THE INFLUENCE OF SOME INSECT GROWTH REGULATORS AND BIO-INSECTICIDES AGAINST COTTON LEAFWORM AND SOME ASSOCIATED PREDATORS UNDER FIELD CONDITIONS

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Abstract

Experiments were carried out at Zagazig district, Sharqia Governorate during two successive seasons, 2007 & 2008 to evaluate the toxicity of some insecticides against *S. littoralis* larvae infesting cotton cultivations and some associated common predators.

Chlorpyrifos and methoxyfenozide were the most potent insecticide in both initial and residual effect that caused highly significant reduction in the infestation rates of the pest as compared to other treatments at the initial and residual effects that recorded (98.21±0.783, 82.55±2.444%) as initial effect and (93.34±2.599, 85.32±2.195%) as residual effect during 2007 while during 2008 season it recorded (96.01±.0.723, 83.97±3.462%) and (89.89±2.715, 86.34±3.398 %) for initial and residual effect, respectively. Considering the initial and residual effects of the rest treatments, it could be arranged descendingly as teflubenzuron, tebufenozide, Tracer and finally Dipel 2X at both tested seasons.

Chlorpyrifos and methoxyfenozide were the most toxic insecticides causing the highest significant reduction in the predator numbers that recorded (79.81±3.544, 24.73±2.162%) and (66.81±5.418, 29.36±3.468%) at 2007 and (71.60±3.84, 23.50±1.799%) and (64.91±3.569, 26.78±3.548) at 2008 in the initial and residual effects, respectively. Followed by Tracer, teflubenzuron, tebufenozide and Dipel 2X during the two successive seasons

INTRODUCTION

Cotton, *Gossypium barbadense* (L.) occupies a prominent position in Egyptian agriculture. It is still the main cash crop for a sizeable selection of Egyptian farmers. Besides it is the main raw material for the largest national industry, the textile industry, as well as the main source of locally produced cotton seed oil. However, cotton plants are liable to be attacked by several pests all over the growing stages that affected and negatively its productivity.

The noctuid *Spodoptera littoralis* (Boisduval) is a major polyphagous pest, widely distributed throughout Africa, Mediterranean Europe, and several parts of Asia (Hosny and Isshak, 1967). To combat the pest, growers use synthetic organic insecticides and some biorational agents such as *Bacillus thuringiensis* Berliner, but

the control achieved is not successful because of the insect's high capacity to develop resistance toward the majority of conventional compounds. Therefore, scientists and growers are seeking alternative materials that are effective against this pest, safe to humans, environmental friendly, and compatible within targeted pest management (IPM) practices. The alternative control tactics that show promise as a potential tool in *S. littoralis* resistant management programs is the use of biorational control agents such as synthetic insect growth regulators (IGRs) and those based on naturally derived products. IGRs are claimed to be safer for beneficial organisms such as predators than conventional products, and they have been successfully used in IPM programs against many tree and small fruit pests. Many predatory insects recorded in the cotton fields in Egypt and the reverse action of applied insecticides against them was studied (Desuky, 2002).

The objective of this study was to evaluate the toxicity of Teflubenzuron, Tebufenozide, Methoxyfenozide, Spinosad, Dipel 2x and chlorpyrifos against cotton leafworm, *S. littoralis* larvae and associated predators under field conditions.

MATERIALS AND METHODS

1. Tested compounds:

1.1. Insect growth regulators:

A. Trade name: **Nomolt® 15%** Suspension Concentrate (SC).

Common name: Teflubenzuron.

Rate: 50 cm^3 / 100 L.

Basic product: BASF Co.

B: Trade name: Mimic® 24% Emulsifiable Concentrate (EC).

Common name: Tebufenozide.

Rate: 350 cm^3 /feddan.

Basic product: Dow AgroSciences.

C: Trade name: Runner® 24% Suspension Concentrate (SC).

Common name: Methoxyfenozide.

Rate: 150 cm^3 / feddan.

Basic product: Dow AgroSciences Co.

1.2. Bio-insecticides:

A. Trade name: Tracer®

Common name: Spinosad 24% Suspension Concentrate (SC). Tracer is comprised primarily of two macrocyclic lactones, Spinosyn A and D, secondary metabolites produced by the actinomycete, *Saccharopolyspra spinosa* under natural fermentation condition.

Rate: 50 cm^3 / feddan.

Basic product: Dow AgroSciences Co.

B: Trade name: Dipel 2X® (6.4 % WP).

Common name: *Bacillus thuringiensis* subsp. *Kurstaki* 32, 000 International Units of potency per mg.

Rate: 500 gram / feddan

Basic product: Chemical and Agricultural Products Division, Abbott Laboratories USA.

1.3. Organophosphorus insecticide:

- Trade name: Dursban ® (48% EC).

Common name: Chlorpyrifos.

Rate: 1 liter / feddan.

Basic product: Dow AgroSciences.

2. Methods of application

These trials were carried at Zagazig district, Sharqia Governorate, during 2007 and 2008 cotton growing seasons to evaluate the efficiency of six insecticides against the cotton leafworm, *S. littoralis* and some common predators. This evaluation was assessed on the basis the reduction percentages in both *S. littoralis* and predators.

An area of about quarter feddan cultivated with cotton variety (Giza 86) was chosen for each insecticide and control as well. Each area was divided into four experimental plots as replicates. Untreated belt (42 x 7m) was left between each two treatments as a border.

Larvae were counted while newly hatched ones were neglected from counting. A pre-treatment count was made for each treatment. Post treatments counts were recorded after 1, 3, 5, 7, and 9 days for chlorpyrifos, Dipel 2X and Tracer, 5, 10 and 15 days for IGRs (teflubenzuron, tebufenozide and methoxyfenozide).

The tested insecticides were applied at the recommended field rate, while control was sprayed with water only using a knapsack motor sprayer, 20 liter in capacity used with 200-liter volume of insecticidal solution per feddan. The

percentage of reduction in the population density of *S. littoralis* was estimated using the equation of Henderson and Tilton (1955).

