TOXICOLOGICAL STUDIES OF SOME INSECTICIDES ON THE PINK BOLLWORM, *PECTINOPHORA GOSSYPIELLA* (SAUND.)

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Abstract

The present study aimed to evaluate the potency of some different groups of insecticides, Synthetic pyrethroids (esfenvalerate, fenpropathrin and lambda cyhalothrin), Organophosphorus compound: (chlorpyrifos), and Carbamate (thiodicarb) against eggs, newly hatched larvae and moths (males& females) of the pink bollworm, *Pectinophora gossypiella* (Saund.), in addition to antimoulting compound (tebufenozide) against the newly hatched larvae. The results could be summarized as follows:

a- Egg stage: Dipping technique was used in treating 1,2,3&4 days old eggs. Fenpropathrin gave the highest effect on 1,2&3 days old eggs.Whereas, chlorpyrifos gave the highest effect on 4 days old eggs compared with the other compounds.

b- Newly hatched larvae: Residual film technique was used. Fenpropathrin was the most potent compound than the other insecticides.

c- Adult moths: Residual film technique was used. Fenpropathrin was the most effective than the other tested insecticides.

The adult male and female moths 1-day old age of the pink bollworm were treated as T♂xT♀, T♂XU♀, U♂XT♀ and U♂XU♀ and determined the number of spermatophores in each female (mating frequency) and mating ability percentage after 24, 72 hours and after females death. The results showed that: Fenpropathrin followed by esfenvalerate and lambda cyhalothrin had the highly reduction of the number of spermatophore (mating frequency) and mating ability percentage in all treatments (T♂xT♀, T♂XU♀ and U♂XT♀) after 24, 72 hours and after female moths death. While, chlorpyrifos and thiodicarb gave the least number of spermatophores compared with the pyrethroid compounds.

INTRODUCTION

The pink bollworm, *Pectinophora gossypiella* (Saund.) is the most harmful pests infesting cotton bolls in Egypt.

Crop production could be increased and bollworms infestation decreased by finding and applying better methods of control cotton the pests. There are many ways in controlling the bollworms, the pesticides still the security valve for this economic cotton crop, it could be considered the most effective against eggs and newly hatched larvae which are present on the outer surface before penetrating cotton bolls (Bariola (1984), Joginder *et al.* (1993) and Abdel-Rahman *et al.* (2002).

Mating ability showing the higher efficiency of the compounds against the pest, in a given ecosystem is an important step for achieving an efficient biological and chemical control program. On the other hand, successful biological and chemical control is a clear indication of adequate pest control, but there is need to test procedures that assess performance before the pest are released, the reproductive performance of the pest should be determined by rearing on artificial diet for treated newly hatched larvae.

The objectives of the present study aimed to investigate the following aspects:

A- Efficacy of some insecticides against different stages of the pink bollworm.

B- Effect of the tested insecticides on the mating frequency and mating ability percentage of the pink bollworm.

MATERIALS AND METHODS

Tested compounds:

Synthetic pyrethroid compounds:

1.1. Esfenvalerate (Sumi-alpha 5% EC.): (S)- α – cyano -3-phenoxy benzyl) (s) – 2-(4-chlorophenyl)-3-methylbutyrate.

1.2. Fenpropathrin (Danitol 30% EC.): alpha-cyano- 3 – phenoxy phenyl methyl 2,2,3,3-tetra methyl cyclopropane carboxylate.

1.3. Lambda cyhalothrin (Karate 5% EC.): a reaction product comprising equal quantities of (S)-α- cyano-3- = phenoxy benzyl (z) -(1R)-cis-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2- = dimethyl cyclopropane carboxylate and (R)- α-cyano-3-phenoxy benzyl (Z) - (1S) –cis-3-(2-chloro- =3,3,3-trifluoropropenyl)-2,2-dimethyl cyclopropane carboxylate.

Organophosphorous compound:

Chlorpyrifos (Dursban 48% EC.) 0,0-diethyl 0-(3,5,6 trichloro –2- pyridinyl phosphorothioate .

