to use each of lufenuron and indoxcarb insecticides to control the cotton leafworm with relatively low effect on natural predator in cotton field.

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## التقييم الحقلى لبعض المبيدات ضد دودة ورق القطن والمفترس الحشري ابو العيد في حقول القطن

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تتسبب دودة ورق القطن في خسائر فادحة للمحاصيل المختلفة لا سيما القطن في جمهورية مصر العربية. وتم بذل الكثير من الجهود لمكافحة تلك الآفة كيميائياً، حيث تستخدم المبيدات والمواد المخلقة كيميائياً منذ أكثر من خمسين عاماً. ونتيجة للاستخدام الكثيف للمبيدات الكيميائيه فقد تآثرت الاعداء الطبيعيه لبعض الافات. أجريت هذه الدراسة بهدف تقييم 3 مبيدات حشرية وهى : إيمامكتين بنزاويت ، اندوكساكارب ، منظم نمو حشري (ليوفينيورون) بالمعدل الموصى به حقلياً لمكافحة دودة ورق القطن وكذلك معرفة التأثير الجانبي لهذه المبيدات على المفترس المصاحب لهذه الآفه وهو حشرة ابو العيد. أظهرت النتائج أن منظم النمو الحشري (ليوفينيورون) كان أكثر المبيدات فعالية فى القتل الفورى والأثر المتبقى ونسبة الخفض العام لدودة ورق القطن خلال موسمى الدراسة 2017 و2018. كما أوضحت النتائج أن أكثر المبيدات المختبرة تأثيراً على مفترس ابو العيد كان ليوفينيورون خلال موسمى الدراسة. التوصية: لذلك يمكن التوصية باستخدام المنظم الحشري اليوفينيورون لانه كان الاكثر معنوية لمكافحة دودة ورق القطن في حقول القطن المصرية