The initial kill was calculated at one day post treatment for chlorpyrifos, Dipel 2X and Tracer, whereas after 5 days was determined IGRs (teflubenzuron, tebufenozide and methoxyfenozide). While, the general mean residual effect was calculated as the mean reduction percentages of larvae observed at days 3, 5, 7, and 9 post treatment for chlorpyrifos, Dipel 2X and Tracer, compared to 10, 15 for IGRs (teflubenzuron, tebufenozide and methoxyfenozide), (Badr, 2000).

At the same inspected times, the lethal effects of different insecticides and control against common predators: ladybird beetles, *Coccinella* spp., *Scymnus* spp., the aphid lion, *Chrysoperla carnea* Steph., the staphylinid beetle, *Paederus alfierii* Koch, the anthocorid bugs, *Orius* spp. and true spider were also studied using Henderson and Tilton equation (1955).

The significance of the main effects was determined by analysis of variance (ANOVA). The significance of various treatments was evaluated by Duncan's multiple range test ($p < 0.05$) (Snedecor & Cochran 1980). Data were subjected to statistical analyses using a software package CoStat® Statistical Software (2005) a product of Cohort Software, Monterey, California.

RESULTS AND DISCUSSION

1. Effects of the tested insecticides against larvae of cotton leafworm, *S. littoralis* under field conditions:

Data concerning Tables (1 & 2) summarize the efficiency of some insecticides against *S. littoralis* infestation during 2007 and 2008 seasons. All the investigated insecticides at the recommended concentrations exhibited reduction in infestation of *S. littoralis* on cotton plants compared to control.

The initial effect measured as the reduction percentages of *S. littoralis* larvae at the first day post treatment for chlorpyrifos, at the third post treatment for Tracer and Dipel 2X and at the fifth day post treatment for IGRs was determined. The difference in the times of initial effect was due to the mode of action of each insecticide.

Through the season 2007 the initial effect of chlorpyrifos methoxyfenozide, teflubenzuron, tebufenozide, Tracer and Dipel 2X, respectively recorded 98.21±0.783, 82.55±2.444, 80.83±2.151, 72.70±1.910, 39.57±2.030 and 16.20±1.720% (Tables 1 & 2).

The same trend was recorded in season 2008, showing chlorpyrifos as the highest initial effect (96.01±0.723%) while Dipel 2X gave the lowest effect (15.29±1.401%).

As for IGRs, the initial effect ranged between 73.23±4.084% for tebufenozide and 83.97±3.462% for methoxyfenozide. There were non significant differences among treatments. Whereas the residual effect measured as the mean reduction percentages of larvae at days of 3, 5, 7 and 9 post treatment for chlorpyrifos, compared to 5, 7 and 9 days post treatment for Tracer and Dipel 2X, whereas the residual effect of IGRs was assed at 10 and 15 days post treatment .

The values of residual effect were recorded 93.34±2.599% for chlorpyrifos, 85.32±2.195 for methoxyfenozide, 81.59±2.777% for teflubenzuron 77.93±2.125 for Tracer and 20.55±1.798 for Dipel 2X at the first implemented season.

During the second season 2008, the residual effect of the tested insecticides ranged between 18.82±2.038% for Dipel 2X to 89.89±2.751% in case of chlorpyrifos. The residual effect of methoxyfenozide recorded 86.34±3.398% followed by 83.34±3.353% for teflubenzuron and 52.21±2.931% for Tracer, (Tables 1 & 2).

The obtained results raveled that chlorpyrifos (Dursban) was the most potent insecticide in both initial and residual effect that caused highly significant effect as compared to the other treatments during 2007 and 2008, seasons. Considering the initial effects, the rest of treatments could be arranged descendingly as follows: methoxyfenozide teflubenzuron, tebufenozide, Tracer and finally Dipel 2X at both tested seasons.

Only chlorpyrifos have higher initial effects than its residual effects comparing to the other tested insecticides. The results are in agreement with the data recorded by Abd El-Latief, (2001) who reported that, the organophosphorus compound (chlorpyrifos) exhibited high initial kill against the cotton leafworm larvae after three days of treatment, then the mortality was decreased steadily. Chlorpyrifos was the superior insecticide in activity followed by profenofos.

The residual reduction percentages of (IGRs) and bio-insecticides increased than that of initial effects during the two successive seasons, indicating that the effectiveness of both insecticides increased with increasing the time. The present results corroborates those of El-Maghraby *et al.*, (1999) who investigated three IGRs applied at the recommended and half recommended rates, compared to three conventional insecticides against *S. littoralis* during 1997 and 1998 seasons. Different rates of spinosad were applied to lettuce and compared to a normal dose of deltamethrin (pyrethroid). All spinosad rates applied 20 days after transplanting

controlled *S. littoralis* for the whole crop. They stated that the persistence of spinosad reached up to 45 days after treatment.

Dipel 2X (*B. thuringiensis*) gave the least significant effective in the initial and residual effects during the two successive seasons. Also, Cordero *et al.*, 2006 found that Acetamiprid, *B. thuringiensis* was inconsistent in its performance in field experiments against some lepidopteran pests and Dipel 2X produced similar level for *S. littoralis* control as thecarbamate insecticide, Lannate. Whereas, *B. thuringiensis* compounds, Dipel 2X, MVPII and Dipel ES/NT revealed initial mortality lower than that obtained with the chemical insecticides, Lannate and Reldan, but residual toxicity after 7 days of application for the entomopathogenic bacteria was higher than the chemical insecticides.

2. Effects of the tested insecticides on some common predators associated with the cotton leafworm under field conditions:

The aim of this experiment is to investigate the side effect of the tested insecticides on reducing populations of some common predators associated with cotton leafworm population, i.e. ladybird beetle, *Coccinella* spp., *Scymnus* spp., the aphid lion, *Chrysoperla carnea* Steph, the staphylinid beetle, *Peaderus alferii* Koch, the anthocorid bugs, *Orius* spp. and the true spiders in cotton fields during the two successive seasons, 2007 and 2008. The initial and residual effects of the tested insecticides were assessed using the reduction percentages of predators and calculated at the same inspected times of the precedent trial against the cotton leafworm, *S. littoralis*.

