COMPARATIVE BIO-RESIDUAL ACTIVITY OF PYRIDALYL AND METHOMY INSECTICIDES AGAINST LARVAE OF THE COTTON LEAFWORM, *SPODOPTERA LITTORALIS* (BOISD.)

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Abstract

The bio-residual activity of two compounds, pyridalyl and methomyl against the second and fourth instar larvae of laboratory strain of the cotton leafworm, *Spodoptera littoralis* was evaluated under laboratory and semi–field conditions. The obtained larvae were fed for 48h on cotton leaves treated with the two compounds at 0, 3, 7 and 12 days after the treatment. To study two tested compounds had a similar effect on the 2nd and 4th instar larvae at 0 and 3days of the treatment. The second instar larvae were more susceptible to the two insecticides than the fourth ones. At leaf residues aged 7 and 12days, methomyl treatments had the greatest residual effect than that of pyridalyl. Pyridalyl and methomyl treatments had a latent effect on the. biological activities of this insect when the larvae fed on the leaf residues aged 12days. The effect was varied according to the larval instar and tested compound. It was found that the 2nd instar larvae treated with both pyridalyl and methomyl or the 4th instar larvae treated with methomyl highly significantly increased the larval duration. Also, the larval treatment of both instars with the two compounds caused highly significant increase on the pupal duration. Pyridalyl and methomyl caused highly significant decrease on the pupal weigh and adult emergence, and pyridalyl treatment had the highest effect in this respect. While, the larval treatment of the second and fourth instar with methomyl and the 2nd instar treated with pyridalyl had the strongest increasing effect on pupal and adult malformation percentages. On the other hand, the 2nd instar treated with methomyl had the most potent in depression of both the total no. of eggs laid per female and eggs hatching to reach zero compared to 508eggs/f and 100% that of control. While, the larval treatment of 2nd and 4th instar larvae with Pyridalyl inhibited the total no. of laid eggs to average57 and 81eggs/f .Hence only ,the 4th instar treated with Pyridalyl reduced the eggs hatching percentage to30%.Also, the larval treatment of 4th instar with both Pyridalyl and Methomyl highly significant decreased the adult longevity. Sex's ratio of adult males and females violent affect with the larval treatment of 2nd and 4th instar with methomyl and with the treated 4th instar with Pyridalyl, where it lead to adult male percentage decrease and female percentage increase, as compared to that of control. While, the larval treatment of 2nd instar with Pyridalyl had adversely effect in adult male percentages increase and females decrease in relative to that of control.

INTRODUCTION

The cotton leafworm, *Spodoptera littoralis* (Boisd) is one of the major pests that cause a considerable damage to many of the important vegetables and field crops in Egypt .The rising consumption of currently used insecticides in developing countries has led to a number of problems such as insect resistance, environmental pollution and the health hazards associated with pesticide residues .It is therefore necessary to complement our reliance on synthetic pesticides with less hazardous, safe, and biodegradable substitutes . Pyridalyl is an insecticide of a novel chemical class (unclassified) with an unknown mode of action that causes loss of vigour and death within 2-3 hours in lepidopterous larvae and is effective in the control of lepidopterous pests and thrips in cotton and vegetables. Toxicity of pyridalyl to insect pest specie, *Spodoptera litura*, was evaluated in the laboratory (Shigeru *et al*., 2004 and Isayama *et al.,* 2005). It active against the resistant strain of diamondback, *Plutella xylostella* (L) and *Heliothis virescens* (F) that are resistant to various insecticides. It also produces unique insecticidal symptoms, so it may have a different mode of action from other existing insecticides.

The conventional insecticide, Methomyl was used for the lepidopterous pests control (Kassem *et al*., 1986).

Therefore, the present study was conducted to compare the bio- residual activity of two compounds, pyridalyl and methomyl against the second and fourth instar larvae of *Spodoptera littoralis* under laboratory and semi–field conditions.

MATERIALS AND METHODS

1. The laboratory strain

The cotton leaf worm, *S. littoralis* was reared in the laboratory for several generations at room temp. ranged between 25 - 28 C^{o} and 60 -65% R.H. Larvae were fed on castor bean leaves, *Ricinus communis* (L.) in a wide glass jars until pupation and adults emergence. The newly emerged adults were mated inside glass jars and supplied with a piece of cotton wetted with 10% sugar solution as feeding source for the emerged moths and branches of Tafla (*Nerium oleander* L.) or castor bean leaves as an oviposition site (El- Defrawi *et al*.,1964 and Mohamed *et al.,*2000). Egg masses were kept in plastic jars until hatching. The obtained second and fourth instar larvae were used for bioassay tests.

