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COTTON BOLLWORM *Helicoverpa armigera*: CONTROL BY BIORATIONAL INSECTICIDES

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ABSTRACT

The present work was devoted to study the impact of some recent insecticides pertaining to biorational insecticides group that have low mammalian toxicity i.e, [chlorantraniliprole, spinetoram, methoxyfenozide, thiamethoxam and lambda-cyhalothrin]which were sprayed individually and/or mixed with each other against the American bollworm (ABW) *Helicoverpa armigera* during the consequent growing cotton seasons of 2014 and 2015 at Al Zeiny - Abohoms, El-behaira Governorate, Egypt. Results of the study showed that the admixed different compounds [Voliam Flexi® 40 WG (Chlorantraniliprol 10%+ Thiamethoxam 20 %), Engeo® %24.7 SC (Thiametoxam 14,1%+ Lambda-cyhalotrina 10,6%), Radiant® 12% SC (Spinosyn JL) and Runner® 24% SC (methoxyfenozide)] gave the highest efficient activity upon the population of *H. armigera* larvae. It could be also said that, the mixing of each of these different compounds together had a strong effect on the annihilation of the population of ABW *H. armigera* larvae more than their use individually.

INTRODUCTION

The cotton plants are attacked by the bollworms which cause about 30-40%losses of seed cotton (Haque 1991). Worldwide, *H.armigera* has been reported on over 180 cultivated hosts and wild species related to at least 45 plant families (Venette *et al*., 2003). The larvae feed mainly on the flowers and fruits of high value crops, and thus high economic damage can be caused at low population densities (Cameron, 1989; CABI, 2007)., Recently, it's one of the most important insect pests of cotton in Egypt. The larval stage of ABW is the injuriously destructive stage. ABW larvae scratch on tender leaf for one day then it prefers to feed on squares, flowers and bolls. One larva can damage 10-12 fruiting branches during its life span (Nyambo, 1988).

Farmers often use insecticides that are in most cases unsuitable rather hazardous to the user, drastic and damaging to beneficial insects and the environment, besides some of such compounds are not suitable or effective on the pest. Therefore, the “Biorational pesticides”, have recently proposed to employ those insecticides that ordinarily are efficacious against the target pest and less detrimental to natural enemies. The term at times has been used to describe only those products derived from natural sources, *i.e.* plant extracts, insect pathogens, etc. However, a biorational pesticide is generally defined as “any type of pesticide active against pest populations, but relatively innocuous to non target organisms and therefore, non-disruptive to biological control.” An pesticide can be “innocuous” by having low or no direct toxicity, systemic or rapid translaminar activity or short field residual, thereby minimizing exposure of natural enemies to the insecticide (CABI, 2007).

Some newer biorational pesticides are grouped on the basis of some shared characteristics, particularly, they have minimal or non risk to the environment due to their chemical make-up, rapid degradation, or the small amounts required to effective control. These pesticides are also safe for application and compatible with Biological control agents due to their selective or short residual activity (Schuster and Stansly, 2005).

Biorational products mainly include insect growth regulators (synthetic or botanically derived), oils, soaps, many of the new products with novel chemistries, microbially-derived products, and living microbes such as fungi and bacteria. The way a product is formulated and applied can also affect its classification as a biorational.

In regard of the above cited literary information, this study was adopted to evaluate some compounds that are acting selectively on insects such as chlorantraniliprole (toxic on immatures of many insects; non-toxic on natural enemies and bees); spinetoram is a second-generation of spinosyn (a contact and stomach toxin. derived from soil bacterium *Saccharopolyspora spinosa*, non-disruptive to most predatory insect species and some parasites). Newnicotinoids (highly systemic, when applied to the roots and/or translaminar effect, i.e. readily absorb into the leaf through the leaf surface) and IGI "Insect Growth Inhibitor" Runner is a Moulting Accelerating Compound (MAC); has a highly effective mode of action than other different chemical insecticides which are affect as larvicides by direct active contact on larvae of all feeding instar, especially young ones.