During the first inspected season 2007, data illustrated in Tables (3 & 4) showed that chlorpyrifos recorded the highest significant initial and residual effects that gave reduction of 74.81±3.544 and 66.81±5.418%, respectively. The other tested compounds caused moderate effects that manifested (24.73±2.162 and 29.36±3.468%) for methoxyfenozide, 21.58±3.453 and 29.17±3.612% for Tracer, 20.18±1.449 and 25.28±2.644% for teflubenzuron. While Dipel 2X had the least values (12.71±2.099 and 16.46±2.890%), respectively.

The same trend was observed during 2008 season, with the exception of teflubenzuron and tebufenozide that changed their places between initial and residual effects as shown in Tables (3 & 4). Chlorpyrifos recorded the highest significant initial and residual effects on the previous predators, which being 71.60±3.84 and 64.91±3.569% followed descendingly order of methoxyfenozide (23.50±1.799 and 26.78±3.548%), Tracer (22.42±2.931 and 26.92±3.24%), teflubenzuron (21.65±2.496 and 23.66±2.969%), (19.70±2.047 and 24.34±2.781),

respectively whereas Dipel 2X occupied the last category that recorded (14.60±2.072 and 17.68±3.586%), respectively

The mean number and reduction percentages in the population of the abovementioned predators that affected by the tested insecticides were tabulated in Tables (5 – 8) through the two successive seasons 2007 and 2008.

During 2007 season methoxyfenozide recorded the highest initial and residual effect among all tested IGRs against true spiders, *Orius* spp. and *Scymnus* spp. that manifested (38.63±3.49 and 27.27±3.51%), (20.63±3.29 and 37.50±2.84%) and (17.44±2.39 and 21.94±2.72%), respectively.

Methoxyfenozide gave the highest initial effect on *Chrysoperla carnea*, *Peaderus alfierii* and *Coccinella* spp. that recorded reduction of 39.71±3.52, 28.89±2.58 and 20.95±3.13%, respectively.

The highest residual effects were obtained by tebufenozide against both *Coccinella* spp. (28.73±3.43%) and *Peaderus alfierii* (20.00±2.48%) and by teflubenzuron against *Chrysoperla carnea* (54.89±4.01%).

No significant differences were observed among the treatments in the initial and residual effect with the exception of tebufenozide and methoxyfenozide on *Coccinella* spp. and *Scymnus* spp., respectively in the residual effect (Table 5).

As for bio-insecticides and chlorpyrifos insecticide, the initial effects of chlorpyrifos ranged between a minimum value of (65.28±4.77%) for *Orius* spp. to a maximum value of (77.52±3.63%) for *Scymnus* spp., whereas the initial effect of Tracer ranged between (3.10±0.40%) for *Scymnus* spp. to (37.78±3.50%) for *Peaderus alfierii*. Dipel 2X ranged between (4.51±0.62%) for *Orius* spp. to (24.71±2.77) for *Chrysoperla carnea*.

Chlorpyrifos caused the highest significant reduction percentages against tested predators, while Dipel 2X gave the lowest reduction percentages (Table, 7).

In case of season 2008, methoxyfenozide recorded the highest significant decrease in the population of *Chrysoperla carnea* (34.91±2.23 and 49.91±4.59%) and true spiders (31.37±3.84 and 21.42±1.64%) in the initial and residual effect, respectively. Also, recorded the highest reduction percentages than the other treatments against *Peaderus alfierii* (41.67±3.50%) and *Scymnus* spp. (19.41±1.46%) in the initial effect and *Orius* spp. (30.66±2.73%) in case of residual effect (Table, 6). Tebufenozide gave the highest decrease in the population of *Coccinella* spp. (20.63±2.33%) and *Orius* spp.(19.84±2.18%) in the initial toxicity and *Peaderus alfierii* (55.75±2.41%) and *Scymnus* spp. (3.91±3.85%) in the residual toxicity without any significant differences among tested IGRs.

Regarding the bio-insecticides and chlorpyrifos group, chlorpyrifos caused the highest significant reduction percentages in the initial and residual effect that ranged between minimum values of (81.25±3.35 and 77.19±3.38%) for *Coccinella* spp. Both Tracer and Dipel 2X gave the highest initial and residual toxicity against populations of *Chrysoperla carnea* that manifested (55.56±3.21 & 55.92±2.57) and (38.46±3.04 & 36.18±2.65%) in the initial and residual effects, respectively (Table, 8).

Populations of the predatory insects found in all treated areas with tested insecticides were significantly reduced comparing to predator numbers registered in the untreated areas during the two successive seasons.

Insect growth regulators and bio-insecticides caused lower effects against tested predators than chlorpyrifos. This may be attributed to the supposed selectivity of such insecticides that had low contact toxicity against insect species. Mandour (2009) found that spinosad was harmless to *Chrysoperla carnea* eggs and pupae irrespective of concentrations or method of application and he reported that buprofezin and cyromazine (IGRs) were innocuous to larvae and eggs of *Chrysoperla* spp. and were selective to immature phase. The results obtained in this topic are in complete agreement with the data recorded by (Duffie *et al.*, 1998) when they tested different classes of insecticides against predators. They found that pyrethroid and organophosphorus classes were the most toxic causing dramatic reductions in the predator numbers, carbamate was moderately toxic. While bio-insecticides, IGRs and the naturalyte (spinosad) had low toxicity to predators.

Similarly, when adults obtained from laboratory colonies of predators were exposed to ten insecticides including four newer insecticides with novel modes of action there was considerable variation in response among the predators tested to the insecticides. In general, Malathion (organophosphorus) was the most toxic one, whereas spinosad was less toxic than the other insecticides against the tested predators, the same conclusions were also obtained by several authors (Desuky, 2002) when tested different insecticides against some common predators.

