RESIDUAL ACTIVITY OF METHOMYL AND RADIANT INSECTICIDES AGAINST THE LARVAE OF COTTON LEAFWORM, *SPODOPTERA LITTORALIS* (BOISD.)

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Abstract

The bio-residual activity of two compounds, methomyl and radiant against the 2nd and 4th instars larvae of the cotton leafworm, *Spodoptera littoralis* was evaluated under laboratory and semi–field conditions. The obtained larvae were fed for 24h on cotton leaves treated with methomyl compound and for 48h on the leaves treated with radiant at 0, 3, 7,9 and 12 days after the treatment. The 2nd instar larvae treated with radiant were more susceptible than the fourth ones. While the treatment of both 2nd and 4th larval instars with the methomyl at the three tested leaf residues 0, 3 and 7days had the highest effect, it caused 100 % mortality. Whereas, the larval treatment with radiant was more higher residual effect than the methomyl after feeding on leaves at 12 days post treatment, it caused 70 and 60% larval mortality of both 2nd and 4th instars, respectively, compared to 60 and 50% for the two instars, respectively, treated with methomyl. Methomyl and radiant treatments had a latent effect on the biological activities of this insect when the larvae fed on leaves at 12 days post treatment. The effect was varied according to the larval instar and tested compound. It was found that the treatment of 2nd and 4th instars larvae with radiant had the strongest effect. It caused an increase in the larval duration and pupal malformation and reduced the pupal weight. While, the treatment of 2nd and 4th instar with methomyl was higher reduced the adult emergence and increased the adult malformation percentages. The treatment of the 2nd instar larvae with the two compounds had the highest effect in decrease the pupation percentage to reach 50 and60% compared to control. While the treatment of the 4th instar with radiant at the 12day age leaf residues had the most potent in the fecundity inhibition to reach zero eggs/female in comparison to 569$\pm$113.2 eggs/female of control, and it reduced the eggs hatching to reach 0% as compared to 99% of control. While the larval treatment of the 4th instar with the both methomyl and radiant had significant decrease in the adult longevity .Whereas, the larval treatment of the same instar with methomyl had the highest effect in adult sex ratio shifting of both males and females as compared to that of control and the radiant had the next effect in this respect.

INTRODUCTION

The cotton leafworm, *Spodoptera littoralis* (Boisd) is one of the major insect 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. Spinetoram is a new member of the spinosyn class of insect management tools developed by Dow Agrosciences Company. It is derived from fermentation of *Saccharopolyspora spinosa* as are other spinosyns, but fermentation is followed by chemical modification to create the unique active ingredient in spinetoram. In Egypt, Temerak (2007) used the spinosyn products, spinosad and spinetoram to combat egg masses of cotton leaf worm; he indicated that radiant SC12% was 5 and 7 times stronger than spintor SC24% under the field and laboratory conditions respectively. Thus, this product have an excellent activity against a wide range of lepidopterous pests on many field crops such as vegetables, fruits, tea, cotton, and rice (Hirooka *et al.*, 2007).It is applied at low rates and has low impact on most beneficial insects (Mertz and Yao, 1990)**.** Pests controlled by spinetoram include beet army worm, *Spodoptera exigua,* thrips, *Frankliniella spp.,* cabbage looper, *Trichoplusia ni* and codling moth, *Cydia pomonella.* It causes excitation of the insect nervous system by altering the function of nicotine and GABA-gated ion channels (Crouse and Sparks, 1998).The conventional insecticide, methomyl was used against the lepidopterous pests (Kassem *et al.*, 1986).

Therefore, the present study was conducted to compare the bio residual activity of two compounds, methomyl and radiant 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 under laboratory conditions at 25±2 C° and 60±5% R.H. Larvae were fed on castor bean leaves, *Ricinus communis* (L.) in a wide glass jars until adult 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.) 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 2nd and 4th instar larvae were used for bioassay tests.

