

THE EFFICIENCY OF SOME COMPOUNDS AGAINST EGG MASSES OF *Spodoptera littoralis* (BOISD.) AND THEIR PREDATORS ON COTTON FIELDS

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ABSTRACT

A field trials were conducted to evaluate the efficiency of the new products of Radiant 12% SC, Spintor 24% SC and Runner 24% SC, alone or as mixture with mineral oil in comparable with conventional insecticide dursban 48% EC, against the egg masses of cotton leafworm *Spodoptera littoralis* and some predators at Qalubia and Sharkia Governorates during 2005 and 2006 cotton seasons, respectively. Generally from the results of the two seasons, radiant, spintor and runner alone recorded moderate percent mortalities for *S. littoralis* egg masses, and when mineral oil was added to radiant and spintor compounds their activities increased and resulted in egg masses percentages equal or in par with that obtained with the conventional insecticide dursban. Increasing the concentrations of radiant and spintor induced a gradual increase in their activities against egg masses of cotton leafworm. Generally, the all tested compounds and their mixtures with mineral oil recorded low reduction percentages in predators population ranging between 19.13 and 37.20 % which recorded for radiant at 10 ml/feddan concentration and spintor 35 ml + mineral oil 1000 ml/feddan, respectively, as compared with 77.29 % resulted with conventional insecticide.

INTRODUCTION

The cotton leafworm (CLW) *Spodoptera littoralis* (Boisd) is a polyphagous key pest in Egypt. It is active all year round without hibernation period and attacking cotton as well as more than 29 hosts from other crops and vegetables in Egypt.

The rate of CLW infestation could reach up to 50,000 egg-masses/feddan, causing severe damage to leaves, flowers and bolls (Temerak 2002).

CLW has seven generations all year round with three ones on cotton. The most serious one is the first generation on cotton fields during the end of May to the first of July. Ministry of Agricultural (MOA) was used young children to cover the whole area of cotton to pick up these egg masses every three days specially in the recently irrigated fields for a period of about 4-5 weeks, in rate of one child/feddan/three days. Where hand-picking of CLW egg-masses is practiced as reliable and safe approach of control, particularly in the first generation of CLW on cotton in Egypt (El-Badawy, *et al* 1980). Recently, government issued a law to prohibit the children from work in cotton and other hard works. Consequently; the Ministry of Agriculture (MOA) has had to spray the cotton crops every year despite hand picking (Temerak 2002).

El-Dahan, *et al* 1990 indicated that IGRs were very weak to control egg masses but chlorpyrifos ethyl was the best ovicides for all ages of CLW

egg masses (100 %). However, MOA cancelled all conventional insecticides from spraying on egg masses to conserve the natural enemies (Temerak 2002) and using IGRs mainly for the newly hatched larvae. The natural insecticide spinosad proved to have a powerful activity against cotton leafworm, and conserve the natural enemies (Raslan 2002 and 2003).

Egypt is suffering from the availability of extra safe good ovidicides. So, these studies aimed to evaluate a new compounds of Radiant, spintor and runner as their toxic activity against CLW egg masses in order to add additional resources for control as well as the use of mineral oil as activation agent for the tested compounds.

Natural enemies play important role in controlling different stages of cotton leafworm *S. littoralis*, especially at the first generation in cotton field where their numbers in this time are in the highest values, so the induced toxic effects of the tested compounds against some important predators were studied.

MATERIALS AND METHODS

Products used in this study:

- 1-Spinetoram (Radiant 12 % SC), it is a trademark of Dow AgroSciences Co, it is a new product from spinosyns group, used at rates of 10, 15 and 20 ml/fed. alone or in tank mix with mineral oil at 1000 ml/feddian..
- 2- Spinosad (Spintor 24 % SC) it is a trademark of Dow AgroSciences Co, it is a metabolite of the Actinomycete, *Saccharopolyspora spinosa* Martz & Yao. It is a naturally occurring mixture of two active compounds of (spinosyn A&D). Used rates were 25, 35 ml alone or tank mix with 1000ml mineral oil/fed,in addition to the recommended rate 50 ml/feddian.
- 3- Methoxyfenozide (Runner24 % SC), it is an insect growth regulator (IGR), which used at rate of 150 ml/feddian.
- 4- Chlorpyrifos ethyl (Dursban 48 % EC) it is a organophosphorous compound which used in its recommended dose of 1 L /feddan.
- 5- Mineral oil at rate of 1000 ml/fed.

