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FIELD EVALUATION OF SOME INSECTICIDES AGAINST EGG MASSES OF *SPODOPTERA LITTORALIS* (BOISD.) IN EGYPT

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ABSTRACT

All the tested treatments gave significant ovicidal effects against egg-masses of cotton leafworm *S. littoralis* at 2 and 4 days post treatment comparing to control with the exception of Capl-1(mineral oil). methoxyfenozide exhibited the highly significant ovicidal among all tested treatments that manifested (93 and 90%) in the first year; (92 and 90 %) in the second year after 2 and 4 days of treatment, respectively. Adding Capl-1 oil to spray emulsions of both Tracer and XDE (used at the least rate) and application on cotton plants significantly increased the ovicidal percentages of the selected concentrations than it solely. There is a direct proportion between the used rates and ovicidal percentages of both Tracer and XDE. Results also indicated that the mortality percentages of newly hatched larvae ranged between zero % for Capl-1oil and control to 97 % for chlorpyrifos in 2007 season and ranged between zero % for Capl-1 oil and control to 96 % for chlorpyrifos in season 2008. The highest general activity against egg masses of *S. littoralis* was detected by the two highest concentrations of XDE, methoxyfenozide and chloropyrifos that recorded the same value (100.00%) at the first tested season and (98, 96, 98 and 98%) at the second season, respectively.

INTRODUCTION

The cotton leafworm, *Spodoptera littoralis* (Boisd.) is the serious chewing pest of cotton and other agronomic crops. It is active all year around without hibernation period. Its rate of infestation can reach to 50.000 egg masses/one feddan attacking leaves, buds, flowers and bolls. Hand picking of cotton leafworm egg masses is a reliable practice as well as a safe approach for control, particularly in the first generation of *S. littoralis* on cotton in Egypt (**El-Badawy *et al.*, 1980**). However, this process is not enough to control cotton leafworm due to its overlapping generations. In addition, when cotton grows too heavy branched, such process becomes not easy to achieve.

Satisfactory handpicking is facing serious problems due to the labor availability as well as the cost factor; thirty kids are located per each 30 feddans every three days to pick up egg masses (**Raslan, 2002**). Recently government issued a legislation to prohibit the children labor in cotton plantations and other related practices. On last few years Ministry Of Agriculture does not recommended using conventional insecticides applications during egg masses presence due to its adverse impacts on the environment, acute and chronic hazardous to beneficial insects.

Spinosad, the mixture of spinosyn A and D, is the first active ingredient in the naturalyte class of insects control products produced during the fermentation of soil actinomycete *Sacharopolyspora spinosa* (**Sparks *et al.*, 1998**). This biopesticide has an unique mode of action, which persistently stimulates the central nervous system of the insect through interaction with the nicotinic acetylcholine receptors through a mechanism distinct from other nicotinic agonists (**Watson, 2001**). Spinosad is particularly active against lepidopteran, dipteran, and thysanopteran pests; it has been reported to be safe to many predatory insects, but in some cases, harmful to parasitoids (**Williams *et al.*, 2003**). In addition, its good environmental performance (quick degradation, low toxicity to humans, and low doses of use) makes spinosad a choice for IPM programs in vegetables and ornamentals (**Pineda *et al.*, 2004**).

Among different classes of insecticides (**Duffie *et al.*, 1998**) found that the biological and IGR classes had low toxicity to predators. So, the aim of this study is to look at alternative methods that had low impact on the environment, cheap and effective for controlling egg masses of *S. littoralis*.

MATERIALS AND METHODS

1. Materials:

A: Trade name: Runer® 24% Suspension Concentrate (SC).

Common name: Methoxyfenozide.

Chemical name: 3-methoxy-2-methylbenzoic acid 2-(3,5-dimethylbenzoyl)-2-(1,1-dimethylethyl) hydrazide.

Recommended Rate: 150 cm^3 / feddan.

Action: Second generation ecdysone agonist. Causes cessation of feeding and premature lethal molt, agonist of 20-hydroxyecdysone a key hormone in the molting process.

Basic product: Dow AgroSciences Co.

B. 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.
Recommended Rate: 50 cm^3 / feddan.
Action: Naturalyte insecticide composed of 50-95% spinosyn A and 50-5% spinosyn D, acts primarily on insect's nervous system at nicotinic acetylcholine receptor.
Basic product: Dow AgroSciences Co.
C: Trade name: XDE®
Common name: Spinosad 24% Suspension Concentrate (SC).
Recommended Rate: 140 cm^3 /feddan.
Action: Naturalyte insecticide composed of 85% spinosyn A and 15% spinosyn D.
Basic product: Dow AgroSciences Co.
D: Trade name: Dursban® (48% EC).
Common name: Chlorpyrifos.
Chemical name: O, O - diethyl O- (3, 5, 6–trichloro-2-pyridinyl) phosphorothioate.
Recommended Rate: 1 liter / feddan.
Action: Organophosphorus insecticide affecting chemical transmission of nervous signal.
Basic product: Dow AgroSciences.
E: Trade name: Capl-1®: A sulfonated solar oil prepared as Emulsifiable Concentrate (EC). (CAPL = brief name for Central Agricultural Pesticides Laboratory) contained 97.23 % base oil.
Common name: Sulfonated light medium (Solar) oil.
Recommended Rate: 1 liter / feddan.
Basic product: Registered to Central Agricultural Pesticide Laboratory produced by Modern Agricide Company, Egypt.