2-Insecticides used

2.1- Pyridalyl

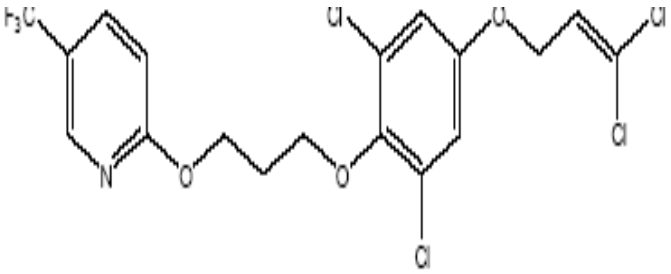
Trade name: The insecticide was introduced by Valent USA for control Lepidopterous pests in cotton under the code (S-1812)**.** The rate of application was 50-200g ai/ha.

Chemical name: 2, 6-Dichloro-4-(3, 3-dichloroallyloxy)phenyl3[5(trifluoromethyl) 2-pyridyloxy] propyl ether

Molecular Formula: C18 H14 Cl4 F3 NO3

Molecular Weight: 491.12

Structure:



2.2- Methomyl

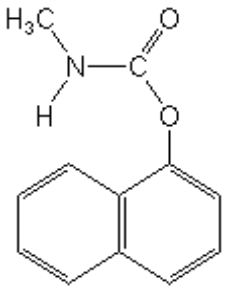
Trade names: Lannate, Lanox 216, NuBait II, Nudrin, SD 14999

Chemical Name: S-Methyl-N-[(methylcarbamoyl) oxy]-thioacetimidate

Molecular formula: C5 H10 N2 O2 S

Molecular weight: 162.20

Structure:



3- Laboratory and Semi–field tests

The present study was carried out in an isolated region within the Sids Station Farm, Beni -Suef .The planting of cotton plant was done using large pots (35x37cm) under field conditions .The two compounds were sprayed at the recommended rates via a simple hand atomizer in small prepared concentrations at 1.5gm/litre for

methomyl and 0.03gm/litre for pyridalyl (the concentrations caused 95% larval mortality of both instars treated with both compounds) .Ten replicates of pots were used in each treatment. The sprayed cotton leaves were random selected among the various replicates of the two treatments at zero, 3, 7 and 12 days of the treatment. Hundred larvae of either 2^{nd} or 4^{th} instar for larval feeding on treated leaves of the two tested compounds at the four time intervals used for48h. The total percent of the larval mortality after 48h of the larval feeding on the leaf residues of the two compounds were recorded and corrected according to Abbott formula (Abbott, 1925).
The different biological effects such larval and pupal duration , pupation and adult emergence percentage , adult fecundity ,eggs hatching% , adult longevity ,sex ratio% were estimated at the leaf residues aged 12 d of the treatment. Also, the observed malformations were recorded and photographed. The residual effect of the tested two compounds was tabulated and diagram illustrated.

4- Statistical analysis

The data of the biology were statically calculated through Excel for windows computer program to determine the F-value, P-value and L.S.D (least significant difference at 0.05 or 0.01freedom degrees).

RESULTS AND DISCUSSION

1- Bio-residual activities

Data presented in Table(1) demonstrated that the two tested compounds, pyridalyl and methomyl were effective against the 2^{nd} and 4^{th} instar larvae of *S. littoralis* extend to 12 days of the treatment . At the four tested leaf residues (0, 3, 7 and 12 d. of the treatment), the second instar larvae were more susceptible for the treatments than the fourth ones. Both compounds pyridalyl and methomyl had the same effect on both instars at 0 and 3 d. of the treatment. These treatments caused 100, 100 and 90, 80 %mortality of both 2^{nd} and 4^{th} instar larvae, respectively, as compared to 0% mortality of control. . Whereas at leaf residues aged 7 and 12 d Methomyl treatments had higher effect on both instars than that of Pyridalyl. Methomyl caused 80, 70 and 70, 60 % mortality for both 2^{nd} and 4^{th} instar larvae, respectively. While, Pyridalyl induced 62, 55 and 40, 34%mortality induced for both instars, respectively, in relative to the check (0%) as shown in fig. (1)

Table.1. Residual effect of Pyridalyl and Methomyl against the 2nd and 4th instar of laboratory strain of *Spodoptera littoralis* larvae at 0, 3, 7 and 12 days after the treatment in relative to control.