In addition, Cordero *et al.*, (2006) found that among a group of different tested insecticides, spinosad and methoxyfenozide are relatively less toxic to natural enemies and thus can fit well into integrated pest management programs. All the tested insecticides with exception of chlorpyrifos have residual effects higher than their initial ones.

Among the tested IGRs, methoxyfenozide was the most toxicant against the tested predaceous insects than both teflubenzuron and tebufenozide during the two successive seasons. In contrary, when Angeli *et al.*, (2000) exposed the 4th instar nymph of *Orius laevigatus* to eleven insect growth regulators. They found that methoxyfenozide, tebufenozide and triflumuron had no effect, teflubenzuron and buprofezin had slightly harmful and hexaflumuron, flufenoxuron and lufenuron had moderately harmful.

In general, *Chrysoperla carnea* was the most susceptible predators towards all tested insecticides whereas *Scymnus* spp. was the most tolerant one. These results are in harmony with findings of Fayad and Ibrahim (1988) who found *C. Carnea* was highly susceptible to deltamethrin, chlorpyrifos, diflubenzuron and profenofos, the first insecticide was the most critical in the disturbance of *Scymnus* and *Orius* spp. No significant differences were noted between the insecticides or interval between treatments. *Peaderus alfierii* and spiders appeared to tolerate the effects of the insecticides and were encountered in moderate numbers throughout the study, the same symmetry was ordered by same authors who reported that *C. carnea* was highly sensitive to most tested insecticides including spinosad that was less toxic than other insecticides tested against these species.

Table 1. The mean number of all larval instars and reduction percentages of cotton leafworm, *S. littoralis* (Boisd.) as affected by IGRs sprayed on cotton fields during seasons of 2007 and 2008 at Zagazig district, Sharqia Governorate.

IGRs	Recommended field rate	Mean No. of larval instars before spray	Mean No. of larvae and % reduction after:						% Initial effect	% General mean of residual effect
			5 days		10 days		15 days			
			No.	%	No.	%	No.	%		
		2007 season								
Teflubenzuron	50 cm^3 / 100 L	979	241	80.83	256	83.22	162	79.95	80.83±2.151a	81.59±2.777a
Methoxyfenozide	150cm^3/feddan	1040	233	82.55	238	85.31	126	85.32	82.55±2.444a	85.32±2.159a
Tebufenozide	350cm^3/feddan	870	305	72.70	285	78.97	166	76.88	72.70±1.910b	77.93±2.125a
Control		950	1220	-	1480	-	784	-	-	-
L.S.D $_{0.05}$									6.972	7.592
Mean temperature		28.70	31.90		32.50		33.80		31.90	-
Mean R.H. %		61	60		57		62		60	-
		2008 season								
Teflubenzuron	50 cm^3 / 100 L	993	246	79.04	229	83.85	146	82.83	79.04±6.720a	83.34±3.353a
Methoxyfenozide	150cm^3/feddan	987	187	83.97	200	85.81	111	86.86	83.97±3.462a	86.34±3.398a
Tebufenozide	350cm^3/feddan	1220	386	73.23	419	75.95	251	75.98	73.23±4.084a	75.97±3.601a
Control		1100	1300	-	1571	-	942	-	-	-
L.S.D $_{0.05}$									15.871	11.045
Mean temperature		31.90	35.50		33.50		32.80		35.50	-
Mean R.H. %		62	58		57		72		58	-

Table 2. The mean number of all larval instars and reduction percentages of cotton leafworm, *S. littoralis* (Boisd.) as affected by bio-insecticides and chlorpyrifos sprayed on cotton fields during seasons of 2007 and 2008 at Zagazig district, Sharqia Governorate.

Compounds	Recommended field rate	Mean No. of larval instars before spray	Mean No. of larvae and % reduction after: 1 day		3 days		5 days		7dasys		9 days		% Initial effect	% General mean of residual effect
			No.	%	No.	%	No.	%	No.	%	No.	%		
		2007												
Tracer	50 cm^3/fed.	1041	1022	12.26	784	39.57	700	47.64	623	56.13	590	61.18	39.57±2.030b	54.98±2.129c
Dipel 2X	500g./ fed.	968	1037	4.26	1011	16.20	1014	18.43	1045	20.87	1093	22.66	16.20±1.720c	20.55±1.798b
Chlorpyrifos	1 liter / fed.	1100	22	98.21	13	99.05	20	98.58	126	91.60	255	84.12	98.21±0.783a	93.34±2.599 a
Control		950	1063	-	1184	-	1220	-	1296	-	1387		-	-
L.S.D $_{0.05}$													5.123	7.040
Mean temp.		28.70	29.70		30.10		31.90		32.00		29.10		30.10	-
Mean R. H.%		61	61		60		60		59		57		60	-
		2008												
Tracer	50 cm^3/fed.	1300	1260	10.78	845	41.01	812	47.15	796	51.61	739	57.86	41.01±2.767b	52.21±2.931b
Dipel 2X	500g./ fed	1200	1230	5.65	1120	15.29	1170	17.50	1230	19.00	1296	19.95	15.29±1.401c	18.82±2.038c
Chlorpyrifos	1 liter / fed	1153	50	96.01	37	97.09	82	93.98	186	87.25	292	81.23	96.01±0.723a	89.89±2.715a
Control		1100	1195	-	1212	-	1300	-	1392	-	1484	-	-	-
L.S.D $_{0.05}$													7.214	8.170
Mean temp.		31.90	31.20		32.20		35.50		33.70		33.20		32.20	-
Mean R. H.%		62	58		57		58		63		58		57	-

Table 3. The influence of IGRs on some common predators in cotton fields during seasons of 2007 and 2008 at Zagazig district, Sharqia Governorate.