Evaluation experiments:

A-: Evaluation against egg masses:

A field trials were conducted to evaluate the efficiency of the new products of natural products of Radiant 12 % SC and Spintor 24 % SC, and the IGR Runner 24 %SC comparable with conventional insecticide Dursban 48% EC, against the egg masses of cotton leafworm *Spodoptera littoralis* at Kafr Shouker region, Qalubia governorate and Abo-Hammad region, Sharkia Governorate during 2005 and 2006 cotton seasons, respectively. Cotton variety was Giza 85 in the first season and Giza 89 in the second season. The first trial planting dates were 30/3/2005 and the second one was on 19/3/2006.The experimental area was divided into 45 plots, representing 15 treatments, each replicated three times. The plot area was 1/20 of feddan.

Before treatments application the egg-masses were located and tagged by market the upper surface of cotton leaves contain the egg mass.

Knapsack sprayer was used for treatments application, using 200 L of insecticide solutions per feddan. Spray took place on 8/6 and 10/6 at 2005 and 2006 cotton seasons, respectively.

After treatments application, the tagged egg masses were inspected daily until five days, and the following assessment was used to classified egg masses:

- 1- Eggmasses hatched, showing all alive neonate larvae without any kill are referred hatched alive.
- 2- Eggmasses hatched, showing dead and alive larvae are referred as hatched alive/dead.
- 3- Egg masses having the neonate larvae dead inside the eggs (cannot emerge) or on the way to exit referred as dead during exit.
- 4- Egg masses having the neonate larvae dead on the top of egg masses or around it on the surface of the cotton leaf are referred as dead top.

The market egg masses which predators prey them did not counted in the total marketed egg masses as well as the egg masses did not hatched naturally..

B- Evaluation against natural enemies:

The harmful effect of the tested compounds against some natural enemies predators were investigated. The numbers of predators, Ladybird beetles, *Coccinella* spp. and *Scymnus* spp.; Staphylinid beetle, *Paedrus affierii* (koch.); Anthocorid bugs, *Orius* spp.; Aphid lion, *Chrysoperla carnea*(steph) and true spiders were counted in ten cotton plants for every replicate, i.e.; 30 cotton plants for every treatment, before and five days after compounds application. Henderson and Telton equation (1955) was used to calculate the reduction percentages of predators. This evaluation was carried out during the experiment of 2005 cotton season at Qalubia Governorate.

RESULTS AND DISCUSSION

A-: Evaluation against egg masses:

Compounds and their used concentrations as well as the resulted percent mortalities against egg masses of cotton leafworm, *S. littoralis*, in cotton fields during 2005 and 2006 seasons, were recorded in Tables (1 & 2).

In 2005 experiment, data in Table (1) showed that radiant compound treatments at 10, 15 and 20 ml/feddan resulted in egg masses mortalities of 58.82, 76.71 and 84.75%, respectively, comparing with their mixtures with 1000 ml of mineral oil, which resulted in 72.55, 81.54 and 88.46% egg masses mortalities, respectively.

Spintor at concentrations of 25, 35 and 50 ml/feddan recorded 58.54, 65.12 and 71.15% egg masses mortalities, respectively, and as a mixture with 1000 ml mineral oil /feddan, the concentrations of 25 and 35 of spintor resulted in egg masses mortalities of 68.89 and 73.91% respectively.

Runner at rate of 150 ml.feddan resulted in satisfactory egg masses mortality of 73.68 %, as comparing with conventional insecticide dursban, which recorded 97.37 % egg masses mortality.

Table (1): Direct field observation mortality of the entire tagged egg masses of *S. littoralis*, five days after being sprayed with some compounds, Qalubia Governorate, 2005 season.

Treatments	Rate at ml/fed	No. of tagged egg masses	No. of dead Egg masses as		No. of egg masses		% Mortality of egg masses
			neonate L. on top of egg masses	neonate L. on the way to exit	have dead & live L.	have only live L.	
Radiant 12 % SC	10	51	30	0	1	20	58.82
	15	73	50	6	3	14	76.71
	20	59	44	6	0	9	84.75
Radiant 12 % SC +oil	10+1000	51	34	3	4	10	72.55
	15+1000	65	50	3	2	10	81.54
	20+1000	52	39	7	0	6	88.46
Spintor 24 % SC	25	41	22	2	3	14	58.54
	35	43	27	1	2	13	65.12
	50	52	32	5	3	12	71.15
Spintor 24 % SC+oil	25+1000	45	28	3	2	12	68.89
	35+1000	46	30	4	2	10	73.91
Runner 24 % SC	150	38	28	0	0	10	73.68
Dursban 48 % EC	1000	38	34	3	1	0	97.37
Mineral oil	1000	20	0	0	0	20	0
Control	----	22	0	0	0	22	0

Table (2): Direct field observation mortality of the entire tagged egg masses of *S. littoralis*, five days after being sprayed with some compounds, Sharkia Governorate, 2006 season.

