BIO-RESIDUAL ACTIVITY OF SOME CONVENTIONAL AND INCONVENTIONAL INSECTICIDES AGAINST FIELD STRAIN COTTON LEAFWORM , *Spodoptera littoralis* (BOISD.)

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Abstract

The bio-residual activity of five compounds, Spinosad, Dursban, Metal oil (kz),Vantex and Camphor oil against the second and fourth instar larvae of field strain of the cotton leafworm, *Spodoptera littoralis* was evaluated under semi–field and laboratory conditions. The obtained 2nd and 4th instar larvae of the field strain were fed for 48h on cotton leaf residues sprayed with the five compounds at 0, 3 ,7 and 12 day of the treatment. The five tested compounds were effective against the 2nd and 4th instar larvae up to 12 days . At the fire tested pesticides ,the second instar larvae were more sensitive for the five treatments than the fourth ones. Dursban had the longest residual effect extended up to 12 days of the treatment but, Vantex had the next effect . Spinosad had the greatest effect at the leaf residues aged 0 and 3 days ,whereas its effect was depressed with the leaf residues aged 7 and 12 days Camphor oil had a higher effect than that of metal oil against both 2nd and 4th instar larvae at the leaf residues aged 0 and 3 days However , Camphor oil had the least residual effect among the five tested compounds with the leaf residues aged 7 and 12 days Among the five tested compounds, only three ones Spinosad , Metal and Camphor oils had a latent effect on the biological activities when the fourth instar larvae feeding on the leaf residues aged 12 days of this compounds. Both of Spinosad and Metal oil treatments had the strongest effect in prolongation of larval durations and increase of malformed pupae , as compared to the Camphor oil in respect to that of control. While, Spinosad was the most suppressive one in reducing the pupation and adult emergence percentages ,as compared to control. Both the Metal and Camphor oils were approximately equal to each other in their effect. On the other hand ,only the Spinosad showed a significant higher effect in prolongation of pupal duration and malformed adults increase and adult longevity decrease, while the two other compounds gave non–significant effect in this respect. Whereas, both Spinosad and Camphor oil treatments had the highest effect in the sex ratio shifting of both adult males and females in respect to control .Accordingly , both fecundity and eggs hatchability were reduced to 0 eggs/f with the two treatments ,as compared to 604.6 and 589.5 eggs/f, adult fecundity and egg hatchability, respectively, of the check .

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 . Among these compounds ,Biotic compounds such , Spinosad played important role in pests control. Spinosad , gets its name from the microbe that produces it, a soil-dwelling bacterium called *Saccharopolyspora spinosa.* poses less risk than most insecticides to mammals, birds, fish, and beneficial insects .It was used for control of Lepidoptera insects (Temarak,2003a) and approved for use on more than 100 crops, including apples, almonds ,citrus ,eggplants ,tomatoes ,and cotton. Also, the mineral and plant oils were used as alternatives to pesticides that had efficient results against the eggs and newly hatched larvae of pink bollworm in the laboratory experiments (Hewady et al.1993)and also against cotton leafworm(Badr et *al.*1995)and such plant oils, e.g. Camphor oil was used as moth repellent and feeding deterrent for Lepidoptera larvae (Spurr and Gregor:2003) Also ,the use of chemical insecticide e.g. Dursban 48% E.C alone gave a considerable efficacy for pink and spiny bollworms control in field study (Ahmed ,2004).While the Vantex was the latest new generation broad spectrum pyrethroid insecticide with a wide range of insect pest control, on vegetables ,fruits, flowers and ornamentals, cereals, coffee, and cotton (Poloznyak,2006).

Therefore, the present study was conducted to investigate the bio-residual activities of five compounds against the second and fourth instar larvae of *Spodoptera littoralis* field strain in the semi- field and laboratory conditions .

MATERIALS AND METHODS

1. The Field strain.

Field strain egg masses were collected from cotton fields at Sids Station Research, Beni- Suef during 2006 cotton growing seasons at which CLW larvae have been exposed to field routine selection pressure of certain conventional insecticides that are usually applied every year from June to September. These insecticides were insect growth regulators, organophosphates (OPs) as Dursban and Tilton insecticides, pyrethroids (PYs) as Sumi- alpha, biotic compounds as Spintor. The egg-masses were collected during June and reared on castor bean leaves *Ricinus communis* (L.) under temp. ranged between 25– 28C and 60–65 % relative humidity until egg hatching. The obtained second and fourth instar larvae were used for bioassay tests.