MATERIALS AND METHODS

Field experiments were carried out in a private farm at Abo-Homos, El-Behaira Governorate, Egypt, during two successive growing cotton seasons of 2014 and 2015. In both seasons an area of one feddan and half was cultivated with cotton (variety Giza 88) on April the 15th. Throughout both seasons the normal agricultural practices were followed; the experimental area was divided into 6 main plots, each of 1/4 feddan (1050 m^2). The completely randomized block design was utilized with three replicates for each treatment as well as the untreated check. Each plot was separated from the adjacent one by half-meter belt to minimize the interference of spray drift from one treatment to another.

The study was performed in eight treatments to evaluate eight biorational compounds their common and chemical names, formulation and applied rates are exhibited in Table (1) .

Hydraulic Knapsack hand sprayer was used for insecticide application. After 3, 7 and 10 days of spray, the existing *Helicoverpa armigera* larval population was inspected, counted and recorded from the upper part of plant canopy. Data were analyzed by the analysis of variance (one ways classification ANOVA) followed by a least significant difference, LSD at 5% (SPSS).

Table (1): The pesticides used.

N.	Comman Name	Trade Name	Formulation	Rates
1	Thiamethoxam	Actara®	25% WG	20 g / 100 L
2	lambda-cyhalothrin	Lambada super®	10% WP	200g/Fed.
3	Chlorantraniliprol	Coragen®)	20% SC	60 cm^3/Fed.
4	Spinetoram	Radiant®	12% SC	35 cm^3/Fed.
5	Methoxyfenozide	Runner®	24% SC	150 cm^3/Fed.
6	Chlorantraniliprol + thiametoxam	VoliamFlexi®	40% WG	160 cm^3/Fed.
7	lambda-cyhalothrin + thiametoxam	Engeo®	24.7 % SC	160 cm^3/Fed.
8	spinetoram + methoxyfenozide	Suggested mixture	12% SC + 24% SC	150 cm^3/Fed.

RESULTS AND DISCUSSION

Our illustrated results in (Table 2) show that all the tested insecticides in cotton season 2014 had significant effect on the population of *H. armigera* larvae. After the 3rd day of spraying both Engeo® and Voliam flexi® were utmostly efficient against the larva of *H. armigera* (6.67, 7.00 larvae/100 plants) respectively; followed by Radiant®+ Runner® and Coragen® (8.33, 8.67larvea/100 plants), respectively. On the other hand, the other applied treatments of Radiant®, Actara® and Runner Lambada super® gave less toxic effect (9.33, 9.67, 10.33, 11.00 larva/100 plants, respectively but were to a more toxic or a less extent affecting on population of *H. armigera* larvae in comparison with the untreated check (12.33 larvea/100 plants). While, After the 7th day each of tested compounds: Voliam flexi®, Engeo® and Radiant®+ Runner® were rather active and gave the highest effect (1.00, 1.33 and 1.33 larvae/100plant), respectively. Vice versa, the performed inspections proved that Coragen®, Actara®, Lambada super®, Radiant® and Runner® gave more or less lower toxic effect represented by (5.67, 6.00, 6.00, 6.00 and 6.00 larvae/100 plant), respectively but still high toxicantly effective on the population of *H. armigera* larvae compared with the untreated check (13.33 larvae/100 plants). After the 10th day of spraying the inspected population of *H. armigera* larva have been annihilated due to the applied treatments of Voliam flexi®, Engeo® and Radiant®+ Runner®, which recorded Zero, While, both Coragen® and Radiant® recorded 1.33 larva to be in the second arrangement of influence on the population of *H. armigera* larvae. Similarly, each of Actara®, Runner® and Lambada super® came at the third rank of influence recording values of (1.67, 1.67 and 2.00 larvae/ 100 plant), respectively.