Treatments	Rate at ml/fed	No. of tagged egg masses	No. of dead Egg masses as		No. of egg masses		% Mortality of egg masses
			neonate L. on top of egg masses	neonate L. on the way to exit	have dead & live L.	have only live L.	
Radiant 12%SC	10	25	14	3	1	7	68
	15	18	14	0	0	4	77.78
	20	31	27	1	3	0	90.32
Radiant 12%SC+oil	10+1000	20	15	1	0	4	80
	15+1000	14	13	0	0	1	92.86
	20+1000	28	27	1	0	0	100
Spintor 24%SC	25	16	10	3	0	3	81.25
	35	21	16	4	0	1	95.24
	50	13	12	1	0	0	100
Spintor 24%SC+oil	25+1000	22	22	0	0	0	100
	35+1000	20	16	4	0	0	100
Runner 24%SC	150	20	15	0	1	4	75
Dursban 48%EC	1000	12	9	3	0	0	100
Mineral oil	1000	24	0	0	0	24	0
Control	----	28	0	0	0	28	0

In 2006 experiment data in Table (2) showed that 100 % mortality of egg masses were recorded with dursban, spintor alone at rate of 50ml

/feddan and as mixture with 1000 ml mineral oil at rates of 25 and 35 ml/feddan, as well as radiant at rate of 20 ml+1000 ml mineral oil /feddan.

Radiant at rates of 10, 15 and 20 ml/feddan resulted in mortalities of 68, 77.78 and 90.32 % for treated egg masses, and when 1000 ml mineral oil per feddan was added for every treatment enhanced the efficacy of radiant compound and resulted in 80, 92.86 and 100 % mortalities, respectively.

The same trend of mineral oil activation was found also when added to the compound of spintor at concentrations of 25 and 35 ml /feddan which resulted alone in 81.25 and 95.24% egg masses mortalities respectively, as comparing with 100 % mortality resulted when mixed with 1000 ml mineral oil /feddan.

Runner at rate of 150 ml/feddan resulted in satisfactory egg masses mortality of 75 % as comparing with conventional insecticide dursban, which recorded 100 % egg masses mortality.

Mineral oil treatment alone at rate of 1000 ml/feddan, as well as control resulted in zero % mortality during the two experimental seasons.

Increasing the concentrations of radiant and spintor induced a gradual increase in their activity against egg masses of cotton leafworm.

Generally from the results of the two seasons, radiant, spintor and runner alone recorded moderate percent mortalities for *S. littoralis* egg masses, and when mineral oil was added to radiant and spintor compounds their activities increased and resulted in egg masses percentages equal or in par with that obtained with the conventional insecticides dursban.

Study of Nolting, *et al* (1997) indicated that mortality in treated eggs of *Heliothis* was from larvae ingesting spinosad as they fed on the chorion of the egg during hatching. It was observed that before neonate larvae die, most of morbid larvae were standing vertically. Raslan (2002) in field experiment found that spinosad have good initial and residual effects against the egg masses of cotton leafworm *S. littoralis*. Spinosad is the one of the most promising new chemicals, which has a favorable mammalian toxicity and environmental profile Sparks *et al* (1995). Adding mineral oil enhances performance and elongate residually of certain products (El-Deeb 1993, Mourad *et al* 1994). No build-up of mites was noticed in all plots. The availability of a novel chemical group, with a new mode of action that is different from conventional insecticides in current use, is assistance to insecticide resistance management programs (Horowitz and Ishaaya 1994). Furthermore, Temerak (2003) indicated that spinosad is not easily affected by the existing resistance mechanisms for conventional insecticides in Egypt.

B- Evaluation against natural enemies:

The number of different predators under investigation were counted before and after application of tested compounds, as well as their reduction percentages, were recorded in Table (3), which illustrated that conventional insecticide dursban resulted in the highest percent reduction for predators (77.29 %), while the least effective treatment was for mineral oil alone at 1000 ml/feddan which resulted in 6.82 % reduction for predators population.

Radiant when used alone at concentrations of 10, 15 and 20 ml/feddan, resulted in 19.13, 23.25 and 33.41 % predators reductions, and

when their concentrations mixed with 1000 ml/ feddan of mineral oil they raised the reductions in predators which were 23.89, 30.41 and 35.42 % reductions, respectively.

Table (3): Reductions in predators of *S. littoralis*, in cotton fields after sprayed with some compounds.