2-Material used:

2.1–Spinosad, the used spinosad (24 %SC)

Trade name: The insecticide was introduced by Dow Agro Sciences for control Lepidopterous pests in cotton under the trade name Tracer (Thompson et al., 1997).

Chemical name : The name spinosad is derived from combining the characters of Spinosyns A and D. The rate of application was 50 cm^3 / fed

Structural formulae:

Empirical formulae: Spinosyn A:C41H65NO10

, Spinosyn D:C42H67NO10

Molecular weight , Spinosyn A:731.98

, Spinosyn D:745.99

2.2–Mineral oil,

Crude oil E. C. : It was produced by Egyptian co.(Kefer -el-zyate), under the name K.z. 95% E.C.

2.3–Camphor oil,

Crude oil E. C. :It was produced by Egyptian Natural oil Co. under the name *Eucalyptus globules* (L.) (Myrtaceae).It contains 99% of camphor oil .

2.4–Dursban (chlorypyrifos 48% E.C). The insecticide was produced by Dow Agro Sciences

Chemical name: O,O-diethyl O-3,5,6-trichloro-2-pyridinyl phosphorothioate

2.5–Vantex (DE-638 penoxsulam 98% E.C). The insecticide was produced by Dow Agro Sciences .

Chemical name :2-(2,2-difluoroethoxy)-N-(5,8-dimethoxy (1,2,4) triazolo(1,5-C)pyrimidin-2-yl)-6-(trifluoro-methyl)benzenesulfonamide.

3- Semi–field and laboratory tests:

The present study was carried in an isolated region within the Sids station farm ,Beni Suef .The planting was done using big pots (35x37cm)under the same field conditions of the farm plants. Planting date was at mid of March in 2006.The five compounds were sprayed at the recommended rates via a hand atomizer in small prepared doses showing 0.25ml / litre of both Spinosad and Vantex compounds and 5ml/litre of Dursban and 10ml /litre of both Metal and Camphor oils. Ten replicates of pots were used in each treatment. The sprayed cotton leaves were random selected among the various replicates of the five 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 five tested compounds at the four time intervals used . Also, the observed malformations were recorded and photographed.

4-Statistical analysis **:**

The total percent of the larval mortality after 48h of the larval feeding on the leaf residues of the five compounds were recorded and corrected according to Abbott formula (Abbott, 1925) .The residual effect of the tested compounds was tabulated

and diagram illustrated. The different biological effects such larval and pupal duration, pupation and adult emergence percentage, adult fecundity, fertility, longevity, sex ratio were estimated at the leaf residues aged 12 d of the treatment. 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 five tested compounds, Spinosad ,Dursban, Metal oil, Vantex and Camphor oil were effective against the 2nd and 4th instar larvae of *S. littoralis* up to 12 days of the treatment . At the four tested leaf residues (0,3,7 and 12 days of the treatment) ,the second instar larvae were more susceptible for the treatments than the fourth ones. Dursban had the longest residual effect extend up to 12 days of the treatment. It caused 100% mortality of both 2nd and 4th instar larvae as compared to 0% of control. The Vantex had the next effect, it induced 100% mortality of both 2nd and 4th instar larvae at 0, 3 and 7 days of the treatment ,and caused 100 and 90 % mortality of both instar larvae , respectively at 12 days the application. Spinosad had the greatest effect at 0 and 3 days of the treatment ,showing 100% mortality of both 2nd and 4th instar larvae ,while it caused 90 and 80% of the two instar larvae, respectively at 7 d of the treatment. Whereas its effect was depressed to induce 60 and 40 % for both 2nd and 4th instar larvae, respectively, after 12 days of the treatment. The Camphor oil had a higher effect than that of metal oil against both 2nd and 4th instar larvae at the leaf residues aged 0 and 3 days , where the camphor oil caused 100% mortality of the two instar larvae at 0 d of the treatment ,and caused 90 and 70% mortality of both instar larvae, respectively at 3 days While the metal oil caused 90, 80 and 80, 70% of the two instar larvae, respectively at 0 and 3 days, respectively of the treatment . The Camphor oil had the least residual effect among the five tested compounds at 7 and 12 d of the treatment , where its effect was lower than that of the metal oil indicating 70 , 50 and 50 , 30% of the two instars, respectively, at 7 and 12 days ,respectively of the treatment .While, the metal oil was produced 70, 60 and 60, 30 mortality % of the two instar larvae, respectively at 7 and 12 days, respectively, in relative to control (0%) as shown in figs.(1- 4)