From the included results in Table (3) it could be indicated that the similar effects of tested compounds was also attained in second season of

2015. Herein Voliam flexi® and Engeo® were the best effective on population of *H. armigera* and recorded (8.33 larvae/100 plants) after the 3rd day of spraying followed by Radiant® and Radiant® + Runner® which indicated value of (11.33). While, Lambada super®, Actara®, Runner® and Coragen® were less effective on the larval population of *H. armigera* (12.00, 12.33, 13.00 and 13.67larvae/100 plant), respectively, but in this situation were considered a high-impact when compared to the untreated check (18.67 larvae/100 plant), after 3 days of spray. In addition, after the 7th day post spraying the toxic effect of each of Voliam flexi®, Engeo® and Radiant®+ Runner® was greatly increased and gave lower mean values of inspected larvae (1.00, 1,00, 1.33 larva/100plants), respectively their efficiency was higher than that detected for Coragen® and Radiant® (6.67, 7.33 larva/100plants), respectively. Despite, both last compounds were more effective than the other tested compounds Lambada super®, Actara® and Runner® which gave less effectiveness expressed by higher mean values of inspected larvae (8.00, 8.33 and 8.33larva/100plants), respectively, but still lower than that recorded for the un-treated check (18.67 larva/100plant) after 7 days of spray. After the 10th day of spray, results of analysis indicated that each of Voliam flexi®, Engeo®, Radiant®+ Runner®, Coragen® and Radiant® were the highest effective compounds on the treated larval population of *H. armigera* (0.00. 0.00, 0.00 1.00 and 1.00) larvae/100plants, followed by the less higher effective ones Actara®, Lambada super® and Runner® (2.33, 2.67 and 2.67 larva/100 plant), respectively.

In conclusion, the followed statistical analysis showed the detected significant differences among all the adopted treatments after the 3rd, 7th, and 10th day of spray. In short, the results indicated that the admixing of different pesticides compounds [Voliam Flexi® 40 SC, Engeo® %24.7 SC and the suggested mixture Radiant® 12% + Runner® 24% SC gave the highest influence on the population of *H. armigera* larvae more than the use of these compounds individually.

Our study are consistent with the results obtained by H. Rafiee *et al*. (2008) who stated that the Biorational insecticides spinosad and hexaflumuron seemed to be more useful than the other insecticides against ABW *H. armigera*. On the other hand, This study agrees with that adopted by Tariq *et al.* (2005) who proved that the new chemical insecticide are more effective for the control of *Helicoverpa armigera* than old insecticides and it can play an important role in managing this insect pest.

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استخدام المبيدات التي لها أصل حيوي في مكافحة دودة اللوز الأمريكية في القطن

هشام محمد البسيونى، هايتى مكرم تادرس و على زكريا النجار
مركز البحوث الزراعية – معهد بحوث وقاية النبات- الدقى- الجيزة

يهدف البحث إلى دراسة تأثير بعض المبيدات الحشرية التى لها أصل حيوى و لديها سمية منخفضة على الثدييات و التى منها [كلورأنترينلبرول (كوراجين®)، سبنتورام (رادينت®)، ميثوكسى فينوزايد (رنر®)، ثيوميزوكسام (أكتارا®) ولمبادا سيهالوثرين (لمبادا سوبر®)] التي تم رشها منفردة و مخلوطة مع بعضها البعض لمكافحة دودة اللوز الأمريكية *Helicoverpa armigera* خلال موسمي زراعة القطن عام ٢٠١٤ و عام ٢٠١٥ بمنطقة الزينى- أبوحمص -البحيرة. وأظهرت نتائج الدراسة أن المركبات المخلوطة [فوليام فليكس®) ٤٠% WG كلورأنترينلبرول + ثيوميثوكسام)، إنجيو® ٢٤.٧% SC(لمبادا سيهالوثرين + ثيوميزوكسام) سجلت أعلى كفاءة فى خفض تعداد يرقات دودة اللوز الأمريكية *H. armigera* و كذلك المخلوط المقترح المكون من مركب الأسبنتورام و المثوكسى فينوزايد عن إستخدام هذة المركبات منفردة. ونستنتج من هذه النتائج بأن خلط هذه المركبات المختلفة معا يكون لها فعالية أكثر على إبادة يرقات دودة اللوز الأمريكية *H. armigera* أكثر من استخدامها بشكل فردي.

Tabel (2): Mean Namber of inspected *Helicoverpa armigera* larvae/100 plants (±SE.) post treatment with tested Biorational insecticides during cotton season 2014.