IGRs	Recommended field rate	Mean No. of predators before spray	Mean No. of predators and % reduction after:						% Initial effect	% General mean of residual effect
			5 days		10 days		15 days			
			No.	%	No.	%	No.	%		
		2007 season								
Teflubenzuron	50 cm3 / 100 L	139	130	20.18	128	23.83	76	26.73	20.18±1.449a	25.28±2.644a
Methoxyfenozide	150 cm3 / fed.	127	112	24.73	110	28.36	66	30.36	24.73±2.162a	29.36±3.468a
Tebufenozide	350 cm3 /fed.	140	133	18.92	135	20.24	78	25.39	18.92±1.782a	22.82±2.718a
Control		134	157	-	162	-	100	-	-	-
L.S.D $_{0.05}$									5.828	9.492
Mean temperature		28.70	31.90		32.50		33.80		31.90	-
R.H. %		61	60		57		62		60	-
		2008 season								
Teflubenzuron	50 cm3 / 100 L	117	116	21.65	117	23.08	82	24.23	21.65±2.496a	23.66±2.969a
Methoxyfenozide	150 cm3 / fed.	122	112	23.50	116	26.22	82	27.34	23.50±1.799a	26.78±3.548a
Tebufenozide	350 cm3 /fed.	110	106	19.70	111	22.38	75	26.29	19.70±2.047a	24.34±2.781a
Control		120	144	-	156	-	111	-	-	-
L.S.D $_{0.05}$									6.827	9.704
Mean temperature		31.90	35.50		33.50		32.80		35.50	-
R.H. %		62	58		57		72		58	-

Table 4. The influence of bio-insecticides and chlorpyrifos on some common predators in cotton fields during seasons of 2007 and 2008 at Zagazig district, Sharqia Governorate.

Compounds	Recommended field rate	Mean No. of predators before spray	Mean No. of predators and % reduction after: 1 day		3 days		5 days		7days		9 days		% Initial effect	% General mean of residual effect
			No.	%	No.	%	No.	%	No.	%	No.	%		
		2007												
Tracer	50 cm^3/fed.	125	116	9.64	109	21.58	107	26.94	110	28.96	111	31.61	21.58±3.453b	29.17±3.612b
Dipel 2X	500g./ fed.	136	130	8.51	132	12.71	137	14.02	140	16.90	141	18.46	12.71±2.099b	16.46±2.890b
Chlorpyrifos	1 liter / fed.	114	30	74.81	38	70.02	44	67.06	49	65.90	52	64.87	79.81±3.544a	66.81±5.418a
Control		134	140	-	149	-	157	-	166	-	174	-	-	-
L.S.D $_{0.05}$													9.928	13.161
Mean temperature		28.70	29.70		30.10		31.90		32.00		29.10		30.10	-
R. H.%		61	61		60		60		59		57		60	-
		2008												
Tracer	50 cm^3/fed.	140	137	8.97	124	22.42	127	24.40	129	26.29	124	30.08	22.42±2.931b	26.92±3.241a
Dipel 2X	500g./ fed	120	120	6.98	117	14.60	121	15.97	124	17.33	122	19.74	14.60±2.072b	17.68±3.586a
Chlorpyrifos	1 liter / fed	131	40	71.60	48	67.91	52	66.92	58	64.58	66	60.22	71.60±3.84a	64.91±3.569a
Control		120	129	-	137	-	144	-	150	-	152	-	-	-
L.S.D $_{0.05}$													9.670	11.100
Mean temperature		31.90	31.20		32.20		35.50		33.70		33.20		32.20	-
R. H.%		62	58		57		58		63		58		57	-

Table 5. The mean numbers and reduction percentages of some common predators in cotton fields after spraying with the tested IGRs during 2007 season.

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times						% General mean of residual effect
				Initial effect 5 day		Residual effect 10 day		Residual effect 15 day		
				No.	% R	No.	% R	No.	% R	
Chrysoperla carnea	Teflubenzuron	50cm^3/100 L	18	16	38.16± 3.41a	16	43.11± 2.68ab	8	66.67± 5.28a	54.89± 4.01a
	Methoxyfenozide	150cm^3/fed.	15	13	39.71± 3.52a	11	53.07± 4.08a	9	36.00± 3.53b	44.54± 2.33 a
	Tebufenozide	350cm^3/fed.	17	17	30.43± 3.01a	17	36.00± 4.74b	7	56.08± 3.00a	46.04± 3.52a
	Control		16	23	-	25	-	15	-	-
L.S.D$_{0.05}$					10.46		12.56		12.98	10.77
Coccinella spp.	Teflubenzuron	50cm^3/100 L	30	28	15.15± 1.78a	27	18.18± 2.99a	19	5.00± 0.91b	16.00± 2.41b
	Methoxyfenozide	150cm^3/fed.	23	20	20.95± 3.13a	20	20.95± 2.40a	14	8.70± 1.15b	14.35± 2.86b
	Tebufenozide	350cm^3/fed.	28	27	12.34± 2.19a	28	9.09± 1.26b	15	19.64± 1.89a	28.73± 3.43a
	Control		36	33	-	33	-	20	-	-
L.S.D$_{0.05}$					7.80		7.74		4.42	9.40
Paederus alfierii	Teflubenzuron	50cm^3/100 L	11	10	27.27± 3.24a	10	27.27± 2.77a	6	27.27± 3.13a	18.64± 3.00a
	Methoxyfenozide	150cm^3/fed.	10	9	28.00± 3.24a	9	28.00± 3.08a	7	6.67± 1.23b	17.34± 3.24a
	Tebufenozide	350cm^3/fed.	9	8	28.89± 2.58a	8	28.89± 4.30a	5	11.11± 1.58b	20.00± 2.84a
	Control		8	10	-	10	-	6	-	-
L.S.D$_{0.05}$					9.73		11.05		7.16	9.70