The obtained results agree with those obtained by Shadia *et al.*(2007) proved that the Basil oil at 3% (conc.) caused 65%mortality of *A .ipsilon* larvae by the feeding of the 4th instar larvae for two days on the oil via the baits. Poloznyak (2006) demonstrated a biological efficiency of vantex 60 at the rate of 0,04 l / ha against

cruciferous flea-beetles in the course of five days showing 89-100% mortality, while at the rate of 0,061/ ha it caused from 95-100% of the rape blossom weevils.

Table 1. Residual effect of Spinosad ,Dursban ,Metal oil (Kz) , Vantex and Camphor oil against the 2nd and 4th instar of field strain of *Spodoptera littoralis* larvae at 0,3,7 and 12 days of the treatment in relative to control.

Leaf residues age (Days)	Mortality% of											
	Spinosad		Dursban		Metal oil		Vantex		Camphor oil		Control	
	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar	2nd instar	4th instar
0	100	100	100	100	90	80	100	100	100	100	0	0
3	100	100	100	100	80	70	100	100	90	70	0	0
7	90	80	100	100	70	60	100	100	70	50	0	0
12	60	40	100	100	60	30	100	90	50	30	0	0

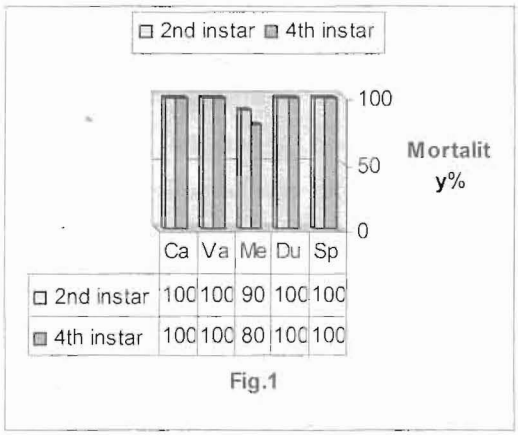


Fig.1

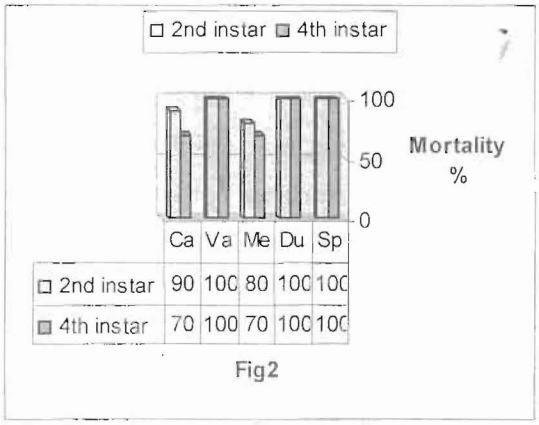


Fig2

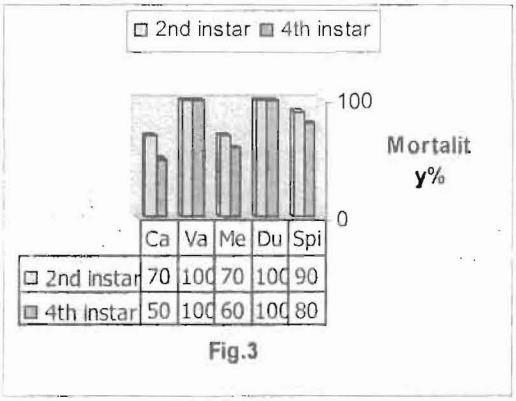


Fig.3

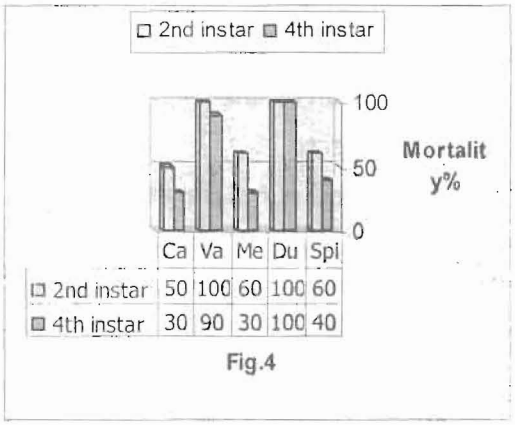


Fig.4

Figs.(1- 4): illustrated the Residual effect of Spinosad ,Dursban ,Metal oil (Kz) , Vantex and Camphor oil against the 2nd and 4th instar of field strain of *S. littoralis* larvae at leaf residues aged 0,3,7 and 12 days, respectively , of the treatment .

Ahmed (2004) reported that the Spinosad was the most effective compound against the newly hatched larvae of both pink and spiny bollworms after 12 days for laboratory and field strain, respectively . Mona *et al.*(2000) evaluated the efficacy of Solar oil, E.C.,CAPL–2 and Jojoba oil E. C. against the newly hatched larvae of

Pectinophora gossypiella, susceptible and Cyanox –resistance strains in laboratory studies. They showed that the Solar and CAPL–2 gave the highest effect and the susceptible strain was more affected than the resistant one. While , Gary *et al.*(1999) mentioned that Spinosad had an unique mode of action coupled with a high degree of activity on targeted pests and low toxicity to non-target organisms (including many beneficial arthropods).It possess rapid efficacy competitive with the best synthetic standards and consider an excellent new tool for management of insect pests and had safety profiles similar to benign biologicals. They showed that the degradation of spinosad in the environment occurs through a combination of routes, primarily photodegradation and microbial degradation to its natural components of carbon, hydrogen, oxygen and