Treatment	**% of Mortality at residues after(Day)treatments**							
	Zero		**3**		**7**		**12**	
	2nd instar	**4th instar**	**2nd instar**	**4th instar**	**2nd instar**	**4th instar**	**2nd instar**	**4th instar**
Pyridalyl	100	100	90	80	62	55	40	**34**
Methomyl	100	100	90	80	80	70	70	**60**
Control	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

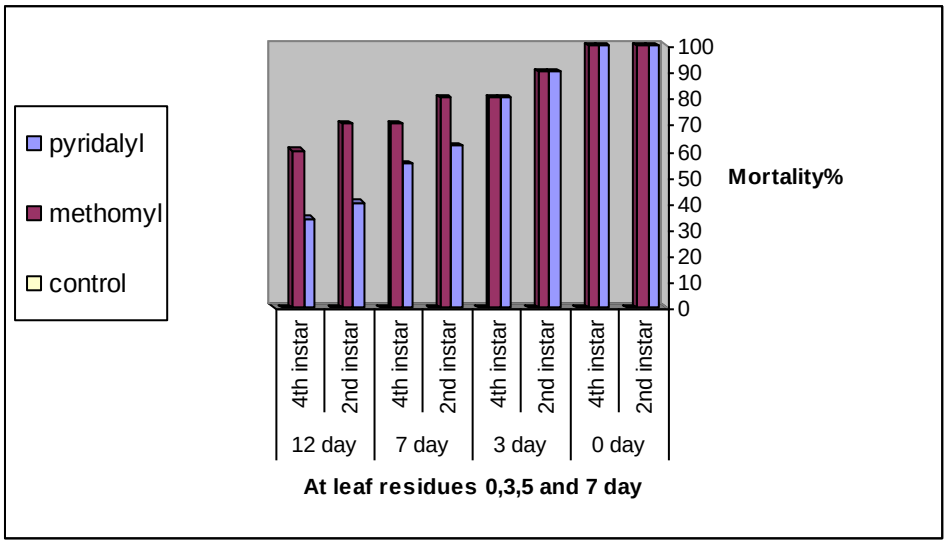


Fig. 1. illustrated the Residual effect of Pyridalyl and Methomyl against the 2nd and 4th instar of laboratory strain of *S. littoralis* larvae at leaf residues aged 0,3,7 and 12 days, respectively , of the treatment .

The obtained results agree with those obtained by Cook *et al. (*2004) reported that Indoxacarb, Pyridalyl, Spinosad, methoxyfenozide, and emamectin benzoate controlled beet armyworm, *Spodoptera exigua*, infestations up to 10 d after treatment compared to the non-treated control. Also, Ahmed (2004) found that the Spinosad was the most effective compound against the newly hatched larvae of both pink and spiny bollworms after 12 days for laboratory strain, respectively. Khalil and Watson (1986) found that the combinations of organophosphorous insecticides , diflubenzuron with either chlorpyrifos or acephate gave 100% mortality of *S.littoralis* larvae after 24h of the treatment. They reported that diflubenzuron plus fenvalerate had a long residual effect followed by diflubenzuron plus chlorpyrifos and the residual activity of chlorpyrifos, profenofos and acephate was increased when they applied in

combination with diflubenzuron. Saad *et al*. (1977) reported that the synthetic pyrethroid NRDC 147 is 10-100 times more stable in light than previous pyrethroids when it was tested in the laboratory and field against the Egyptian cotton leafworm *Spodoptera littoralis* and its residual effect (LT_{50}) is more than 7 days while it was 5.8, 6.8 and 4.2days for cyolane, leptophos and methamidophos.

2. Latent effect

2.1. Larval and pupal durations

Data presented in Table (2, 3) demonstrated the residual effect of the two tested compounds (pyridalyl and methomyl) reflected the biological activities of *S. littoralis.* The feeding of both 2nd and 4th instar larvae on the leaf residue after 12 days of the two compounds, increased the larval duration. The effect was more pronounced with the 2nd instar treated with both treatments. The larval duration showed highly significant($p< 0.01$) increase to average 24 and 22days for the two compounds ,respectively ,as compared to 15days of control (untreated 2nd instar larvae).Also, the larval treatment of 4th instar with methomyl highly significant($p< 0.01$)increased the larval duration to average 17days,as compared to12days of the check. While the fourth instar larvae feeding on Pyridalyl at the same leaf residue (12days) induced less significant increase ($p<0.05$) in the larval duration to average 16days in relative to that of the control (12days)

On the other hand, the second and fourth instar larvae feeding on the leaf residues aged 12d of the two compounds highly significant ($p<0.01$) increased the pupal duration (Table.2,3) of the resulting pupae to average 16.4$\pm$4.3, 13.3$\pm$1.3 and12$\pm$1.3, 13$\pm$2.8 days of both 2nd and 4th instar larvae treated with Pyridalyl and Methomyl, respectively, as compared to8.2$\pm$0.5 and 7.3$\pm$0.2days pupal duration of the resulting pupae from untreated 2nd and 2nd instar larvae of the check.