Carbamate compound:

Thiodicarb (Larvin 80% WP.): 3,7,9,13 – tetramethyl – 5,11-dioxa-2,8,14-trithia-4,7,9,12- tetra- azapentadeca-3,12-diene-6,10-dione.

Antimoulting compound:

Tebufenozide (Memic 24% FL.) : [N – tetra – butyl – N – (4 – ethylbenzoyl) – 3,5 – dimethyl benzohydrazide].

Toxicity of tested insecticides to the different stages of the pink bollworm:

A laboratory strain of the different stages of the pink bollworm (eggs, newly hatched larvae and adult moths) were reared at the Integrated Pest Management Laboratory, Bollworms Department, Plant Protection Research Institute, A.R.C. on modified artificial diet as described by Abdel-Hafez *et al.*,(1982). Rearing conditions were controlled at 27±1°C and 65-75%R.H.

Egg-stage:

The dipping technique was used. Three replicates were used from each concentration and each replicate contained number of eggs, 1- 4 days old. The peace of paper contained deposited eggs was dipped for 1min in each tested concentrations, another 3 replicates were treated with water for the check. Each treated replicate/each concentration was placed in a clean tube (3x10 cm.) after water evaporation until hatching under the controlled conditions (27±1°C & 65-75%R.H).. The dead and alive eggs were counted.

Newly hatched larvae:

Thin film technique was used as a method of application in the present work. Each Petri-dish was treated with 1.0 ml of the tested concentration. The Petri-dish which used as control was treated with water only.Twenty five of newly hatched larvae were exposed for one hour to the insecticide film in each Petri-dish. The alive larvae from each treatment were transfered to clean vials containing the artificial diet and maintained under 27 ^{0}C. Then the numbers of alive and dead larvae were counted three days after treatment. Five replicates for each concentration and the control were done.

Adult moths:

The film technique (exposure to treated surface) was used.Groups of newly emerged moths (10 male or female) were placed in clean glass lamp chimnies used as cages covered with treated petri-dish. Three replicate were used for each concentration as well as untreated check. One-hour after treatment the petri-dishes were removed and the cages were provided with cotton soaked in 10% sugar solution and covered with muslin cloth held in position by rubber bands. After 48-hour the dead and alive moths were counted.

LC_{50} & LC_{90} values were measured by software computer probane. The efficiency of different insecticides could be measured by using Sun 's equation (1950) as follows:

$$\text{Toxicity index} = \frac{LC_{50}\ (LC_{90}) \text{ of the compound A}}{LC_{50}\ (LC_{90}) \text{ of the compound B}} \times 100$$

Where A: is the most effective compound.

B: is the other tested compounds.

Effect of tested insecticides on the mating frequency and mating ability percent of the treated moths:

The adult moths (1-day old age) of the pink bollworm were treated as T♂xT♀, T♂XU♀, U♂XT♀ and U♂XU♀ in 3 replicates, each replicate contained five males and five females treated by the LC_{50} of the tested compounds, esfenvalerate,

fenpropathrin, lambda cyhalothrin, chlorpyrifos and thiodicarb as previously described in adult moths method.

Mating frequency was done by dissection the females to determine the presence of spermatophores after 24& 72 hours from the end of the treatment and after the death of female moths. Evaluation of the mating frequency was determined by counting the number of spermatophores per mated female.

While, Mating ability percentage was calculated as follows:

$$\text{Mating ability\%} = \frac{\text{Number of mated females}}{\text{Total number of experimental females}} \times 100$$

RESULTS AND DISCUSSION

Efficacy of tested insecticides against the Pink Bollworm, *P. gossypiella*:

a- Egg stage: Regarding the LC_{50} values in Table (1), it could be noted a gradual decrease in the efficacy of the three pyrethroids by increasing the age of eggs at the time of treatment. On the contrary, the efficacy of chlorpyrifos and thiodicarb appeared to be related to the progression of egg development at the time of exposure. It means that the LC_{50} values of the tested insecticides were found to be age-dependent. For example the LC_{50} values were 8.59, 6.3, 15.88 ppm when 1-day old eggs were treated with esfenvalerate, fenpropathrin and Lambda cyhalothrin, respectively. These values increased to 33.08, 7.07 & 34.24 ppm, 34.95, 7.8 & 60.74 ppm and 39.82, 34.25 & 61.26 ppm when 2, 3 and 4-day old eggs were treated with the same compounds, respectively.