Table 5. continued

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times						% General mean of residual effect
				Initial effect 5 day		Residual effect 10 day		15 day		
				No.	% R	No.	% R	No.	% R	
Scymnus spp.	Teflubenzuron	50cm^3/100 L	39	37	13.20± 2.18a	36	17.31± 2.81a	24	19.81± 2.78a	18.56± 3.46ab
	Methoxyfenozide	150cm^3/fed.	41	37	17.44± 2.39a	38	16.97± 2.31a	23	26.90± 2.80a	21.94± 2.72a
	Tebufenozide	350cm^3/fed.	46	44	12.49± 1.26a	45	12.36± 2.95a	32	9.35± 0.85b	10.86± 1.02b
	Control		43	47	-	48	-	33	-	-
L.S.D$_{0.05}$					6.43		8.66		7.47	7.78
Orius spp.	Teflubenzuron	50cm^3/100 L	26	25	14.15± 3.11a	25	19.87± 2.57a	12	42.31± 3.14a	31.09± 3.32a
	Methoxyfenozide	150cm^3/fed.	27	24	20.63± 3.29a	24	25.93± 2.73a	11	49.07± 4.22a	37.50± 2.84a
	Tebufenozide	350cm^3/fed.	29	27	16.87± 2.74a	27	22.41± 2.47a	14	39.66± 4.42a	31.84± 2.79a
	Control		25	28	-	30	-	20	-	-
L.S.D$_{0.05}$					9.78		7.90		12.71	9.59
True spiders	Teflubenzuron	50cm^3/100 L	15	14	30.00± 4.40a	14	30.00± 3.52b	7	6.67± 0.88a	18.34± 2.79a
	Methoxyfenozide	150cm^3/fed.	11	9	38.63± 3.49a	8	45.45± 3.33a	5	9.09± 0.83a	27.27± 3.51a
	Tebufenozide	350cm^3/fed.	11	10	31.82± 2.29a	10	31.82± 3.60a	5	9.09± 0.72a	20.46± 1.60a
	Control		12	16	-	16	-	6	-	-
L.S.D$_{0.05}$					11.24		11.16		2.52	8.88

Table 6. The mean numbers and reduction percentages of some common predators in cotton fields after spraying with the tested IGRs during 2008 season.

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times						% General mean of residual effect
				Initial effect 5 day		Residual effect 10 day		15 day		
				No.	% R	No.	% R	No.	% R	
Chrysoperla carnea	Teflubenzuron	50cm^3/100 L	10	10	23.08± 2.98b	10	37.50± 3.35a	7	46.15± 3.07a	41.83± 2.85ab
	Methoxyfenozide	150cm^3/fed.	13	11	34.91± 2.23a	11	47.16± 3.80a	8	55.66± 1.77a	49.91± 4.59a
	Tebufenozide	350cm^3/fed.	12	12	23.08± 2.45b	14	27.08± 1.49b	10	35.90± 3.47a	31.49± 1.97b
	Control		10	13	-	16	-	13	-	-
L.S.D$_{0.05}$					8.274	9.767		9.170		11.174
Coccinella spp.	Teflubenzuron	50cm^3/100 L	31	30	17.05± 2.97a	30	27.42± 1.31a	22	18.11± 3.02a	22.77± 1.93a
	Methoxyfenozide	150cm^3/fed.	25	24	17.71± 2.69a	27	19.00± 1.69b	20	7.69± 1.05b	13.35± 1.67b
	Tebufenozide	350cm^3/fed.	27	25	20.63± 2.33a	26	27.78± 2.06a	20	14.53± 1.52a	21.16± 1.25a
	Control		30	35	-	40	-	26	-	-
L.S.D$_{0.05}$					8.569	5.494		6.549		5.264
Paederus alfierii	Teflubenzuron	50cm^3/100 L	7	7	33.33± 3.08a	8	42.86± 2.42b	5	57.14± 2.20a	50.00± 4.05a
	Methoxyfenozide	150cm^3/fed.	8	7	41.67± 3.50a	7	56.25± 2.47a	6	55.00± 3.037a	55.63± 2.92a
	Tebufenozide	350cm^3/fed.	8	8	33.33± 2.66a	7	56.25± 2.47a	6	55.00± 3.21a	55.75± 2.41a
	Control		6	9	-	12	-	10	-	-
L.S.D$_{0.05}$					9.940	7.857		9.132		10.193

Table 6. continued

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times						% General mean of residual effect
				Initial effect 5 day		Residual effect 10 day		Residual effect 15 day		
				No.	% R	No.	% R	No.	% R	
Scymnus spp.	Teflubenzuron	50cm^3/100 L	35	35	13.64± 2.05a	34	19.75± 1.11a	29	1.61± 0.16c	10.68± 0.98a
	Methoxyfenozide	150cm^3/fed.	41	38	19.96± 2.24a	40	19.41± 1.46a	28	18.90± 1.96a	19.16± 2.02b
	Tebufenozide	350cm^3/fed.	34	33	16.18± 2.54a	31	24.68± 2.22a	18	37.13± 3.01a	30.91± 3.85a
	Control		38	44	-	46	-	32	-	-
L.S.D$_{0.05}$					7.324		5.333		6.664	8.252
Orius spp.	Teflubenzuron	50cm^3/100 L	19	19	15.38± 1.46a	19	12.00± 1.02b	10	42.11± 2.62a	27.06± 3.37a
	Methoxyfenozide	150cm^3/fed.	23	22	19.06± 1.27a	20	23.48± 1.37a	13	37.83± 4.17a	30.66± 2.73a
	Tebufenozide	350cm^3/fed.	19	18	19.84± 2.18a	21	2.74± 0.28c	14	18.95± 1.84b	10.85± 0.69b
	Control		22	26	-	25	-	20	-	-
L.S.D$_{0.05}$					5.397		3.211		9.726	8.122
True spiders	Teflubenzuron	50cm^3/100 L	15	15	17.65± 2.52b	16	12.16± 1.61b	9	16.00± 1.28a	14.08± 1.71a
	Methoxyfenozide	150cm^3/fed.	12	10	31.37± 3.84a	11	24.51± 2.35a	7	18.33± 1.87a	21.42± 1.64b
	Tebufenozide	350cm^3/fed.	10	10	17.65± 1.86b	12	1.18± 0.38c	7	2.00± 0.12b	1.59± 0.11c
	Control		14	17	-	17	-	10	-	-
L.S.D$_{0.05}$					9.168		5.267		4.205	4.384

Table 7. The mean number and reduction percentages of predators as affected by bio-insecticides and chlorpyrifos sprayed on cotton fields during season of 2007 at Zagazig district, Sharqia Governorate.