The obtained results agree with those obtained by Morillo and Notz (2004)found that the duration of the larval and pupal stages and the developmental period from egg to adult of *Spodoptera frugiperda* was significantly longer in the lambdacyhalotrin-selected strain and the methomyl-selected strain compared to the control strain, from the first to the last generation. Ahmed (2004) who mentioned that the larval period was elongated and the pupal period shorted for the new hatched larvae of pink and spiny bollworms (Laboratory strain) treated with the higher concentrations of Spinosad when compared with untreated larvae

Table. 2. Latent effect of Pyridalyl and Methomyl against the 2nd instar larvae of the lab. Strain of *S. littoralis* at 12 d. of the treatment in relative to control.

Treatments	Larval periods (days) ± SD	% Pupation ± SD		Pupal duration days	Pupal weight mg	*% Moth emergence ± SD*	
		Normal	Malfo.			Normal	*Malfo.*
Pyridalyl	24±1**	30±7**	22.8**	16.4±4.3**	268±43**	55±3.1**	*16**
Methomyl	22±1.3**	10±4**	33.3**	13.3±1.3**	303±33**	74±6**	*25**
Control	15±0.8	100	0	8.2±0.5	507±3.8	100	*0*
F value	255.2	1097.7	1469.5	89.158	150.001	260.1796	*4078.9*
P value	0.00384	0.000230	0.000274	0.000618	0.001445	0.000688	*0.00006*
L.S.D. at 0.05	*2.4*	*9.74*	*3.2*	*3.9*	*63.1*	*7.75*	*2.6*
0.01	*4.4*	*17.9*	*6*	*7.2*	*115.7*	*14.23*	*6.8*

** = Highly Significant (p<0.01) * Significant (p<0.05)

S.D. =Standard deviation Malfo. = Malformation%

L.S.D. = Least significant difference Lab. =Laboratory strain

N. S. =none Significant (p>0.05)

Table. 3. Latent effect of Pyridalyl and Methomyl against the 4th instar larvae of the lab. Strain of *S. littoralis* at 12 days of the treatment in relative to control.

Treatments	Larval periods (days) ± SD	% Pupation ± SD		Pupal duration days	Pupal weight mg	*% Moth emergence ± SD*	
		Normal	**Malfo.**			**Normal**	***Malfo.***
Pyridalyl	16±2.3*	60±7.1**	4n.s.	12±1.3**	285+21**	60+10**	*4.3n.s.*
Methomyl	17±0.4**	20+14**	20**	13±2.8**	320+104**	78+5.6**	*15**
Control	12±1.7	100	0	7.3±0.2	439+0.9	100	*0*
F value	24.5	236.9	24	55.1	141.6	49.6	*493.96*
P value	0.029524	0.00131	0.016277	0.005135	0.001732	0.010	*0.00020*
L.S.D. at 0.05	*3.85*	*13.3*	*12.9*	*2.2*	*42.1*	*14.3*	*2.2*
0.01	*7.10*	*23.5*	*23.9*	*3.985*	*77.3*	*26.1*	*3.95*

** = Highly Significant (p<0.01) * Significant (p<0.05)

S.D. =Standard deviation Malfo. = Malformation%

L.S.D. = Least significant difference Lab**.** =Laboratory strain

N. S=none Significant (p>0.05)

2.2. Pupation and Pupal weight

Data presented in Table (2,3) showed that the second and fourth instar larvae of *S. littoralis* which fed on the leaf residues aged 12days from treatment with pyridalyl and methomyl highly significant ($p < 0.01$) decreased the pupation percentage in respect to control. The effect was more pronounced with the methomyl treatment, the pupation averaged 10 and 20 % for both 2nd and 4th instar larvae treated with this compound, as compared to 100 %pupation of control. Whereas, the larval feeding of the 2nd instar larvae with pyridalyl on the same leaf residue (12days) had next effect on pupation decrease to reach 30%pupation, as compared to 60%pupation of 4th instar larvae treated with pyridalyl, as compared to that of check (100%).