2-Insecticides use

In these testes, two compounds namely Golden 90 %(Methomyl) and Radiant 12 % SC (Spinotoram) were used at rate of 0.125 m/liter for radiant and 1.5 gm/liter for the methomyl

3- Laboratory and Semi–field tests:

The present study was carried out at the Sides Research Station, 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 0.125 ml/liter for radiant and 1.5 gm/liter for methomyl .Ten replicates of pots were used in each treatment. The sprayed cotton

leaves were randomly selected among the various replicates of the two treatments at zero, 3, 7, 9 and 12 days of the treatment. Four replicates of hundred larvae of each 2^{nd} and 4^{th} instars used for feeding on treated leaves for each tested compound at each of the five interval times used for 24h for methomyl and 48h for radiant. The total percent of the larval mortality after 24h and 72h of the larval feeding on both methomyl and radiant, respectively, were recorded and corrected according to Abbott ś formula (Abbott, 1925). The different biological effects i.e. larval and pupal duration , pupation percentage and adult emergence percentage , adult fecundity ,eggs hatching% , adult longevity ,sex ratio were estimated on 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 considered.

4-Statistical analysis:

The obtained data 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

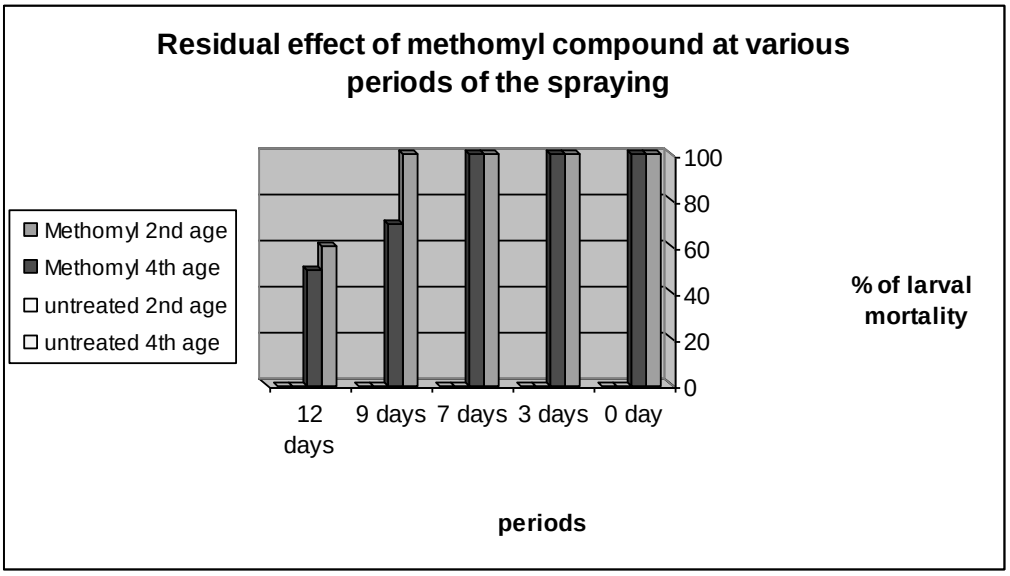
1-Bio-residual activities:

Data presented in Table (1) and Fig1 and 2 demonstrated that the two tested compounds (radiant and methomyl) were effective against the 2^{nd} and 4^{th} instar larvae of *S. littoralis* up to 12 days of the treatment. For Radiant treatment, the 2^{nd} instar larvae were more susceptible for the treatment than the 4^{th} ones. It caused 100,95,85,80 and 70% larval mortality of 2^{nd} instar and 80,75,70,65 and 60% for the 4^{th} instars after feeding on treated leaves at 0,3,7,9 and 12 days of spray,

respectively, as compared to 0% of the control. While methomyl treatment had the highest effect at the three tested leaf residues 0, 3 and 7 days, it caused 100 % mortality of both 2nd and 4th instars. Whereas, radiant treatment revealed higher toxicity than methomyl after 12 days of treatment, it caused 70 and 60% larval mortality of both 2nd and 4th instars, respectively, as compared 60 and 50% for the two instars, respectively, treated with the methomyl .