nitrogen. The half-life of spinosad degraded by soil photolysis is 9-10 days. It is less than 1 day for aqueous photolysis and leaf surface photolysis results in a half-life of 1.6 to 16 days. The half-life of spinosad degraded by aerobic soil metabolism in the absence of light is 9-17 days. Manoharan and Uthamasamy (1993)mentioned that the feeding of *Helicoverpa armigera* larvae on chlorpyrifos caused 100%mortality both alone and in combination with all the used synergists (neem oil, sesame oil, cotton seed kernel and molasses). Also, 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 diflubenuron plus fenvalerate had a long residual effect ,followed by diflubenuron plus chlorpyrifos and the residual activity of chlorpyrifos, profenofos and acephate was increased when they applied in combination with diflubenuron.

2. Latent effect:

2.1. Larval and pupal durations:

Data presented in Table(2) demonstrated a residual effect of three (Spinosad, Metal and Camphor oils) of the five tested compounds reflected the biological activities of *S. littoralis.* The fourth instar larvae feeding on the leaf residues aged 12 d of the three compounds, increased the larval duration. The effect was more pronounced with the Spinosad and Metal oil, where the larval duration highly significant ($p< 0.01$) increased to average 14.5 and 13.5 days, respectively, as compared to 10 d. of the control (untreated 4^{th} instar larvae).While the fourth instar larvae feeding on the Camphor oil at the same leaf residues induced less significant increase ($p<0.05$) in the larval duration to average 13d. in relative to that of the control.

On the other hand, the fourth instar larvae feeding on the leaf residues aged 12 days only, Spinosad of the three tested compounds highly significant ($p<0.01$)

increased the pupal duration (Table.2) of the resulting pupae to average 9 d in respect to 5.5 d of the untreated check. Whereas, the larval feeding on the leaf residues of both the Metal and Camphor oils after 12 days of the application induced non-significant increase in the pupal durations to average 7.5 and 6.5 d., as compared to that of the check(5.5d)

These results are agreement to those obtained by Shadia *et al.*(2007)who demonstrated that Basil Oil and Eugenol had an insecticidal activity on the developmental stages of *A. ipsilon* .Also, 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 and field strains) treated with the higher concentrations of Spinosad when compared with untreated larvae.

Table. 2. Latent effect of Spinosad , Metal oil (Kz) and Camphor oil against the 4th instar larvae of the field strain of *Spodoptera littoralis* at 12 days of the treatment in relative to control.