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times										% Initial effect	% General mean of residual effect
				1 day		3 days		5 days		7 days		9 days			
				No.	% R.	No.	% R.	No.	% R.	No.	% R.	No.	% R.		
Chrysoperla carnea	Tracer	50 cm^3/fed.	11	9	27.27	10	27.27	9	43.08	9	47.64	9	47.64	27.27± 3.08b	46.12± 3.05b
	Dipel 2X	500g./ fed.	17	16	16.34	16	24.71	20	18.16	19	28.47	18	32.23	24.71± 2.77b	26.29± 3.19c
	Chlorpyrifos	1 liter / fed.	15	4	76.30	4	78.67	7	67.54	7	78.13	8	65.87	76.30± 3.53a	72.55± 2.72a
	Control		16	18	-	20	-	23	-	25	-	25	-	-	-
L.S.D.05														9.414	9.583
Coccinella spp.	Tracer	50 cm^3/fed.	32	30	3.75	24	30.77	23	21.59	25	17.28	26	18.75	30.77± 3.53b	19.21± 2.30b
	Dipel 2X	500g./ fed.	35	33	3.02	35	7.69	31	3.38	32	3.19	32	8.57	7.69± 1.33c	5.71± 0.12c
	Chlorpyrifos	1 liter / fed.	30	8	72.57	7	78.46	8	70.91	9	68.24	9	70	72.57± 2.41a	71.90± 2.27a
	Control		36	35	-	39	-	33	-	34	-	36	-	-	-
L.S.D.05														8.287	6.134
Paederus alfierii	Tracer	50 cm^3/fed.	9	8	11.11	7	37.78	7	37.38	7	43.43	7	48.15	37.78± 3.50b	42.99± 3.12a
	Dipel 2X	500g./ fed.	8	8	0.00	9	10.00	6	40.00	8	27.27	8	33.3	10.00± 1.87c	33.53± 2.01a
	Chlorpyrifos	1 liter / fed.	7	2	71.43	4	54.29	5	42.86	7	27.27	7	33.33	71.43± 2.49a	39.44± 3.55a
	Control		8	8	-	10	-	10	-	11	-	12	-	-	-
L.S.D.05														8.640	9.508

Table (7) continued

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times										% Initial effect	% General mean of residual effect
				1 day		3 days		5 days		7 days		9 days			
				No.	% R.	No.	% R.	No.	% R.	No.	% R.	No.	% R.		
Scymnus spp.	Tracer	50 cm^3/fed.	38	38	4.40	36	3.01	36	13.33	34	10.92	34	18.14	3.01± 0.40b	14.13± 2.38b
	Dipel 2X	500g./ fed.	47	46	6.48	45	1.98	46	10.46	47	8.52	48	6.56	1.98± 0.15b	8.51± 1.42b
	Chlorpyrifos	1 liter / fed.	34	8	77.52	10	69.89	8	78.47	9	75.78	9	75.78	77.52± 3.63a	56.06± 3.26a
	Control		43	45	-	42	-	47	-	47	-	47	-	-	-
$L.S.D._{.05}$														6.759	7.908
Orius spp.	Tracer	50 cm^3/fed.	26	24	3.85	24	3.85	24	17.58	23	26.28	23	34.95	3.85± 0.12b	26.27± 4.17b
	Dipel 2X	500g./ fed.	24	23	0.17	22	4.51	26	3.27	27	6.25	27	17.28	4.51± 0.62b	8.93± 0.81c
	Chlorpyrifos	1 liter / fed.	18	6	65.28	12	30.56	10	50.40	9	58.33	11	55.07	65.28± 4.77a	48.59± 3.64a
	Control		25	24	-	24	-	28	-	30	-	34	-	-	-
$L.S.D._{.05}$														8.900	10.348
True spiders	Tracer	50 cm^3/fed.	9	7	6.67	8	23.81	8	33.33	12	15.79	12	20	23.81± 2.83b	23.04± 2.16b
	Dipel 2X	500g./ fed.	5	4	4.00	5	14.29	6	10	7	11.58	8	4	14.29± 1.47c	8.53± 0.76c
	Chlorpyrifos	1 liter / fed.	10	2	76.00	4	65.71	6	55	8	49.47	8	52	76.00± 2.76a	55.55± 2.31a
	Control		12	10	-	14	-	16	-	19	-	20	-	-	-
$L.S.D._{.05}$														7.871	6.024

Table 8. The mean number and reduction percentages of predators as affected by bio-insecticides and chlorpyrifos sprayed on cotton fields during season 2008 and at Zagazig district, Sharqia Governorate.

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times										% Initial effect	% General mean of residual effect
				1 day		3 days		5 days		7 days		9 days			
				No.	% R.	No.	% R.	No.	% R.	No.	% R.	No.	% R.		
Chrysoperla carnea	Tracer	50 cm^3/fed.	15	14	33.33	10	55.56	11	43.59	11	54.17	9	70.00	55.56± 3.21b	55.92± 2.57b
	Dipel 2X	500g./ fed.	13	13	28.57	12	38.46	14	17.16	13	37.50	12	53.85	38.46± 3.04c	36.18± 2.65c
	Chlorpyrifos	1 liter / fed.	14	5	74.49	5	76.19	5	72.53	5	77.68	8	71.43	74.49± 2.55a	74.46± 2.02a
	Control		10	14	-	15	-	13	-	16	-	20	-	-	-
L.S.D.05														9.441	7.786
Coccinella spp.	Tracer	50 cm^3/fed.	37	36	8.78	32	18.92	31	28.19	32	25.87	29	26.52	18.92± 3.78b	26.86± 3.21b
	Dipel 2X	500g./ fed.	31	32	3.23	29	12.30	30	17.05	32	11.52	32	3.23	12.30± 1.54b	10.60± 1.49c
	Chlorpyrifos	1 liter / fed.	35	7	81.25	7	81.25	9	77.96	8	80.41	10	73.21	81.25± 3.35a	77.19± 3.38a
	Control		30	32	-	32	-	35	-	35	-	32	-	-	-
L.S.D.05														9.768	9.053
Paederus alfierii	Tracer	50 cm^3/fed.	8	8	14.29	7	34.38	7	41.67	7	41.67	7	52.27	34.38± 2.88b	45.20± 3.57a
	Dipel 2X	500g./ fed.	6	6	14.29	6	25.00	6	33.33	7	22.22	7	36.36	25.00± 2.46b	30.64± 3.49b
	Chlorpyrifos	1 liter / fed.	7	4	51.02	5	46.43	6	42.86	7	33.33	7	45.45	51.02± 3.53a	42.02± 3.36a
	Control		6	7	-	8	-	9	-	9	-	11	-	-	-
L.S.D.05														9.558	11.122