Table.1. Residual effect of methomyl and radiant against the 2nd and 4th instar of laboratory strain of *Spodoptera littoralis* larvae at 0, 3, 7, 9 and 12 days after the treatment in relative to control.

Treatment	% of Mortality at residues after(Day)treatments									
	Zero		3		7		9		12	
	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar
Methomyl	100	100	100	100	100	100	100	70	60	50
Radiant	100	80	95	75	85	70	80	65	70	60
Control	0	0	0	0	0	0	0	0	0	0



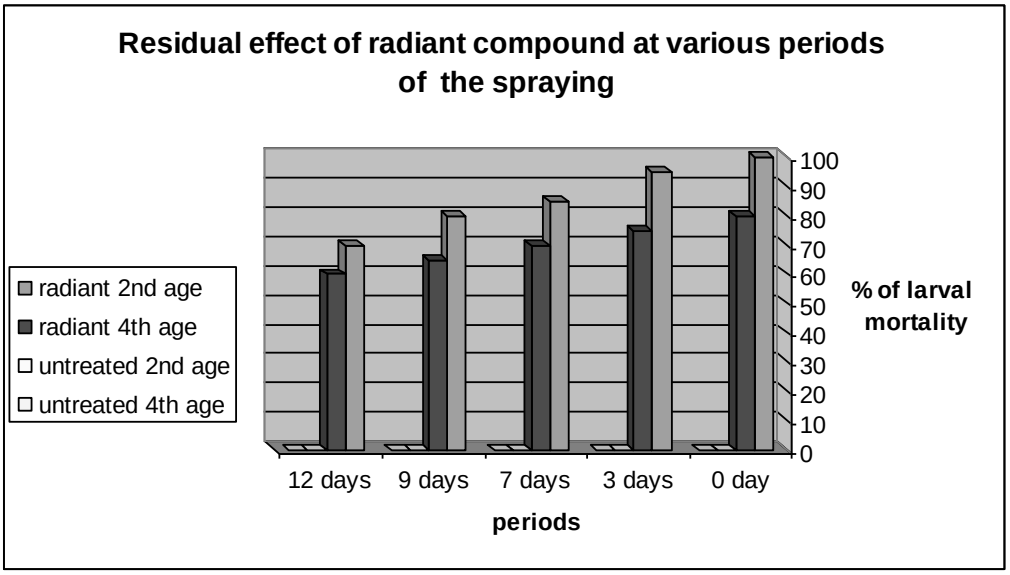


Fig.(1 and 2): illustrated the residual effect of Methomyl and radiant against the 2nd and 4th instar of laboratory strain of *S. littoralis* larvae at leaf residues aged 0,3,7,9 and 12 days, respectively , of the treatment .

The obtained results agree with those obtained by Cook *et al.* (2004).They 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) demonstrate the residual effect of the two tested compounds reflected the biological activities of *S. littoralis.* The feeding of both 2nd and 4thinstar larvae on sprayed leaves after 12 days of application, prolonged the larval duration. The effect was more pronounced with the radiant treatment of both 2nd and 4th larval instars. The larval duration showed highly significant increase to average 62±2 and 47±17 days for the 2nd and 4th instars, respectively, as compared to 22.5±5.7 and 15.6±6.3days of control, respectively. Also, the larval treatment of 2nd and 4th instars with methomyl significant increased the larval duration to average 33±16.2 and 25±17.3days, respectively, as compared to that of control.

On the other hand, the 2nd and 4th instar larvae feeding on the leaves after12days of spray of methomyl compound alone induced a highly significant increase of the pupal duration (Table.2,3) to average 31.5±9.2 and 22.2±5.9 days of both 2nd and 4th instar larvae, respectively ,as compared to17.9±8.8 and 14.7±7.9 days, respectively, of control. On adversely, the larval treatment of the 2nd instars with radiant gave significant decrease in the pupal duration to average12.5±2.1 compared to17.9 ±8.8 of control.While,the 4thinstar larvae treated with radiant significant increased the pupal duration to average 17.1±2.3,as compared to 14.7+7.9days of control.