Treatments	Larval periods (days) ± SD	% Pupation ± SD		Pupal period (days) ± SD	% Moth emergence ± SD	
		Normal	Malfo.		Normal	Malfo.
Spinosad	14.5± 0.9**	59.7± 8.2**	32.8**	9 ± 1**	56 ± 3.5**	18.3*
Metal oil (KZ)	13.5± 2.2**	70 ± 8.1**	23.5*	7.5± 0.9 n.s.	63.5± 2.7**	13.3n.s.
Comphor oil	13.0± 3*	70.3± 7.8**	6.9 n.s.	6.5± 0.8 n.s.	66.8± 2.4**	9.3n.s.
Control	10± 2.5	100± 0	0	5.5± 1.7	100± 0	0
F value	24.697	69.913	52.274	30.0	971.923	10.11
P value	0.01	0.0040	0.03416	0.00773	0.000008	0.0705
L.S.D. at 0.05	2.3	14.7	12.03	1.996	3.98	15.0
0.01	3.8	27.1	22.1	3.298	6.6	24.9

** = Highly Significant (p<0.01) * Significant (p<0.05)
S.D.=Standard deviation Malfo.= Malformatiom%
L.S.D.= Least significant difference

2.2. Pupation and adult emergence:

Data presented in Table (2) showed that the fourth instar larvae of *S. littoralis* which feeding on the leaf residues aged 12 days from treatment with Spinosad ,Metal and Camphor oils, decreased the pupation percentage (highly significant, $p < 0.01$) in respect to control. The effect was more pronounced with the Spinosad, where the pupation reached to 59.7%,as compared to 100 %pupation of control . Whereas, the

larval feeding on the same leaf residues of both Metal and Camphor oils had a similar effect on the pupation ,both of them induced 70%pupation.

A similar effect demonstrated with the larval feeding on the leaf residues of the three compounds (Spinosad , Metal and Camphor oils).Highly significant ($p < 0.01$)decrease(Table.2)was induced in the adult emergence. Spinosad gave the highest effect on the adult emergence, it reached to 56%,as compared to 100% of control. While the larval feeding on the Metal and Camphor oils recorded 63.5 and 66.8% ,respectively ,of adult emergence in relative to that of the check(100%).

These results are agreement to those obtained by Shadia *et al.*(2007)who demonstrated the insecticidal activity of the Basil essential oil which derived from the seeds of *Ocimum americanum* against the black cutworm, *A .ipsilon* ,at 3% (conc.) of the essential oil . They indicated that only 35 % of the larvae were reached the pupal stage with 67.16 % reduction than control. While, the Eugenol which was identified as the major compound of the essential oil caused 40 % larval mortality with 36.84 % reduction in the pupation % than control and the reduction in percentage of adult emergence at 3 % and 2 % of Basil reached 76.84 and 54.74 % , respectively . Also, Ahmed (2004) found that the average percentage of pupations and adult emergence 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. Morphogenetic effects :

Data presented in Table(2) demonstrated that the larval feeding of *S. littoralis* on the leaf residues of the three compounds (Spinosad , Metal and Camphor oils) induced increase in the pupal malformations percentage in relative to control. But only Spinosad caused a highly significant ($p<0.01$) increase in the pupal malformation percentages (32.8% , as compared to 0% of control). Also, the Metal oil induced significant ($p<0.05$) increase of malformed pupae (23.5%). Whereas, the Camphor oil was produced non-significant increase (6.9%) ,as compared to that of the check(0%).

On the other hand the larval feeding of *S. littoralis* on the leaf residues of the same three compounds induced an increase in the adult malformation percentages, as compared to that of the control (0%).But only, Spinosad induced significant ($p<0.05$) increase of the malformed adults reached to 18.3%.Whereas, both of the Metal and Camphor oils produced non-significant increase of adult malformation percentages (13.3 and 9.3% ,respectively) as compared to 0% of control (Table. 2).

These results are agreement to those obtained by Shadia *et al.* (2007) who indicated that treatment with the Basil Essential oil derived from the seeds of

Ocimum americanum at 3 % (conc.)caused, 13 % of the pupae of *A . ipsilon* were deformed , and also deformities among the adults reached 11 % and 7 % at 3 and 2 % of Basil oil , respectively. .Ahmed (2004) reported 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.