Compound		Before Spry	After Spry		
Common name	Trade name		3 Days	7 Days	10 Days
Thiamethoxam	Actara®	13.00 ±1.00	9.67 ±0.58$_{cd}$	6.00±2.65$_{b}$	٠.٥٨±١.٦٧$_{b}$
lambda-cyhalothrin	Lambada super®	12.33 ± 0.58	10.33 ±0.58$_{bc}$	6.00±1.73$_{b}$	2.00±1.00$_{b}$
Clorantraniliprol	Coragen®	12.33 ±1.15	8.67±0.58$_{de}$	5.67±1.15$_{b}$	1.33±1.15$_{bc}$
Spinetoram	Radiant®	13.00 ±1.00	9.33±0.58$_{cde}$	6.00±1.00$_{b}$	1.33±0.58$_{bc}$
Methoxyfenozide	Runner®	12.00±1.73	11.00±1.00$_{b}$	6.00±1.00$_{b}$	1.67±1.15$_{b}$
clorantraniliprol + thiametoxam	Engo®	12.67±2.08	6.67±0.58$_{f}$	1.33±0.58$_{c}$	0.00±0.00$_{c}$
lambda-cyhalothrin +thiametoxam	Voliam flexi®	12.00±1.00	7.00 ±1.00$_{f}$	1.00±1.00$_{c}$	0.00±0.00$_{c}$
spinetoram + methoxyfenozide	Radiant®+ Runner®	12.33±2.31	8.33±0.58$_{e}$	1.33±1.15$_{c}$	0.00±0.00$_{c}$
Control		12.00±1.00	12.33±0.58$_{a}$	13.33±0.58$_{a}$	12.33±0.58$_{a}$
F		0.236	20.904	24.066	86.268
LSD		2.45	1.20	2.31	1.24
Sig. (P value)		NS	***	***	***

***. The mean difference is significant at the 0.05 level.**

Table (3): Mean Number of inspected *Helicoverpa armigera* larvae/100 plants (±SE.) post treatment with tested Biorational insecticides during cotton season 2015.

Compound		Before Spry	After Spry		
Common name	Trade name		3 Days	7 Days	10 Days
Thiamethoxam	Actara®	17.00±0.58	$12.33\pm0.33_{b}$	$8.33\pm0.33_{b}$	$2.33\pm0.33_{b}$
lambda-cyhalothrin	Lambada super®	17.67±0.88	$12.00\pm0.58_{b}$	$8.00\pm0.58_{bc}$	$2.67\pm0.33_{b}$
Clorantraniliprol	Coragen®	17.33±0.88	$13.67\pm2.67_{b}$	$6.67\pm0.33_{c}$	$1.00\pm0.00_{c}$
Spinetoram	Radiant®	17.00±1.15	$11.33\pm0.33_{bc}$	$7.33\pm0.33_{bc}$	$1.00\pm0.58_{c}$
Methoxyfenozide	Runner®	17.00±1.53	$13.00\pm0.58_{b}$	$8.33\pm0.33_{b}$	$2.67\pm0.33_{b}$
clorantraniliprol + thiametoxam	Engo®	18.00±0.58	$8.33\pm0.33_{c}$	1.00 ± 0.58^{d}	$0.00\pm0.00_{c}$
lambda-cyhalothrin +thiametoxam	Voliam flexi®	17.00±0.58	$8.33\pm0.88_{c}$	$1.00\pm0.58_{d}$	$0.00\pm0.00_{c}$
spinetoram + methoxyfenozide	Radiant®+ Runner®	17.00±1.15	$11.33\pm0.67_{bc}$	$1.33\pm0.33_{d}$	$0.00\pm0.00_{c}$
Control		17.00±0.58	$18.67\pm0.67_{a}$	$18.00\pm0.58_{a}$	$17.00\pm0.58_{a}$
F		.158	8.744	136.324	260.611
LSD		2.78	3.10	1.36	1.00
Sig. (P value)		NS	***	***	***

***. The mean difference is significant at the 0.05 level.**