The obtained results agree with those obtained by Morillo and Notz (2004).They found that the duration of the larval and pupal stages and the developmental period from egg to adult of *Spodoptera frugiperda* was significantly longer with the lambdacyhalotrin-selected strain and the methomyl-selected strain compared to the control strain, from the first to the last generation. Moreover, Ahmed (2004) 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 golden and radiant against the 2nd instar larvae of the lab. strain of *S. littoralis* at 12 d. of the treatment in relative to control.

Treatments	Larval duration (days) ± SD	% Pupation ± SD		Pupal duration days	Pupal weight mg	Moth emergence %		
		Normal	Malfo.			Total	Normal	Malfo.
Methomyl	33±16.2**	50±28**	10	31.5±9.2**	328±46**	33.3	0.0	100
Radiant	62±2**	65±7.1**	16.7	12.5±2.1**	262±15**	100	100	0.0
Control	22.5±5.7	100	0	17.9±8.8	418±40	100	100	0.0
L.S.D. at 0.05	9.4	4.292		4.66	47.1			

** = 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 methomyl and radiant against the 4th 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		
		Normal	Malfo.			Total	Normal	Malfo.
Methomyl	25±17.3**	60±10n.s	10	22.2±5.9**	304±5**	60	83.3	16.7
Radiant	47±17**	70±10n.s	14.3	17.1±2.3**	316±27**	100	85.7	14.3
Control	15.6±6.3	100	0	14.7±7.9	394±45	100	100	0.0
L.S.D. at 0.05	1.1	18.3		4.79	60.2			

** = 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 instar larvae of *S. littoralis* which fed on the sprayed leaves after 12days from treatment with methomyl and radiant induced a highly significant decrease of the pupation percentage in respect to control to average 50 and 65% for larvae treated with the two compounds, respectively, as compared to 100 %pupation of control. Whereas, the larval feeding of the 4th instar larvae with the two compounds caused none significant decrease in the pupation to average 60 and 70, respectively, as compared to that of check (100%).

On the other hand, the larval feeding of 2nd instar on the leaf residues aged 12 days of the two tested compounds highly significantly ($p<0.01$) reduced the pupal weight of the resulting pupae. Radiant was the most suppressive one on the pupal weight, it decreased the pupal weight to average 262$\pm$15 mg., as compared to418$\pm$40 mg of the pupal weight produced from untreated 2nd instar larvae.Also,the 2nd instar larvae treated with methomyl decreased the pupal weight to average 328$\pm$46mg,as compared to that of control to (418$\pm$40 mg). Whereas, the 4th instar larval treatment with the methomyl and radiant had significant ($p<0.05$) decrease of the pupal weight to average 304$\pm$5 and 316$\pm$27 mg, respectively, as compared with that of the control (394$\pm$45mg).

The obtained results are in harmony with 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 pupa 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:

Results show that both of the 2nd and 4th instar larvae fed on the sprayed leaves after 12days of application of the two tested compounds induced emergence percentage was 33.3% for the adults produced from 2ndinstar treated with methomyl that included 100% malformed adults and 0% normal adults. While, the 4th instar treated with methomyl gave 60% the adult emergence (Table.2, 3). It included 16.7% malformed adults and 83.3% normal adults as compared to 100% of control (0:100%malformed: normal adults). While the larval feeding of the 4th instar on radiant gave 100% adult emergence was 14.3% malformed adults and an 85.7% normal adult whereas, the 2nd instar treated with radiant recorded100% adult emergence and gave none malformed adults was noted. Thus, the treatment of 2nd

and 4th instar with methomyl was higher reduced the adult emergence than the radiant one.