Malformations of *S .littoralis* pupae resulting from the larval treatment the 2nd and 4th instars larvae with spinosad mostly appeared as malformed pupae , showing body shrinkage and blacking (Fig.5)or larval-pupal monstrosity with larval cuticle patches , head capsul and thoracic legs, posterior half of the body has the pupal properties (fig.6) ,while the malformed adults showed as varied degrees of abnormal bodies or wings (fig.7,8,9,10 and 11) for pupae and adults malformations. Malformed pupae appeared as larval -pupal intermediates (Fig.12) or pupae failed to cast the old cuticle with complete blackening of the body leading to death(Fig.13) and malformed adults demonstrated as twisting wings or deformed body bear peculiar wings(Fig.14 and 15) for pupae and adults malformations gave from both Metal and Camphor oils treatments, in compared to normal pupae and adults of control were illustrated in Figs.16 and 17 .

Table 3. Latent effect of Spinosad ,Metal oil (Kz) , and Camphor oil against the 4th instar of field strain of *Spodoptera littoralis* larvae at 12 days of the treatment in relative to control.

Treatments	Fecundity eggs/ f	Fertility eggs/ f	Longevity (days)	Adult sex ratio (%)	
	Mean ± S.D.	Mean ± S.D.	Mean ± S.D.	Male	Female
Spinosad	0**	0**	4± 0.7*	100	0
Metal oil (Kz)	8.0± 3.1**	4.95 ± 2.2**	5.3± 1.3n.s.	40	60
Comphor oil	0**	0**	6.8± 1.6 n.s.	91.9	9.1
Control	604.6± 106	589.5± 92	9± 2.1	50	50
F value	159.3	203.3	11.100		
P value	0.00023	0.000141	0.0482		
L.S.D. at 0.05	147.9	127.9	4.3		
0.01	247.42	212.23	6.7		

** = Highly Significant (p<0.01) * Significant (p<0.05)
S.D.=Standard deviation Malfo.= Malformatiom%
L.S.D.= Least significant difference

2.4. Adult fecundity and fertility:

Data presented in Table(3) demonstrated that the larval feeding of *S. littoralis* on the leaf residues of the three compounds (Spinosad , Metal and Camphor oils), highly significant (p<0.01)reduced the adult fecundity in respect of control. Both of

Spinosad and Camphor oil had the strongest effect on the adult fecundity, they completely inhibited the eggs laying(0.0) ,as compared to 604.6 eggs/ f of control. While the total number of eggs laid by adult females fed as 4th instar larvae on the Metal oil was 8.0 eggs/ f ,as compared to control (604.6 eggs/ f).

Likewise, the larval feeding of *S. littoralis* on the leaf residues of the three compounds (Spinosad , Metal and Camphor oils)highly significant ($p<0.01$)reduced the eggs hatching ,as compared to control. Both of Spinosad and Camphor oil had the most potent effect because they completely inhibited the eggs laying. Whereas , the total number of viable eggs laid by adult females fed as 4th instar larvae on leaf residues treated with the Metal oil was 4.95 eggs/f in relative to that of the control (589.5 eggs/f) as showed in Table (3).

These results are agreement to those obtained by Shadia *et al.* (2007) who reported that the female moths of *A. ipsilon* resulting from larvae fed on leaves treated with basil oil for 24 hrs were deformed and mostly died before oviposition and the reduction in egg hatchability % was significantly high (54.08 and 36.74 %)in case of 3 and 2 % concentration, respectively. This reduction in egg hatchability may be due to physiological disturbance in the hormonal system of the adult when fed as larvae (4th instar)on treated leaves. 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 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.* Also, Ahmed (2004) reported that the number of eggs produced by spiny bollworm females resulting from the treated larvae with the Spinosad for laboratory and field strains larvae was decreased per female as compared with the control. They mentioned that the average % hatchability for the eggs of treated females in both strains were decreased in both of the pink and spiny bollworms as compared with control. 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.

2.6. Adult longevity:

Data presented in Table(3) showed that feeding the fourth instar larvae on the leaf residues aged 12 days sprayed with the Spinosad, Metal and Camphor oils decreased the adult longevity of S. littoralis in relative to control. Spinosad caused significant ($p<0.05$) shorten in the adult longevity to average 4 days, as compared to

9 d. of the check. While both the Metal and Camphor oils induced non–significant decrease to average 5.3 and 6.8 d. ,respectively, as compared to that of control (9d.).