Table 1. Efficacy of some recommended insecticides against the 1,2,3 and 4-day old eggs of the Pink bollworm, *P. gossypiella* .

Insecticides	LC_{50} ppm	LC_{50} 95%Confidence limits	LC_{90} ppm	LC_{90} 95%Confidence limits	Slope (b)	Toxicity index (LC_{50})
1- day old eggs						
Esfenvalerate	8.59	7.399 ± 9.802	103.0	99.97 ± 107.4	1.188	73.34
Fenpropathrin	6.30	5.005 ± 7.883	162.6	152.9 ± 169.8	0.908	100.0
Lambda cyhalothrin	15.88	13.91 ± 18.09	167.7	159.9 ± 171.8	1.252	39.97
Chlorpyrifos	59.84	47.04 ± 73.17	647.9	639.5 ± 652.3	1.239	10.53
Thiodicarb	135.1	110.3 ± 161.8	2019.4	1982.4±2049.1	1.094	4.66
2- day old eggs						
Esfenvalerate	33.08	28.43 ± 38.302	324.6	300.2 ± 344.5	1.292	21.37
Fenpropathrin	7.07	5.713 ± 8.604	39.60	37.43 ± 41.82	1.713	100.0
Lambda cyhalothrin	34.24	28.53 ± 40.012	484.4	468.1 ± 498.9	1.121	20.28
Chlorpyrifos	34.86	29.115 ± 40.83	179.9	168.8 ± 199.9	1.779	20.65
Thiodicarb	94.30	64.401 ± 124.1	788.5	769.8 ± 812.5	1.390	7.50
3- day old eggs						
Esfenvalerate	34.95	29.06 ± 40.894	390.1	382.5 ± 444.6	1.223	22.23
Fenpropathrin	7.80	6.051 ± 9.463	69.54	59.35 ± 77.12	1.347	100.0
Lambda cyhalothrin	60.74	52.71 ± 69.18	554.3	523.1 ± 571.2	1.335	12.79
Chlorpyrifos	29.34	21.53 ± 37.36	379.3	367.7 ± 394.5	1.153	26.48
Thiodicarb	80.49	71.65 ± 89.80	795.2	778.9 ± 812.4	1.071	9.65
4- day old eggs						
Esfenvalerate	39.82	35.42 ± 44.65	3455.2	3412 ± 3482.1	0.661	28.55
Fenpropathrin	34.25	22.37 ± 52.42	361.8	344.8 ± 386.4	1.252	33.20
Lambda cyhalothrin	61.26	52.81 ± 69.89	719.4	709.6 ± 731.4	1.198	18.56
Chlorpyrifos	11.37	9.728 ± 13.32	86.14	79.85 ± 94.12	1.457	100.0
Thiodicarb	74.69	63.85 ± 85.42	895.2	878.1 ± 921.3	1.188	15.22

These results were more closely to those reported by Abdel-Megeed *et al.,* (1987), Hirano and Saton (1993), Joginder *et al.,* (1993) and Abdel-Hafez *et al.,*(1996) who found that survival of the pink bollworm eggs was significantly affected by treating with pyrethroid compounds, followed by OP insecticides and the

carbamates were the least effective. Roeder (1953) explained the mode of action of the pyrethroids and mentioned its affect on ATPase enzymes in addition to their effect on central nervous system, also the embryo were killed just after hatching. In the present study, increasing of the efficacy of chlorpyrifos and thiodicarb in relation to the progression in egg development at the time of exposure was in concerning to the finding of the same author (Roeder 1953) who stated that different esterases started to accumulate in 1- day old eggs and increased gradually with 2nd and 3rd days. Acetylcholine esterase, which considered the site of action of chlorpyrifos, also accumulated in eggs until 2-4 days old eggs to the level quite enough to inhibit acetylcholine esterase. Carbamate compound (thiodicarb) also inhibits acetylcholine esterase with in low efficient compared to organophosphorus compound (chlorpyrifos).

b- Newly hatched larvae:

The five aforementioned insecticides in addition to the antimoulting insecticide (tebufenozide) were tested against the newly hatched larvae. Results in Table (2) showed that fenpropathrin was the most potent with LC_{50} 0.0009 mg/cm^2, followed by esfenvalerate with LC_{50} 0.0017 mg/cm^2, lambda cyhalothrin (0.016 mg/cm^2), chlorpyrifos (0.021 mg/cm^2), thiodicarb (0.062 mg/cm^2) and tebufenozide (1.056 mg/cm^2). These results are in agreement with those recorded by Nassar *et al.,* (1985) they found that polytrin was the most toxic insecticide against the larvae of *P. gossypiella* and *E. insulana.* Also, Abdel-Rahman *et al.,* (2002) indicated that esfenvalerate proved high insecticidal activities on *E. insulana* and the young larvae was the most susceptible stage followed by egg, adult and pupal stages. The present data also show that lambda cyhalothrin, chlorpyrifos and then thiodicarb gave a moderate effect on newly hatched larvae with LC_{50}'s: 0.016, 0.021 and 0.062 mg/cm^2, respectively.While tebufenozide gave the least effect with LC_{50}: 1.056 ppm.

Table 2. Efficacy of some recommended insecticides against the newly hatched larvae of the Pink bollworm, *P. gossypiella.*

Insecticides	LC_{50}(mg/cm²) 95%Confidence limits	LC_{90}(mg/cm²) 95%Confidence limits	Slope (b)	Toxicity index (LC_{50})
Es fenvalerate	0.0017 0.0009 ± 0.003	0.179 0.097 ± 0.394	0.636	52.94
Fenpropathrin	0.0009 0.0006±0.0013	0.0034 0.001 ± 0.045	2.251	100.0
Lambda cyhalothrin	0.016 0.0057 ± 0.028	0.529 0.093 ± 0.738	0.836	5.63
Chloropyrifos	0.021 0.0043 ± 0.035	0.131 0.035 ± 0.354	1.599	4.29
Thiodicarb	0.062 0.052 ± 0.073	0.389 0.168 ± 0.890	1.601	1.45
Tebufenozide	1.056 0.684 ± 1.87	10.568 6.846 ± 14.29	1.281	0.09

c- Adult stage:

Male moths: According to the toxicity index, the data in Table (3) showed that fenpropathrin was the most potent insecticide (toxicity index = 100) at the two LC levels, followed by the other two pyrethroids, esfenvalerate (LC_{50} =52.73 & LC_{90}= 28.61) and lambda cyhalothrin (LC_{50} = 42.49% & LC_{90}= 39.64), whereas chlorpyrifos and thiodicarb gave slight toxicity index at the two LC levels ranged between 4.09 - 13.74%.

Female moths: The data in Table (3) indicated that fenpropathrin was the most potent insecticide (toxicity index = 100) at the two LC levels. On the contrary, chlorpyrifos (10.75 & 6.15) and thiodicarb (8.21 & 4.35) were the least efficient compounds at the two LC levels, while the other insecticides, esfenvalerate (59.74 & 39.28) and lambda cyhalothrin (45.94 & 24.64) had a moderate effect at the two LC levels.

Comparing the results of the two sexes, it could be noted that males were more susceptible to the aforementioned insecticides than females. So greater mortality percent were obtained among males than females when they were treated with the same concentration. Bariola (1984) found the same results and mentioned that it may be due to the size differences between males and females. Also, he stated that pyrethroids gave the least LC_{50}'s values compared with the other tested compounds.

Table 3. Efficacy of some recommended insecticides against male and female moths of the pink bollworm , *P. gossypiella* .