2. Methods:

Field trial was carried out at Zagazig district Sharqia Governorate during two successive seasons 2007 and 2008, cotton variety was Giza 86. The tested compounds; Tracer, XDE, Capl-1 oil, methoxyfenozide and chlorpyrifos were evaluated against egg masses of *S. littoralis*.

Tracer was applied at the rate of 12.50, 25 and 50 ml. /feddan (**Temerak, 2005**), while XDE was applied at 20, 35, 70 and 104 ml. / feddan. Capl oil was used only at the rate of 13 ml. used as mixture with the least concentration of both Tracer and XDE. Methoxyfenozide and chlorpyrifos were applied at their recommended rates as 150 ml. / feddan and 1000 ml. /feddan, respectively. During the peak of the first generation of egg deposition on cotton plants (mid-June), wherever the

cotton plants at flowering stage, each concentration of the tested treatments was sprayed on area about four kirates contained one hundred remarked egg masses (twenty five egg mass / kirate as a replicate) using motor sprayer at the rate of 120 L. insecticidal solution/feddan. Untreated belt about one kirate was left between each two treatments as a border.

Hatched (which produced neonate and over of 90% were alive) and unhatched egg masses were recorded after 2 and 4 days for all treatments and control (**Raslan, 2002**), dead hatching egg masses (referred as egg masses produced all neonate larvae and seen at time of inspection as dead inside the eggs or on the top of egg masses without any locomotion on the leaves around) were also detected. Data were calculated as following equation:

$$\textbf{\% Ovicidal} = \frac{\text{Total remarked egg masses} - \text{Hatched egg masses}}{\text{Total remarked eggs}} \times 100$$

$$\textbf{General Activity} = \frac{\text{No. of unhatched egg masses} + \text{No. of dead-hatched egg masses}}{\text{Total No. of remarked egg masses}} \times 100$$

Statistical analysis:

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

The ovicidal activities of different treatments during the two tested seasons 2007 and 2008 were tabulated in Tables (1 & 2). All the tested treatments gave significant ovicidal effects against egg-masses of cotton leafworm *S. littoralis* at 2 and 4 days post treatment comparing to control with the exception of Capl-1 (mineral oil).

Tracer and XDE were tested at recommended rate, half of recommended rate and quarter of recommended rate while in case of XDE the rate of 17.50 ml. /feddan (1/8 of the recommended rate) was also tested against eggs of *S. littoralis*. The highly ovicidal activities were observed with methoxyfenozide which resulted in 90 and 98% after 4 days in 2007 and 2008 seasons, respectively followed by the highest concentration of Tracer and XDE in both seasons which recorded (89 and 86) and (85 and 84), respectively.

Table (1): Summary of obtained results occurred by tested treatments against *S. littoralis* egg masses in Zagazig district, Sharqia Governorate season 2007.

Treatment	Conc. ml./feddan	Ovicidal actions at indicated days after treatment							% General activity
		After 2 days			After 4 days				
		Hatched	Unhatched	% Ovicidal	Hatched		Un-hatched	% Ovicidal	
					alive	dead			
Capl-oil	13	94	6	6.00c	97	0	3	3.00 f	3.00
Tracer	50	5	95	95.00a	2	9	89	89.00a	98.00
	25	10	90	90.00 ab	8	12	80	80.00 abc	92.00
	12.50	20	80	80.00 b	25	28	47	47.00 e	75.00
	12.5+ Capl	7	93	93.00 a	16	24	60	60.00 d	84.00
XDE	104	6	94	94.00 a	0	14	86	86.00 ab	100.0
	70	10	90	90.00 ab	0	19	81	81.00 abc	100.0
	35	15	85	85.00 ab	7	20	73	73.00 c	93.00
	17.50	20	80	80.00 b	18	20	62	62.00 d	82.00
	17.50+ Capl	10	90	90.00 ab	8	17	75	75.00 bc	92.00
Methoxyfenozide	150	7	93	93.00 a	0	10	90	90.00 a	100.0
Chlorpyrifos	1000	10	90	90.00 ab	0	97	3	3.00 f	100.0
Control	-	95	5	5.00 c	100	0	0	0.00 f	0.00
L.S.D $_{0.05}$		7.389			8.308				

Table (2): Summary of obtained results occurred by tested treatments against *S. littoralis* egg masses in Zagazig district, Sharqia Governorate season 2008.