These results are agreement to those obtained by 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.

2.7. Adult sex ratio :

Data in Table (3)indicated that the fourth instar larvae of *S. littoralis* feeding on the leaf residues sprayed with the Spinosad ,Metal and Camphor oils shifted the adult sex ratio in respect to that of the control. Spinosad and Camphor oil had the strongest effect on the sex ratio .Both of them violent reduced the adult females percentages to reach 0 and 9.1%,respectively,as compared to 50% of untreated adult females ,while the two compounds increased the adult males percentages to reach 100 and 91.9%,respectively,as compared to 50% of untreated adult males. Whereas ,the Metal oil had a contract effect of the two mentioned compounds ,it decreased the adult males to reach 40 %,as compared to that control (50%),and increased the adult females to reach 60% ,as compared to that of the check (50%).

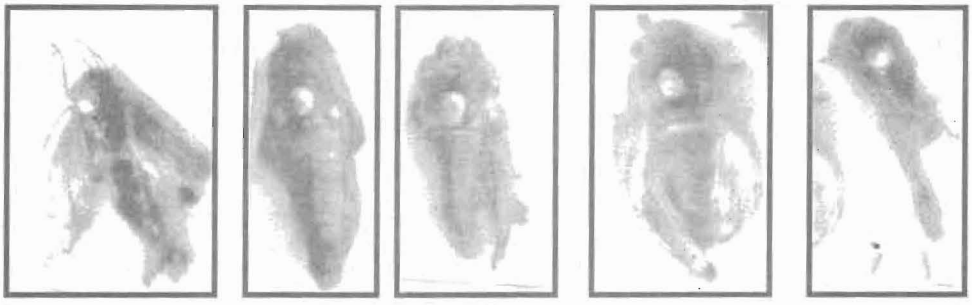
2.8.Conclusion:

The results of the present work demonstrated that the five tested compounds were effective against survival of the 2nd and 4th instar larvae of *S .littoralis* up to 12 days .Dursban and Vantex had the greatest effect up to12 days While Spinosad had a higher effect up to 7 days Whereas, both Camphor and Metal oils had stronger effect up 3 days Also , Spinosad and Camphor oil had the most potent ones against the sex ratio of adult males and females and caused sterility of adults led to none eggs laying and viable eggs in respect of control. Thus, the use of bio–insecticides and natural products (of this study) such Spinosad, Vantex and oils may give a high effect of the insect control for a consider period and were safe means maintain the environment and organisms.

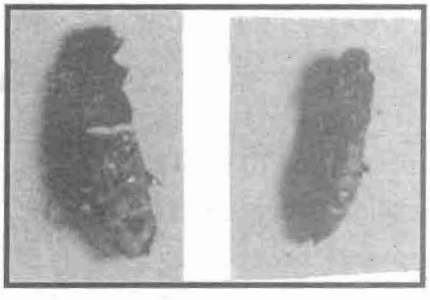
(fig.5) malformed pupae appeared as abnormal pupae showing body shrinkage and blacking

(fig.6) or larval_ pupal monstrosity with larval cuticle patches , head capsul and thoracic legs; posterior half of the body has the pupal properties

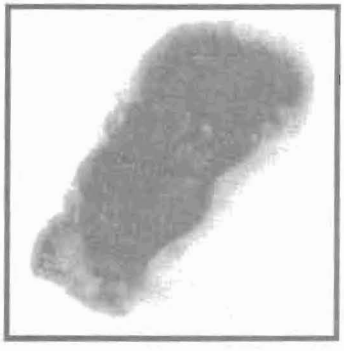
(fig.7,8,9,10 and 11)malformed adults showed as varied degrees of abnormal bodies or wings.



Figs.5 to11 pupae and adults malformations of *Spodoptera littoralis* was produced by the Spinosad treatment.



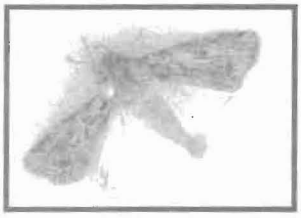
(Fig.12) malformed pupae appeared as larval_pupal intermediates.