Likewise, the larval feeding of 2nd and 4th instar larvae on the leaf residues aged 12days of the two tested compounds highly significantly ($p<0.01$) reduced the pupal weight of the resulting pupae. Pyridalyl was the most suppressive one on the pupal weight, it decreased the pupal weight to average 268$\pm$43 and 285$\pm$21 mg. for pupae treated as 2nd and 4th instar larvae, respectively, as compared to507$\pm$3.8 and439 $\pm$0.9mg of pupal weight produced from untreated 2nd and 4th instar larvae, respectively. Whereas, the methomyl had the least effect on the pupal weight, it averaged 303$\pm$33 and 320$\pm$104 mg. for pupae treated as 2nd and 4th instar larvae, respectively ,as compared with that of the control(507$\pm$3.8. and439$\pm$0.9mg).

The obtained results similar to that obtained by Swelam and Makram (2006) who reported that at different combinations of insecticides, methomyl, carbaryl, esfenvalerate and profenofos used by mixing at the level of LC25 with the ratios of 1: 2, 1: 1 and 2: 1 against *S. littoralis* appeared significant changes in the pupae weight compared with the control. Also, Ahmed (2004) found that the average of pupation percentages for pink and spiny bollworms gradually decreased with increasing concentrations of the tested compounds (Agerin, Diple 2x Naturalis L, Spinosad) in laboratory and field strains, respectively.

2.3. Moths emergence

The larval feeding on the leaf residues of the two compounds after 12days of the treatment caused highly significant ($p <0.01$) decrease on the adult emergence (Table.2, 3). Pyridalyl gave the highest effect in the adult emergence decrease to reached 55 and60% for adults produced from treated 2nd and 4th instar larvae, respectively, as compared to 100% of control. While the larval feeding of the two instar larvae on methomyl recorded 74 and 78%, respectively, of adult emergence in relative to that of the check (100%).

These results are agreement to those obtained Ahmed (2004) who found that adult emergence for pink and spiny bollworms gradually decreased with increasing concentrations of the tested compounds (Agerin , Diple 2x Naturalis L , Spinosad) in laboratory strain.

2.4. Morphogenetic abnormalities

Data presented in Table (2, 3*)* demonstrated that the larval feeding of *S. littoralis* on the leaf residues of the two compounds (pyridalyl and methomyl) induced increase in the pupal malformations percentage in relative to control. But the larval treatment of the 2nd and 4th instar larvae with methomyl caused a highly significant ($p<0.01$) increase in the pupal malformation percentages to reach 33.3 and 20%, for the two instar larvae, respectively, as compared to 0% of control. Also, Pyridalyl induced highly significant ($p<0.01$) increase of malformed pupae (22.8%) only in case of the treated 2nd instar larvae. Whereas, it was produced non–significant increase (4%) with the larval treatment of 4th instar, as compared with 0% of the check.

A similar effect demonstrated with the larval feeding of *S. littoralis* on the leaf residues of the two compounds induced an increase in the adult malformation percentages, as compared to that of the control (0%).But the larval treatment of the 2nd and 4th instar larvae with methomyl caused a highly significant ($p<0.01$) increase in the adult malformation percentages to reach 25 and15% for the two instar larvae, respectively, as compared to 0% of control. Also, pyridalyl induced highly significant ($p<0.01$) increase of malformed adult (16%) only in case of the treated 2nd instar larvae. Whereas, it was produced non–significant increase (4.3%) with the larval treatment of 4th instar, as compared with 0% of the check.

Malformations of *S .littoralis* pupae resulting from the larval treatment of the 2nd and 4th instars with pyridalyl in the present work mostly appeared as a larval-pupal intermediates with larval cuticle patches, head capsule and thoracic legs; posterior half of the body has the pupal properties (Fig.1) or undersized pupae: pupae showing body shrinkage (Fig.2).Moreover, moth malformations showing adult malformations often appeared as a moth failed to emerge from the pupal cuticle (Fig.3)or moths with deformed twisted wings and weakly developed body (Figs. 4,5) However , the treatment of 2nd and 4th instars with methomyl ,appeared as larval-pupal monstrosity with larval cuticle, head capsule and thoracic legs; posterior half of the body has the pupal properties (Fig.6) or pupae failed to cast the old cuticle with complete blackening of the body leading to death (Fig.7) and the moth malformations appeared as adult malformations often showing a moth with deformed twisted wings (Fig.8)as compared to normal pupae and adults (Figs.9,10).