Treatment	Conc. ml./feddan	Ovicidal actions at indicated days after treatment							% General activity
		After 2 days			After 4 days				
		Hatched	Unhatched	% Ovicidal	Hatched		Un-hatched	% Ovicidal	
					alive	dead			
Capl-oil	13	92	8	8.00 **c**	96	0	4	4.00 **e**	4.00
Tracer	50	8	92	92.00**a**	4	11	85	85.00**ab**	96.00
	25	10	90	90.00 **a**	9	9	82	82.00 **ab**	91.00
	12.50	23	77	77.00 **b**	30	17	53	53.00**d**	70.00
	12.5+ Capl	10	90	90.00 **a**	19	18	63	63.00 **c**	81.00
XDE	104	5	95	95.00 **a**	2	14	84	84.00 **ab**	98.00
	70	9	91	91.0 **a**	4	16	80	80.0 **ab**	96.00
	35	18	82	83.00**ab**	10	14	76	76.00 **b**	90.00
	17.50	22	78	78.00 **b**	20	16	64	64 .00**c**	80.00
	17.50+ Capl	13	87	87.00 **ab**	16	5	79	79.00 **ab**	84.00
Methoxyfenozide	150	8	92	92.00 **a**	2	8	90	90.00 **a**	98.00
Chlorpyrifos	1000	15	85	85.00 **ab**	2	96	2	2.00 **e**	98.00
Control	-	94	6	6.00 **c**	100	0	0	0.00 **e**	0.00
L.S.D $_{0.05}$		7.379			8.026				

There is a direct proportion between the used rates and ovicidal percentages of both Tracer and XDE. As for Tracer, the ovicidal activity after 4 days were recorded 89, 80 and 47% in season 2007 and 85, 82 and 35% in season 2008 at concentrations 50, 25 and 12.5 ml. /feddan, respectively, while XDE at concentrations 104, 70, 35 and 17.5 ml. /feddan resulted in 86, 81, 73 and 62% in the first tested season and 84, 80, 76 and 64% in the second season, respectively, Tables (1 & 2).

Capl oil and chlorpyrifos recorded less ovicidal activity that gave 3 and 3% in season 2007 and 4 ad 2% in 2008 season, respectively.

Adding Capl-1 oil to spray emulsions of both Tracer and XDE (used at the least rate) and applied on cotton plants increased the ovicidal percentages of the selected concentrations than it solely. This increase in the activities accompanied with significant difference among the used concentrations at the tested successive seasons. The mixture of Capl-1 oil with Tracer elevated the ovicidal percentages from (80 and 47 %) for the least concentration to (93 and 60 %) for the mixture after 2 and 4 days of treatment in the first season, respectively. Whereas in the second season increased form (77 and 53 %) to (90 and 63 %), respectively Tables (1 & 2). The mixture of Capl oil with XDE increased the ovicidal impact from (80 and 62% for XDE at concentration of 17.50 ml./feddan to (90 and 57%) for the mixture after 2 and 4 days of treatment in season 2007 and from (78 and 64%) to (87 and 79%) in season 2008, respectively.

The general activities which represented as unhatched egg masses and dead hatched egg masses as neonate larvae inside the eggs or on the top of eggs masses were 100% for XDE at concentrations 104 and 70 ml./feddan, methoxyfenozide and chlorpyrifos in season 2007. In season 2008, XDE at concentration 104, methoxyfenozide and chlorpyrifos that recorded the highest general activity (98%). While the least general activity resulted 3 and 4% for Capl oil in 2007 and 2008 seasons, respectively.

The higher the concentration the greater the general activity of both Tracer and XDE that manifested (75, 90 and 98%) in 2007 and (70, 91 and 96%) in 2008 for Tracer at concentrations 12.5, 25 and 50 ml./feddan.While XDE at concentrations 17.5, 35, 70 and 104 gave general activity of (82, 93, 100 and 100%) in the first tested season and (80, 90, 96 and 98%) in the second season, respectively.

All the tested treatments caused significant increase in the mortality percentages of *S. littoralis* eggs than control except Capl-1 oil. The present conclusion was in harmony with (**Pineda *et al.* 2006** and **Osman and Mahmoud 2009**) when used methoxyfenozide and spinosad under laboratory conditions against *S. littoralis* eggs. The reason of mortality of the neonate larvae probably due to the direct contact with the

treated surfaces (egg masses and plant leaves) or stomach feeding on the poisoned egg shells.