Insecticides	LC_{50}(mg/cm^2) 95%Confidence limits	LC_{90}(mg/cm^2) 95%Confidence limits	Slope (b)	Toxicity index (LC_{50})
Male moths				
Es fenvalerate	0.220 0.13 ± 0.346	0.776 0.567 ± 0.976	2.338	52.73
Fenpropathrin	0.116 0.096 ± 0.153	0.222 0.168 ± 0.352	4.552	100.0
Lambda cyhalothrin	0.273 0.224 ± 0.344	0.560 0.424 ± 0.686	4.103	42.49
Chloropyrifos	0.844 0.543 ± 1.23	2.506 0.989 ± 3.989	2.712	13.74
Thiodicarb	1.940 1.384 ± 2.468	5.426 3.448 ± 7.231	2.869	5.98
Female moths				
Es fenvalerate	0.303 0.147 ± 0.584	0.83 0.650 ± 1.002	2.932	59.74
Fenpropathrin	0.181 0.153 ± 0.244	0.326 0.115 ± 0.575	5.05	100.0
Lambda cyhalothrin	0.394 0.193 ± 0.621	1.323 0.899 ± 2.142	2.434	45.94
Chloropyrifos	1.683 0.988 ± 2.393	5.304 0.335 ± 7.151	2.57	10.75
Thiodicarb	2.206 1.179 ± 3.174	7.488 5.886 ± 9.847	2.415	8.21

Effect of some Insecticides on Mating Frequency and Mating Ability Percentage:

1- Mating frequency:

Mating frequency in normal female was increased by increasing the period after treatment until female death as it reached four times in some females (Table 4), while, the number of spermatophores/ mated female averaged 1.6, 1.83 and 2.93 spermatophores after 24&72 hrs. of treatment and at the end of female life, respectively. While, the number of spermatophores/ mated females (1.0 spermatophore) indicated that one mating only was occurred through the first 24 hrs. after treatment with the three pyrethroids (esfenvalerate, fenpropathrin and lambda cyhalothrin). While, few females mated twice through the 72 hrs. following treatment of one sex only with Lambda cyhalothrin. On the other hand, mating frequency increased in all combinations by increasing the periods after treatment until female

death, as some females mated twice and the average number of spermatophores/ mated female ranged between 1.2-1.9 spermatophores.

Comparing with the other insecticides tested, more mating frequency was achieved in all combinations after treatment with thiodicarb as many females mated for three times through their life.

The average number of spermatophores/ mated females ranged between 1.17-1.4 spermatophores at 24 hrs. after treatment, 1.53-1.8 at 72 hrs. after treatment and 2.0-2.13 spermatophores after female death. As for treatment with the organophosphorus compound, chlorpyrifos, the females mated for one time only (1.0 spermatophore) through the first 24 hrs. after treatment while, some of them mated twice (1.2-2.0 spermatophores) through their life. The reduction in mating frequency of the pink bollworm moths in the present study was in agreement with the finding of Bariola (1984) who stated that all the pyrethroid affected mating and oviposition of the pink bollworm moths when used sublethal doses of cyfluthrin, fenpropathrin, fenvalerate, fluthrinate and permethrin against pink bollworm strain in U.S.A. Also the significant reduction on the mating frequency in the treated moths was obtained previously by many investigators when they tested different compounds against some cotton insects (Eid and Moursy 1992, Salem *et al.,* 1992 & 1994 and Mohamed *et al.,* 1996). They mentioned that the number of spermatophores per mated female significantly reduced when both or either sex was treated compared with the control. Also, they added that the number of malformed spermatophores increased when crosses were contained treated males and females.

2- Mating ability percentage:

Table (4) showed that control crosses (U♂x U♀) had percent of mating averaged (60.7%) 24 hrs. after treatment, while it increased to 73.3% at 72 hrs. after treatment and 80.0% after female death. Pyrethroids were more active in reducing mating ability of the treated moths than the other tested groups. In these group, fenpropathrin appeared to be the most effective in all the tested periods particularly when both sexes were treated (13.3, 16.0 and 26.7%, respectively) followed by esfenvalerate (15.0, 18.0 & 28.0%, respectively) and lambda cyhalothrin. (21.7, 28.0 & 33.3%, respectively). The efficacy order of the three aforementioned pyrethroids took the same trend when one sex only was treated. The values were: 16.0, 20.0 & 28.0%, 18.0, 24.0 & 30.0% and 26.3, 33.3 & 36.0% when males only were treated. While, these percentages were 20.0, 26.7 & 30.0%, 25.0, 28.0 & 35.0% and 30.0, 35.0 & 38.0% when females only were treated with the three compounds, respectively. The carbamate compound thiodicarb seemed to be the least effective as the percent of mating ranged between 40-59% in all treated combinations.