Table (8) continued

Predators	Treatments	Recommended field rate	Mean no. of predators before spray	Mean number and % reduction of predators at indicated times										% Initial effect	% General mean of residual effect
				1 day		3 days		5 days		7 days		9 days			
				No.	% R.	No.	% R.	No.	% R.	No.	% R.	No.	% R.		
Scymnus spp.	Tracer	50 cm^3/fed.	41	40	2.44	39	11.84	41	11.48	41	13.64	38	14.10	11.84± 1.90b	13.07± 2.49b
	Dipel 2X	500g./ fed.	39	38	2.56	38	9.69	37	18.07	37	18.07	35	16.82	9.69± 0.68a	17.65± 2.20b
	Chlorpyrifos	1 liter / fed.	40	12	70.00	15	65.24	14	69.77	16	65.45	16	62.93	70.00± 4.31a	65.8± 53.34a
	Control		38	38	-	41	-	44	-	44	-	41	-	-	
L.S.D.05														8.80	8.726
Orius spp.	Tracer	50 cm^3/fed.	24	24	4.35	23	12.15	26	8.33	26	14.88	28	11.49	12.15± 1.82b	11.57± 1.39b
	Dipel 2X	500g./ fed.	21	21	4.35	21	8.33	22	11.35	23	13.95	23	16.91	8.33± 0.50b	14.07± 1.75b
	Chlorpyrifos	1 liter / fed.	26	7	74.25	9	68.27	12	60.95	15	54.67	17	50.40	74.25± 4.54a	58.72± 3.20a
	Control		22	23	-	24	-	26	-	28	-	29	-	-	
L.S.D.05														9.092	7.226
True spiders	Tracer	50 cm^3/fed.	15	15	6.67	13	28.63	11	39.61	12	37.78	13	36.14	28.63± 3.30b	37.84± 2.94a
	Dipel 2X	500g./ fed.	10	10	6.67	11	9.41	12	1.18	12	6.67	13	4.21	9.41± 1.14c	4.02± 0.50b
	Chlorpyrifos	1 liter / fed.	9	5	48.15	7	35.95	6	45.10	7	39.51	8	34.50	48.15± 3.02a	38.77± 4.14a
	Control		14	15	-	17	-	17	-	18	-	19	-	-	-
L.S.D.05														8.692	9.434

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تأثير بعض منظمات النمو الحشرية و المركبات الحيوية على دودة ورق القطن و بعض المفترسات المصاحبة لها تحت الظروف الحقلية

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أجريت تجارب حقلية فى منطقة الزقازيق بمحافظة الشرقية خلال موسمى زراعة القطن ٢٠٠٧ و ٢٠٠٨ لتقييم سمية بعض المبيدات ضد يرقات دودة ورق القطن التى تصيب زراعات القطن بهذه المنطقة كذلك التاثير على بعض المفترسات المصاحبة لها، و قد أشارت النتائج الى ان مركبى كلوربيريفوس و ميثوكسيفينوزيد هما أكثر المبيدات المختبرة فعالية حيث سجلا نسب إبادة بلغت (٠,٧٨٣ ± ٩٨,٢١٪، ٢,٤٤٤ ± ٨٢,٥٥ ٪) فى التأثير الفورى، (٢,٥٩٩ ±٩٣,٣٤ ٪، ٢,١٩٥±٨٥,٣٢ ٪) فى التأثير المتبقي فى موسم ٢٠٠٧، مقارنة بقيم (٠,٧٢٣±٩٦,٠١٪ ، ٣,٤٦٢±٨٣,٩٧٪) و(٢,٧١٥±٨٩,٨٩٪ ، ٣,٣٩٨±٨٦,٣٤٪) فى موسم ٢٠٠٨ على الترتيب.

بالنسبة للتأثيرين الفورى و المتبقى لباقى المركبات المختبرة فيمكن ترتيبها تنازلياً كما يلى: تيفلوبنزيرون و تيبوفينو زيد و تراسر و دايبل تو اكس على مدار موسمى الدراسة.

اظهر مركبا كلوربيريفوس و ميثوكسيفينوزيد التأثير الأكثر سمية على المفترسات المصاحبة لدودة ورق القطن فى حقول القطن حيث أعطيا اكبر نسبة خفض فى التعداد بلغت ٣,٥٤٤±٧٩,٨١ و ٢,١٦٢±٢٤,٧٣ ٪، ٥,٤١٨± ٦٦,٨١، ٣,٤٦٨± ٢٩,٣٦٪ فى موسم ٢٠٠٧ بينما بلغت ٣,٨٤±٧١,٦٠ و ١,٧٩٩±٢٣,٥٠٪، ٣,٥٦٩± ٦٤,٦١، ٣,٥٤٨± ٢٦,٧٨ ٪ فى موسم ٢٠٠٨ فى التأثيرين الفورى والمتبقي على الترتيب متبوعا بكل من تراسر و تيفلوبنزيرون و دايبل تواكس خلال موسمى الدراسة.