Also, **Ascher and Nemny (1990)** reached the same results when tested the ovicidal activity of organophosphorus insecticides including chlorpyrifos and other insecticides in the laboratory. **Ascher *et al.*, (1980)** found that respiration in the *S. littoralis* eggs treated with IGR (diflubezuron) was decreased rapidly comparing with control. On contrary, **Abd El-Halim *et al.*, (1999)** mentioned that mineral oil Capl-1 was effective in controlling egg masses and newly hatched larvae as they gave controlling percentages equal 48 % under field conditions.

Mortality of *S. littoralis* egg masses as neonate larvae inside the eggs or on the top of egg masses without any locomotion on the leaves around was also observed by many authors (**Pineda *et al.* 2000 & 2004, Raslan, 2002** and **Temerak, 2005**) after treated egg masses with Tracer and methoxyfenozide under laboratory and field conditions. **Temerak (2007)** utilize two spinosyn products, Spinosad 24% SC, Spinetoram 12% SC and Dursban 48% EC against masses of *S. littoralis* in cotton fields. The tested concentrations showed 100% mortality of the entire hatched egg masses 4 days after spraying. Majority of the mortality effect took place just after hatching for all tested insecticides The mortality of the neonate larvae may be refer to direct contact with the treated surfaces (egg masses and cotton leaves) or stomach poisonous due to feeding on the treated egg shells. Moreover, **Temerak (2005)** found that the most effective dose of spinosad was 50 ml./ feddan. This dose resulted in 100% initial mortality of the entire fresh natural egg masses of *S. littoralis* during and after hatching, and showed 90 % residual mortality of those egg masses deposited3 days after spraying or inspected 6 days after spray.

The general activity of XDE either solely or as mixture was most potent than spinosad against egg masses of *S. littoralis*. In the same context, **Temerak (2007)** found that Spinetoram was 7 times stronger than spinosad when tested the two spinosyn products against egg masses of *S. littoralis*.

Addition of Capl-1 mineral oil which low priced, non toxic to human and animals and feasible in application to the least concentration of both Tracer and XDE enhancing their ovicidal activities more than Tracer and XDE solely. The influence of some additives (KZ oil, Capl-2 oil and Jojoba oil) to three insecticides; Marlene Sumi alpha and Dursban were evaluated by (**Badr and El-Sisi 1999**). Adding any of the adjuvants to Dursban at 65 % rate of recommended rate caused 100 % initial mortality of the 4th instar larvae of ***S. littoralis***. As for the residual effect, using KZ oil and Capl-2 oil activated the residual toxicity of the

insecticides with lesser dose to be more as compared to complete field application. The addition of some mineral oils to insecticides spray solution cause changes in the physico-chemical properties of spray solutions such as (viscosity, surface tension and pH values) therefore it cause enhancement of insecticides efficiency against target insect, *S. littoralis* (**Badr and El-Sisi 1999** and **Badr *et al.*, 1999**). Oils also reduced pesticide evaporating (**Kirkwood, 1993**) and accelerate its absorbance inside plant cells (**Urvoy, 1992**)

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تقييم حقلى لبعض المبيدات الحشرية على بيض دودة ورق القطن

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برهنت كل المبيدات المختبرة ان لها تأثيرا ابادياً على بيض دودة رق القطن حتى بعد ٢ و ٤ يوم من المعاملة مقارنة بالكنترول باستثناء الزيت المعدنى كابل-١ ، و كان مركب ميثوكسيفينوزيد هو الأكثر إبادة للبيض و سجل ٩٣,٩٠ ٪ فى الموسم الأول للدراسة و ٩٢,٩٠ ٪ فى الموسم الثاني بعد ٢ و ٤ يوم من المعاملة.

أدت إضافة الزيت المعدنى كابل-١ الى كل من تراسر و اكس دى إى الى زيادة القدرة الإبادية لهذه المركبات على البيض عن استعمالها بحالة منفردة كما أشارت النتائج الى ان معدلات موت اليرقات حديثة الفقس تراوحت بين صفر٪ للزيت المعدنى كابل-١ و الكنترول، الى ٩٧,٠٠ ٪ مع كلوربيريفوس فى موسم ٢٠٠٧ كما تراوحت النسبة المئوية لإبادة اليرقات حديثة الفقس بين صفر مع الزيت المعدنى كابل-١ و الكنترول الى ٩٦,٠٠ ٪ مع كلوربيريفوس فى موسم ٢٠٠٨.

بصفة عامة، كان تأثير اعلي تركيزين مستخدمين لمركب ميثوكسيفينوزيد، كلوربيريفوس هما الأكثر قدرة ابادية على بيض دودة رق القطن حيث سجلا نفس القيمة (١٠٠٪) فى العام الأول، بينما سجلا ٩٨، ٩٦، ٩٨، ٩٨٪ فى العام الثانى.