Table 4. Mating frequency (number of spermatophores/ mated female) and mating ability Percentage of the pink bollworm *P. gossypiella* treated with LC_{50} concentrations of some insecticides.

Treatments	Crosses					
	T♂xT♀		T♂xU♀		U♂xT♀	
	% Mating ability	No. spermatophores/ Mated female ± SE (Range)	% Mating ability	No. spermatophores/ Mated female ± SE (Range)	% Mating ability	No. spermatophores/ Mated female ± SE (Range)
24 hrs. after treatment						
Esfenvalerate	15	$1^{b} \pm 0.0$ (0-1)	18	$1^{b} \pm 0.0$ (0-1)	25	$1^{b} \pm 0.0$ (0-1)
Fenpropathrin	13.3	$1^{b} \pm 0.0$ (0-1)	16	$1^{b} \pm 0.0$ (0-1)	20	$1^{b} \pm 0.0$ (0-1)
Lambda cyhalothrin	21.7	$1^{b} \pm 0.0$ (0-1)	26.3	$1^{b} \pm 0.0$ (0-1)	30	$1^{b} \pm 0.0$ (0-1)
Chloropyrifos	33.3	$1^{b} \pm 0.0$ (0-1)	36	$1^{b} \pm 0.0$ (0-1)	38	$1^{b} \pm 0.0$ (0-1)
Thiodicarb	40	$1.17^{b} \pm 0.167$ (0-2)	45	$1.33^{a} \pm 0.167$ (0-2)	49	$1.4^{a} \pm 0.208$ (0-2)
Control	60.7	$1.6^{a} \pm 0.153$ (0-2)	60.7	$1.6^{a} \pm 0.153$ (0-2)	60.7	$1.6^{a} \pm 0.153$ (0-2)
$LSD_{.05}$		0.284		0.284		0.325
72 hrs. after treatment						
Esfenvalerate	18	$1^{c} \pm 0.0$ (0-1)	24	$1.1^{c} \pm 0.099$ (0-1)	28	$1.17^{bc} \pm 0.167$ (0-1)
Fenpropathrin	16	$1^{c} \pm 0.0$ (0-1)	20	$1^{c} \pm 0.0$ (0-1)	26.7	$1.1^{c} \pm 0.099$ (0-1)
Lambda cyhalothrin	28	$1.17^{bc} \pm 0.167$ (0-2)	33.3	$1.3^{bc} \pm 0.0$ (0-2)	35	$1.57^{ab} \pm 0.167$ (0-2)
Chloropyrifos	35	$1.2^{bc} \pm 0.099$ (0-2)	38	$1.33^{bc} \pm 0.0$ (0-2)	40	$1.67^{a} \pm 0.203$ (0-2)
Thiodicarb	43	$1.53^{ab} \pm 0.233$ (0-2)	49	$1.57^{ab} \pm 0.167$ (0-2)	53	$1.8^{a} \pm 0.099$ (0-2)
Control	73.3	$1.83^{a} \pm 0.088$ (0-2)	73.3	$1.83^{a} \pm 0.088$ (0-2)	73.3	$1.83^{a} \pm 0.088$ (0-2)
$LSD_{.05}$		0.398		0.317		0.426
After female death						
Esfenvalerate	28	$1.4^{c} \pm 0.208$ (0-2)	30	$1.57^{bc} \pm 0.296$ (0-2)	35	$1.77^{b} \pm 0.233$ (0-2)
Fenpropathrin	26.7	$1.2^{c} \pm 0.145$ (0-2)	28	$1.27^{c} \pm 0.099$ (0-2)	30	$1.67^{b} \pm 0.33$ (0-2)
Lambda cyhalothrin	33.3	$1.57^{bc} \pm 0.066$ (0-2)	36	$1.63^{bc} \pm 0.067$ (0-2)	38	$1.9^{b} \pm 0.099$ (0-2)
Chloropyrifos	38	$1.63^{bc} \pm 0.066$ (0-2)	44	$1.67^{bc} \pm 0.202$ (0-2)	46	$2^{b} \pm 0.289$ (0-2)
Thiodicarb	46	$2^{b} \pm 0.173$ (0-3)	55	$2.07^{b} \pm 0.185$ (0-3)	59	$2.13^{b} \pm 0.233$ (0-3)
Control	80	$2.93^{a} \pm 0.233$ (0-4)	80	$2.93^{a} \pm 0.233$ (0-4)	80	$2.93^{a} \pm 0.233$ (0-4)
$LSD_{.05}$		0.499		0.606		0.763