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 2nd and 4th instars of *S. littoralis* on the leaf residues of the two compounds (methomyl and radiant) induced increase in the pupal malformations percentage in relative to control. The radiant treatment induced a marked percentage16.7 and 14.3% malformed pupae result from the treated 2nd and 4th instar larvae, as compared to0% of control. While the methomyl treatment recorded 10% of malformed pupae produced from the treatment of both 2nd and 4th instar larvae.

The larval feeding of *S. littoralis* on the leaves after 12 days of spray 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 with methomyl induced the highest percentage to reach 100and16.7%, respectively, as compared to 0% of control. Also, the 4th instar larvae treated with Radiant increased the malformed adults to reach 14.3%, respectively, as compared with 0% of the check. While the treatment of 2nd instar larvae with Radiant gave none adult malformation percentages (0%).

Malformations of *S .littoralis* pupae resulting from the larval treatment of the 4th instars with radiant mostly appeared as a larval-pupal monstrosity with larval cuticle patches and pupal abdomen. (Fig.3,4) or undersized pupae: pupae showing body shrinkage (Fig.5).Moreover, moth malformations showing adult malformations often appeared malformed adults had abnormal body and wings(Fig.6).However , the treatment of 2nd and 4th instars with methomyl ,appeared pupae with complete blackening of the body leading to death (Fig.7) or pupae failed to cast the old cuticle (Fig.8) and the moth malformations appeared as adult malformations often showing a moth with deformed twisted wings (Fig.9)as compared to normal pupae and adults (Figs.10 and11).

These results are in agreement with 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) 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* produced some malformations in the pupae and moths stages. 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.

2.4. Adult fecundity and fertility:

Data presented in Table (4) demonstrated that the larval feeding of *S. littoralis* on the leaf residues of the two compounds (methomyl and radiant), induced a highly significant ($p<0.01$) reduce of the adult fecundity in respect of control. While radiant had the strongest effect on the adult fecundity, it completely inhibited the eggs laying (0.0) in case of the treated 4th instar larvae, as compared to 569±113.2 eggs/ females of control. While the methomyl treatment had the next effect, it decreased the total number of eggs to average 25±5 eggs/ females, as compared to control (569±113.2 eggs/ female).

Likewise, the larval feeding of *S. littoralis* on the leaf residues aged12days of the two compounds (methomyl and radiant) reduced the total number of viable eggs laid by adult females fed as 4th instar larvae , as compared to control. Also, radiant had the strongest effect on the eggs hatching; it completely inhibited the eggs laying (0.0) and therefore, the eggs hatching, as compared to 99%of control. While the methomyl gave decrease in the total number of viable eggs laid by adults to reach 40% that fed as 4th instar,as compared to control(99%) .

Table. 4. Latent effect of methomyl and radiant 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
Methomyl	25±5**	40	9±2.2*	66.7	33.3
Radiant	0.0±0**	zero	8.3±3.0*	57.1	42.9
Control	569±113.2	99	10.8±1.7	47.6	52.4
L.S.D. at 0.05	22.8		2.445		

** = 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 ($p>0.05$)

These results are agreement with 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) demonstrated that Spinosad and Methoxyfenozide reduced in a dose-dependent manner the fecundity and fertility of *S. littoralis* adults when orally and residually treated. They reported that the combination of lethal and sublethal effects of methoxyfenozide 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) showed that feeding of the fourth instar larvae on the leaf residues aged 12d sprayed with methomyl and radiant significant($p<0.01$) decreased the adult longevity of S. littoralis to average 9 and 8.3d ,respectively, as compared to 10.8day adult longevity of control .

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) indicated that the 4th instar larvae of *S. littoralis* fed on the leaf residues sprayed with methomyl and radiant shifted the adult sex ratio in respect to that of the control. The methomyl treatment had the strongest effect on the sex ratio. It violent reduced the adult female percentages to reach 33.3% , as compared to 52.4% of untreated adult females. And it increased the adult males to reach 66.7, as compared to 47.6% of untreated adult males. Also, the radiant treatment decreased the adult female' percentages to reach 42.9% and increased the adult male percentages to reach 57.1%, as compared to52.4:47.6%of control (both females and males, respectively).