These results are agreement to those obtained by Javier *et al*. (2008) demonstrated that Align when administered orally *Lobesia botrana* gave phenotypic effects included inability to molt properly and deformities Swelam and Makram (2006) who reported that at different combinations of insecticides, methomyl, carbaryl, esfenvalerate and profenofos by mixing at the level of LC25 with the ratios of 1: 2, 1: 1 and 2: 1 used against *S. littoralis* some malformations in the pupae and moths stages were produced. Also, Ahmed (2004) indicated that Spinosad gave malformed pupal and adults in both laboratory and field strains of both Pink and Spiny bollworms. Solsoloy and Rejesus (1993) mentioned that the crude oils of *Jatropha curcas*, seed kernel caused production of larval–pupal intermediates and abnormal adults, indicating an insect growth regulatory (IGR) effect.

Table. 4. Latent effect of Pyridalyl and Methomyl against the 2nd instar larvae of the lab. Strain of *S. littoralis* at 12 d. of the treatment in relative to control.

Treatments	Fecundity eggs/ f	Eggs hatching %	Longevity (days)	Adult sex ratio (%)	
	Mean ± S.D.		Mean ± S.D.	Male	Female
Pyridalyl	57±4.7**	90	7.3±1.8*	57.1	42.9
Methomyl	0**	0	7.7±3.3n.s.	33.3	66.7
Control	508+41	100	9+1.9	50	50
F value	**700.57**		**8.75**		
P value	**0.001424**		**0.01601**		
L.S.D. at 0.05	**75.6**		**1.7**		
0.01	**174.4**		**2.5**		

** = Highly Significant (p<0.01) * Significant (p<0.05)

S.D. =Standard deviation Malfo. = Malformation%

L.S.D. = Least significant difference Lab**.** =Laboratory strain

n. s=none Significant (p>0.05)

Table. 5. Latent effect of Pyridalyl and Methomyl against the 4th instar larvae of the lab. Strain of *S. littoralis* at 12 d. of the treatment in relative to control.

Treatments	Fecundity eggs/ f	Eggs hatching%	Longevity (days)	Adult sex ratio (%)	
	Mean ± S.D.		Mean ± S.D.	Male	Female
Pyridalyl	81+0.8**	30.1	7.9+1.1**	43	57
Methomyl	50+8.2**	100	9.7+0.5**	40	60
Control	549+34	100	12+1.5	50	50
F value	**437.91**		**29.32**		
P value	**0.002362**		**0.000638**		
L.S.D. at 0.05	**100.4**		**1.25**		
0.01	**231.8**		**1.8**		

** = Highly Significant (p<0.01) * Significant (p<0.05)
S.D. =Standard deviation Malfo. = Malformation%
L.S.D. = Least significant difference Lab**.** =Laboratory strain
n. s=none Significant (p>0.05)

2.4. Adult fecundity and fertility

Data presented in Table (4, 5) demonstrated that the larval feeding of *S. littoralis* on the leaf residues of the two compounds (pyridalyl and methomyl), highly significant (p<0.01) reduced the adult fecundity in respect of control. While methomyl had the strongest effect on the adult fecundity, it completely inhibited the eggs laying (0.0) in case of the treated 2nd instar larvae, as compared to 508±41 eggs/ females of control. While the total number of eggs laid by adult females fed as 4th instar larvae on the methomyl was 50±8.2 eggs/ females, as compared to control (549±34 eggs/ females).On the other hand, the total number of eggs laid by adult females fed as 2nd and 4th instar larvae with pyridalyl was 57±4.7 and 81±0.8 eggs/ females, as compared to508±41 and 549±34 eggs laid by adults produced from untreated 2nd and 4th instar larvae, respectively.

Likewise, the larval feeding of *S. littoralis* on the leaf residues aged12days of the two compounds (pyridalyl and methomyl) reduced the total number of viable eggs laid by adult females fed as 2nd and 4th instar larvae , as compared to control. Also, methomyl had the strongest effect on the eggs hatching, it completely inhibited the eggs laying (0.0) in case of the treated 2nd instar larvae, as compared to 100%of control. While the methomyl gave none decrease in the total number of viable eggs laid by adults fed as 4th instar(100%),as compared to control(100%) . On reversely, the larval treatment of 4th instar larvae with pyridalyl had higher effect in depression the total number of viable eggs laid by adult females to reach 30%, as compared to 100% eggs hatching of control. While, the 2nd instar larvae treated with Pyridalyl

reduced the eggs hatching of adult females only to90%, as compared to that of the check (100%).