An intermediate effect in mating ability percent of the pink bollworm moths was achieved after treatment with the organophosphorus compound chloropyrifos, as the percent of mating ranged between 33.3- 46.0% in all combinations after the tested periods.

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دراسات سمية لبعض المبيدات على دودة اللوز القرنفلية

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يهدف هذا البحث الى دراسة تـأثير مركبـات الـــ اس.فينفـاليرات es fenvalerate و الفينبروباثرين fenpropathrin و اللامبدا سيهالوثرين lambda cyhalothrin و هى ثلاثـة مركبـات شـائعة الاسـتخدام مـن مجموعـة البيرثرويـدات التركيبيـة (المخلقـة صـناعيا)، و مركـب الكلوربيريفـوس chlorpyrifos كنمـوذج لأحـد مركبـات الفوسـفور العضـوية و مركـب الثيوديكارب thiodicarb كممثل لمركبات الكرباميت على أطوار البيض و الفقس الحديث و الفراشات (ذكور – إناث) لدودة اللوز القرنفلية (.*Pectinophora gossypiella* (Saund بالإضافة إلـى مـانع الإنسلاخ التبيوفينوزيد tebufenozide على الفقس الحديث. **و يمكن تلخيص النتائج كمايلى:**

أ- طور البيضة: استخدمت طريقة الغمر فى معاملات البيض بالمركبات السابقة و كان الفينبروباثرين أكثر المبيدات كفاءة فى معاملات بيض عمر يوم و يومين و ثلاثة بينما الـكلوربيريفوس كان أكثرهم كفاءة فى معاملات بيض عمر أربعة أيام.

ب- يرقات الفقس الحديث: استخدمت طريقة الفيلم الرقيق فى المعاملة بالمبيدات السابقة و كان الفينبروباثرين اكثرهم كفاءة.

ج- الفراشات: استخدمت طريقة الفيلم الرقيق فى المعاملة بالمبيدات السابقة و كان الفينبروباثرين اكثرهم كفاءة.

تم دراسة تأثير التركيز النصفى المميت (LC_{50}) للمركبات السابقة على الفراشـات فـى عـدة معاملات: ذكور غير معاملة x اناث غير معاملة (U♂XU♀) ، ذكور غير معاملة x اناث معاملـة (U♂XT♀) ، ذكور معاملة x اناث غير معاملة (T♂XU♀) ، ذكور معاملة x اناث معاملـة (T♂xT♀)على عدد مرات التزاوج و ذلك بحساب عدد الأكياس المنويـة spermatophores فـى القابلة المنوية spermathica فى الاناث و كذلك حساب النسبة المئوية للقدرة على التزاوج و ذلك بعد فترات ٢٤، ٧٢ ساعة و بعد انقضاء فترة حياتها و الموت **و قد أوضحت النتائج ما يلى:**

تفوق مركب الفينبروباثرين على غيره من المركبات فى اعطاء أعلى قيمة لخفض عدد مـرات التزاوج و ذلك بخفض عدد الأكياس المنوية فى الاناث و أيضا خفض النسبة المئوية للقـدرة علـى التزاوج يليه فى كفاءة الخفض مركب الـ اس.فينفاليرات و اللامبدا سيهالوثرين فى معاملات الـــ (T♂xT♀, T♂XU♀ and U♂XT♀) فى الفترات الثلاثة ٢٤ ، ٧٢ ساعة و بعد الموت و ذلك مقارنة بالكونترول. أما مركبى الكلوربيريفوس والثيوديكارب فقد أعطيا أقل قيمة لخفـض عـدد الأكيـاس المنوية مقارنة بمركبات البيريثرويد.