Treatments	Rate at ml/fed	Numbers of predators before and after 5 days of application														Total before spray	Total 5 days after spray	% Reduction
		Coccinella spp.		Chrysoperl a carnea		Paederus affierii		Scymnus spp.		Orius spp.		Tru spiders						
		*B	**A	B	A	B	A	B	A	B	A	B	A					
Radiant 12 % SC	10	12	10	11	11	6	6	8	8	9	6	10	10	56	51	19.13		
	15	8	6	12	12	7	7	7	6	13	10	12	10	59	51	23.25		
	20	7	4	14	12	10	9	6	4	11	7	12	9	60	45	33.41		
Radiant 12 % SC +oil	10+1000	6	4	16	15	11	11	8	8	18	12	11	10	70	60	23.89		
	15+1000	9	5	16	15	10	9	6	5	21	14	12	10	74	58	30.41		
	20+1000	13	9	13	11	8	7	4	3	17	10	11	8	66	48	35.42		
Spintor 24 % SC	25	14	12	13	12	12	13	8	8	17	12	10	9	74	66	20.81		
	35	16	12	15	13	10	9	7	7	20	14	13	10	81	65	28.75		
	50	17	12	19	16	8	7	8	7	16	8	12	7	80	57	36.74		
Spintor 24 % SC+ oil	25+1000	12	9	17	13	11	11	6	6	18	11	10	8	74	58	30.41		
	35+1000	17	12	18	14	10	9	7	6	18	9	12	8	82	58	37.20		
Runner	150	16	13	16	15	8	7	10	10	17	12	12	10	79	67	24.70		
Dursban 48 % EC	1000	17	5	22	6	7	2	8	2	21	3	11	4	86	22	77.29		
Mineral oil	1000	20	21	15	15	12	13	8	10	12	11	14	15	81	85	6.82		
control	----	21	23	23	25	13	16	11	14	20	22	15	16	103	116	-----		

*B = the number of predator before application

**A = the number of predator 5 days after application.

Spintor at the rates of 25 and 35 ml/feddan resulted in 20.81 and 28.75 % reductions for predators comparing with the higher reductions occurred when mixed with 1000 ml mineral oil/feddan, which were 30.41 and 37.20 %. Spintor at the highest used concentration of 50 ml/feddan recorded 36.47 % reduction in predators.

The IGR, runner at the rate of 150 ml/feddan recorded 24.70% on predators populations.

Generally, the all tested compounds and their mixtures with mineral oil recorded low reduction percentages in predators population ranging between 19.13 and 37.20% which recorded for radiant at 10 ml/feddan concentration and spintor 35 ml+mineral oil 1000 ml/feddan, respectively, as compared with 77.29 % resulted with conventional insecticide.

Peterson *et al* (1997) indicated that application of spinosad in conjunction with naturally occurring beneficial arthropods are an excellent example of a functional cotton integrated pest management (IPM) program. Raslan (2003) found that natural product spinosad, and the IGRs of consult

and atabron showed low impact on cotton pests predators, while dursban resulted in high reduction.

Generally the previous results indicated that it can obtained a good control for the egg masses of cotton leafworm *S. littoralis*, in cotton field especially at the first generation on cotton where the number of egg masses are in its highest values as well as their natural enemies. The use of radiant, spintor and runner resulted in high mortalities for cotton leafworm and conserve predators, so the use of them in this time control high percentages of egg masses found and the rest will become in natural balance with their predators.

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تأثير بعض المركبات علي لطع دودة ورق القطن ومفترساتها في حقول القطن

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - مصر.

أجريت تجارب حقلية لتقييم فعالية مركبات جديدة وهي راديانت ١٢٪، سبينتور ٢٤٪ و رانر ٢٤٪ منفردة أو مخلوطة بالزيت المعدني ، مقارنة بالمبيد التقليدي دورسبان ٤٨٪ ضد لطع بيض دودة ورق القطن وبعض مفترساتها وذلك في محافظتي القليوبية و الشرقية موسمي قطن ٢٠٠٥ و ٢٠٠٦ ، علي التوالي .

أظهرت النتائج ان الريديانت ١٢ ٪ ، سبينتور ٢٤ ٪ و رانر ٢٤ ٪ منفردين حققوا نسبة موت متوسطة للطع دودة ورق القطن وزادت نسبة الموت الناتجة عنها عند خلطها بالزيت المعدني وأصبحت مماثلة أو قريبة من نسب الموت الناتجة من استخدام المبيد التقليدي دورسبان. أظهرت النتائج أن جميع المركبات المختبرة ومخالطها مع الزيت المعدني زادت تأثير سمي منخفض علي مجموع المفترسات وتراوحت بين ١٩,١٣ - ٣٧,٢٠ ٪ لكل من راديانت بتركيز ١٠ مل/فدان و سبتور ٣٥ مل + ١٠٠٠ مل زيت معدني ، علي التوالي مقارنة بـ ٧٧,٢٩ ٪ نسبة خفض للمفترسات الناتجة من المعاملة بالمبيد التقليدي الدروسبان .