These results are agreement to those obtained by Javier *et al*. (2008) recorded that Align When administered orally, reduced the fecundity and fertility of adults of *Lobesia botrana* treated with 1, 5, and 10 mg litre-1 and at the highest doses, fecundity and fertility were zero. Also, Pineda *et al.* (2007)who demonstrated that Spinosad and Methoxyfenozide reduced in a dose-dependent manner the fecundity and fertility of *S. littoralis* adults when treated oral and residually. They reported that the combination of lethal and sublethal effects of methoxy -fenozide and Spinosad might exhibit significant effects on the population dynamics of *S. littolaris*. Likewise, Swelam and Makram (2006) found that some of the mixtures of insecticides, methomyl, carbaryl, esfenvalerate and profenofos at the level of LC25 with the ratios of 1: 2, 1: 1 and 2: 1 against *S. littoralis* showed sterility effect. Also, Morillo and Notz (2004) mentioned that the fertility of eggs of *S. frugiperda* diminished to 50.61 and 47.31% in the last generation, in the lambdacyhalotrin-selected strain and the methomyl-selected strain, respectively. They indicated that the differences in the duration of some of the insect phases represent a reproductive deterioration in compensation of the survival to the process of selection pressure with the insecticides lambdacyhalotrin and methomyl Solsoloy and Rejesus (1993) reported that the female moths of *Helicoverpa amigera* that emerged from the larva treated with crude oils derived from the psychic nut, *Jatropha curcas*, seed showed ovaroles with malformed oocytes such as disintegrated follicular epithelium on atrophid oocytes and the males produced from the treated larvae had few spermatozoa.

2.5. Adult longevity

Data presented in Table(4 and5) showed that feeding of the fourth instar larvae on the leaf residues aged 12 d sprayed with Pyridalyl and Methomyl highly significant($p<0.01$) decreased the adult longevity of *S. littoralis* to average 7.9and 9.7d ,respectively, as compared to 12d adult longevity of control. Whereas, the larval treatment of 2nd instar larvae treated with Pyridalyl induced significant ($p<0.05$) decrease in the adult longevity to average7.3d, as compared to9d that of the check. Whereas, the larval treatment of 2nd instar larvae with Methomyl gave none significant decrease in adult longevity to average7.7d, as compared to control (9d)

These results contracted with those obtained by Javier *et al*. (2008) recorded that Align When administered orally, longevity of *Lobesia botrana* adults was not affected. Shadia *et al.* (2007) who showed that the longevity of exposed male and female of *A. ipsilon* moths was considerably affected by the tested basil oil as well as its active component (eugenol). They reported that the adult male lived longer than adult female and the adult longevities were greatly reduced in case of basil oil as compared with eugenol and control .Also, Morillo and Notz (2004) found that the longevity of males and females of *Spodoptera frugiperda* only showed differences in some generations in the strains exposed to insecticides

2.6. Adult sex ratio

Data in Table (4 and5)indicated that the second and fourth instar larvae of *S. littoralis* fed on the leaf residues sprayed with Pyridalyl and Methomyl shifted the adult sex ratio in respect to that of the control. Methomyl treatment had the strongest effect on the sex ratio .It violent reduced the adult male percentages to reach 33.3 and 40% for adults emerged from the treated 2nd and 4th instar larvae, respectively, as compared to 50% of untreated adult males (of both instar) . And it increased the adult females to reach 66.6 and 60% for adults emerged from the treated 2nd and 4th instar larvae, respectively, as compared to50% of untreated adult females (of both instar). Also, Pyridalyl treatments decreased the adult male' percentages to reach 43% and increased the adult female percentages to reach 57% in case of the treated 4th instar, as compared to50%of control (both males and females). Whereas, the larval treatment of 2nd instar with Pyridalyl had a contract effect of the mentioned effect, it increased the adult males to reach 57.1 %, and decreased the adult females to reach 42.9%, as compared to that control (50%).