(Fig.13) pupae failed to cast the old cuticle with complete blackening of the body leading to death

(Fig.14 and 15)malformed adults demonstrated as twisting wings or deformed body bear peculiar wings.

Figs12 to15. pupae and adults malformations of *S. littoralis* gave from the Metal and Camphor oils.



(Fig16 and 17) normal pupae and adults of *S. littoralis*

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تقيم النشاط الحيوى المتبقى لبعض المبيدات التقليدية وغير التقليدية ضد يرقات العمر الثانى والرابع لسلالة حقلية ليرقات دودة ورق القطن الكبرى

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مركز البحوث الزراعية . معهد وقاية النباتات . الدقى . الجيزة

اجريت هذه الدراسة بغرض تقيم التاثير المتبقى لخمسة مركبات:الآسبينوساد ،دروسبان ،زيت معدنى، زيت الكافوروالفانتكس ضد يرقات العمر الثانى والرابع لسلالة حقلية لدودة ورق القطن فى تجارب شبه حقلية معملية . غذيت يرقات العمر الثانى والرابع المتحصل عليها فى صورة لطع للفقس من الحقل لمدة ٤٨ ساعة على متبقيات ورقية لنبات القطن مرشوشة بالمركبات الخمسة بعد صفرو٣و٧و١٢يوم من المعاملة .وجد ان المركبات الخمسة المختبرة كانت فعالة ضد يرقات العمر الثانى والرابع معا وان فعاليتها امتدت لمدة اكثر من ١٢ يوم بعد المعاملة.كما انه وجد عند المتبقيات الورقية الآربعة ان يرقات العمر الثانى كانت اكثر حساسية للمعاملات الخمسة عن يرقات العمر الرابع وكان الدروسبان له التأثير الأقوى فى المعاملات الخمسة ثم يليه الفانتكس ،بينما كان لمركب الآسبينوساد الحيوى التأثير الآكبر عند المتبقيات الورقية اللتى عمرها صفر و ٣يوم ،بينما انخفض تأثيره مع متبقيات ورقيه عمرها ٧ و١٢ يوم . كان لزيت الكافور المستخدم فعالية عالية عن الزيت المعدنى ضد كلآ العمرين عند متبقيات ورقية عمرها صفر و ٣ يوم ، بينما انخفضت فعاليته مع المركبات الخمسة المختبرة عند متبقيات ورقية عمرها ٧ و١٢ يوم . كما وجد ان النشاطات البيولوجية للحشرة تأثرت بثلاث فقط من المركبات الخمسة المختبرة وهى الآسبينوساد و الزيت المعدنى و زيت الكافور وظهر ذلك عند تغذية يرقات العمر الرابع على متبقيات ورقية عمرها ١٢ يوم معاملة بتلك المركبات.كما وجد لمعاملآت كل من الآسبينوساد و الزيت المعدنى تأثير اقوى فى زيادة العمر اليرقى والعذراى المشوهة اذا ما قورنت بتلك التى لزيت الكافور او اذا ما تم المقارنة مع تلك التى للغير معامل . بينما وجد ان الآسبينوساد كان له التأثير الآعلى فى تقليل نسب التعذير والآختراق مقارنة بتلك التى للكنترول،فى جين ان كل من معاملات الزيت المعدنى والكافور كانوا متساويين فى تأثيراتهم بالنسبة للهذا الشأن.على الجانب الآخر وجد ان الآسبينوساد فقط اظهر تأثير معنوى عالى ادى الى زيادة فى العمر العذرى والحشرات المشوهة وقصر فى العمر الحشرى ،بينما اعطى المركبين الآخرين تأثير غير معنوى فى تلك الآنشطة.وجد ان معاملآت كل من الآسبينوساد وزيت الكافور كانت لهم التأثير الآعلى فى تغير نسب الذكور والآناث الجنسية مقارنة بتلك التى للغير معامل وهذا بدوره ادى الى اضمحلآل فى نسب الآناث المخترقة الشان الذى اثر وبشدة فى معدل وضع البيض ونسب الفقس لتصل الى الصفر مقارنة ب ٦٠٤و ٥٨٩ بيضة لكل انثى سجلت لكل من معدل وضع البيض ومعدل الفقس بالتالى فى حالة الكنترول .