2.8. Conclusion:

The results of the present work demonstrated that the 2nd instar larvae were more susceptible for the radiant treatment than the 4th instar of *S .littoralis*. It caused 100,95,85,80,70% larval mortality of 2nd instar and 80,75,70,65,60 for the 4th instars at the at the five leaf residues 0,3,7,9 and 12 days, respectively ,as compared to 0% of the control. The methomyl treatment had the highest effect, it caused 100 % mortality of both 2nd and 4th instar larvae at the three tested leaf residues 0, 3 and 7days.Whereas, the radiant treatment was more effective in larval duration and pupal malformation increase and it decreased the pupal weight and inhibited the fecundity and eggs hatching than the methomyl.Thus, the use of bio–insecticides (of this study) such radiant may give a high effect of the insect control for a consider period and were safe means maintain the environment and organisms.

صورة

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الأثر المتبقي لمبيدي المثيوميل والرادينت ضد يرقات دودة ورق القطن

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أجريت هذه الدراسة بغرض مقارنة التأثير الحيوي المتبقي لأ ثنين من المركبات: المثيوميل والرادينت ضد يرقات العمر الثاني والرابع لسلالة معمليه لدودة ورق القطن في تجارب معملية شبه حقليه. غذيت اليرقات المر با ه معمليا لمدة 24 ساعة على أوراق نباتات القطن مرشوشة بمركب المثيوميل ولمدة 48 ساعة على متبقيات ورقيه معامله بمركب الرادينت وذلك بعد صفرو 3و7و 9 و12يوم من المعاملة . في حالة المعاملة بمركب الرادينت كان العمر الثاني أكثر حساسية للمعاملة من العمر الرابع وكانت معاملة المثيوميل الأعلى تأثيرا عند التغذية على متبقيات ورقيه عمرها 0 و3 و 7 بعد الرش حيث أنها أعطت نسبة موت بلغت 100% لكلا العمرين مقارنة بغير المعامل. بينما المعاملة بمركب الرادينت كان لها تأثير متبقي اقوي عند التغذية على المتبقيات الورقية عمرها 12 يوم من المعاملة حيث أنها أعطت نسب موت 70 و60 % لكل من العمرين الثاني والرابع بالتتالي مقارنة بنسبة موت 60و50 % والتي نتجت من التغذية على أوراق معاملة بالمثيوميل.كانت لمعاملات المثيوميل والرادينت تأثير على الأنشطة البيولوجية لهذه الحشرة عند تغذية اليرقات على متبقيات ورقيه عمرها 12 يوم. اختلف التأثير باختلاف العمر اليرقي والمركب .وجد أن المعاملة بالرادينت كان لها التأثير الأقوى في زيادة العمر اليرقى والتشوه العذري ونقص للوزن العذري مقارنة بغير المعامل . في حين إن معاملة العمرين بالمثيوميل كان له تأثير كبير في خفض نسب خروج الفراش وزيادة نسب تشوه. كما كان لمعاملة العمر الثاني بالمركبين التأثير الأعلى في إنقاص نسبة التعذير إلى 50و 65 % بالنسبة لغير المعامل. وكما إن معاملة العمر الرابع بالرادينت عند متبقيات ورقيه عمرها 12 يوم كان له التأثير الأقوى في انخفاض الخصوبة حتى سجلت zero مقارنة569+113.2 eggs/female لغير المعامل واختزل نسب فقس البيض مقارنة بنسبة فقس 99% لغير المعامل .بينما المعاملة للعمر الرابع بمركب المثيوميل والرادينت قلل معنويا من عمر الحشرة الكاملة مقارنة بالكنترول. وكان لمعاملة نفس العمر بمركب المثيوميل التأثير اللافت للنظر في تغير النسب الجنسية للذكور والإناث مقارنة بالكنترول و ويليه معاملة الراديانت.