2.8. Conclusion

The results of the present work demonstrated that the two tested compounds had a similar residual effect against survival of the 2nd and 4th instar larvae of *S . littoralis* at 0 and 3 days of the treatment (they induced 100,100and90, 80%larval

mortality for both instars treated with both treatments, respectively).While, Methomyl had the greatest effect at 7 and12days compared to Pyridalyl ones. It induced larval mortality reached 80, 70 and 70, 60% for the two instars, respectively. While Pyridalyl induced 62, 55 and 40, 34% for the two instars, respectively .Pyridalyl toxicity mostly due to inhibition of the cell growth (at0.01 µM)**,** Shigeru *et. al* (2005).Therefore, the Methomyl treatment had the strongest effect in pupation depression (to10 and20%) on larval feeding on leaf residue aged12d. And pupal and adult malformation percentages increase and it had the most potent one in fecundity and eggs hatching (reached 0) and play important role in the sex ratio shifting of adult males and females in respect of control. Also, Pyridalyl had the highest effect in pupation pupal weight and adult emergence decrease. Thus, the use of bio–insecticides (of this study) such Pyridalyl may give a high effect of the insect control for a consider period and were safe means maintain the environment and organisms.

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مقارنة الأثر الباقي لمبيدي البيريداليل و الميثوميل ضد يرقات دودة ورق القطن

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أجريت هذه الدراسة بغرض مقارنة التأثير الحيوي المتبقي لأ ثنين من المركبات: البيريداليل والميثوميل ضد يرقات العمر الثاني والرابع لسلالة معمليه لدودة ورق القطن في تجارب معملية شبه حقليه. غذيت يرقات العمر الثاني والرابع المر باه معمليا لمدة 48 ساعة على أوراق نباتات القطن مرشوشة بالمركبين وذلك بعد صفرو 3و7و12يوم من المعاملة .وجد أن المركبين المختبرين كانوا لهم نفس التأثير على يرقات العمر الثاني والرابع عند تغذية اليرقات على أوراق مرشوشة بعد صفر، 3 يوم من المعاملة. كما انه وجد أن يرقات العمر الثاني كانت أكثر حساسية للمركبين عن يرقات العمر الرابع وكان المثيوميل له التأثير الأقوى في المعاملتين عند التغذية على أوراق مرشوشة بعد 7، 12يوم من المعاملة ،بينما كان لمركب البيريداليل التأثير الأقل . كما وجد أن القياسات البيولوجية للحشرة تأثرت نتيجه ألتغذيه على الأوراق المعاملة وظهر ذلك عند تغذية يرقات العمر الثاني و الرابع على أوراق مرشوشة بعد 12 يوم من المعاملة بهذه المركبات.كما وجد أن معاملة العمر اليرقى الثاني بكل من البيريداليل والميثوميل وكذلك العمر الرابع بالميثوميل له التأثير الأقوى في زيادة معنوية للعمر اليرقى. أيضا أدت ألتغذيه على أوراق مرشوشة بكلا المركبين إلى أطالة فتره طور العذراء ونقص معنوي في وزن العذراء .وكان ذلك واضحا في حالة البيريداليل أكثر من الميثوميل كما كان لمركب البيريداليل التأثير الأقوى في نقص نسب خروج الفراشات . وجد أن تغذيه العمرين على أوراق معامله بالميثوميل والعمر الثاني على أوراق معامله بمركب البيريداليل له التأثير الأقوى في زيادة نسب التشوهات في طور العذراء والحشرة الكاملة مقارنه بغير المعامل.على الجانب الآخر وجد أن يرقات العمرالثانى المعاملة بالميثوميل امتلك جهد عالي في انخفاض واضح في عدد البيض الموضوع لكل أنثى ليصل إلى الصفر مقارنة بالكنترول(508 بيضه) .كما انه أدى إلى انخفاض نسب الفقس إلى الصفر مقارنه بنسب فقس البيض الغير المعامل(100%).أيضا أدت المعاملة للعمرين الثاني والرابع إلى انخفاض العدد الكلى للبيض ليصل إلى 57و81 بيضه لكل أنثى ، كما أن معاملة العمر الرابع بهذا المركب أدى إلى انخفاض نسب فقس البيض إلى 30% .أيضا معاملة العمر الرابع بالبيريداليل والميثوميل نقص معنويا في طول عمر الفراشة. وكذلك النسب الجنسية للذكور والإناث البالغة تأثرت وبشده مع المعاملة اليرقية للعمرالثانى والرابع بالميثوميل والعمر الرابع البيريداليل حيث أدى إلى نقص نسب الذكور البالغة وزيادة نسب الإناث البالغة بالمقارنة بالكنترول.بينما المعاملة اليرقيه للعمر الثاني بالبيريداليل كان لها التأثير العكسي في زيادة نسب الذكور ونقص نسب الآناث بالنسبة لغير المعامل .