J. Plant Prot. and Path., Mansoura Univ., Vol. 3 (12): 1345 - 1352, 2012

EFFECTS OF THREE PESTICIDES ON SOME BIOLOGICAL ASPECTS OF COTTON LEAF WORM (*Spodoptera littoralis*, BOISD) LARVAE UNDER LABORATORY CONDITIONS .

Marzouk , E. A.[*] ; M. M. M. Megahed[*] ; W. L. Abouamer[*] and M. M. El-Bamby [**]

*** Plant protection Dept., Fac. Agric., Al-Azhar Univ., Nasr City , Cairo, Egypt.**

****Environment and Bio-Agriculture, Fac. Agric., Al-Azhar Univ., Nasr City , Cairo, Egypt.**

ABSTRACT

The effects of bromoxynil (Brominal W 24 % EC, herbicide) and mancozeb (Acrobate mancozeb72% WP, fungicide) on some biological aspects of Egyptian cotton leafworm, *Spodoptera littoralis* (Boisd.) larvae compered to profenofos (Silicron 72 % EC, insecticide), as a refrence compound were investigated. 4th instar larvae were fed on castor-bean leaves treated with profenofos at 40, 45, 50, 60, 75 and 90 ppm, bromoxynil and mancozeb, both at 500, 750, 1000, 1250, 1500, 2000 and 2500 ppm. The obtained results showed that larval and pupal weights, growth rate, consumption index (C.I.), fecundity level , % of hatchability , % of deformed pupa , % of emergency and % of sterility decreased by the tested pesticides compared with that in control. Profenofos, caused significant increases in larval and pupal duration, but not observed with bromoxynil and mancozeb concentrations. Profenofos markedly affect all the tested parameters of 4th instar larvae of cotton leaf worm, *S. littoralis.*

Keywords: Profenofos; bromoxynil; mancozeb; 4th instar larvae *Spodoptera littoralis*

INTRODUCTION

Cotton leaf worm is considered one of the most injurious and destructive polyphagous lepidopterous insect pests attacking crops, vegetables and fruit trees all over the world (Berlinger *et al*, 1997; Kandil *et al*., 2003. The intensive use of conventional pesticides caused some side effects such as pest resurgence, pest resistance and outbreak of secondary pests. The insect pests usually encounter a mixture of pesticides including insecticide, herbicide and fungicide. These substances are sprayed in order to kill pests. However, they also have an influence on not harmful or even useful creatures. Moreover, all pesticides may cause many unpredicted effects. Although chemical and biological action of pesticides has been extensively studied (Bradbauer, 1973; Jansen, 1996), their side effects are still not fully known; partly because of the relatively short time that pesticides have been in use. The toxic effect of pesticides may be observed at least at three levels. Antifeedant and insect growth regulator act as potent acute and chronic insecticides against a variety of insect species including *S. littoralis* (Abo-El-Ghar *et al*,1996). It is believed that using herbicide and fungicide in integrated pest control programs having favorable environmental characteristics such as more safe, low toxicity to beneficial insects and low

risk to human. The object of this work is to study the effect of three different pesticides at different concentrations on some biological aspects and nutritional parameters on 4th instar larvae of *S. littoralis*.

MATERIALS AND METHODS

Chemicals:

The pesticides used in this study were:

Profenofos (Silicron 72 % EC) at 40 , 450 ,50 60,75and 90 ppm, bromoxynil (Brominal W 24 % EC) and mancozeb (Acrobate mancozeb 69 % WP) , both at 500 , 750 , 1000 , 1250 , 1500 , 200 and 2500 ppm .

Insects:

Cotton leaf worm, *S.littoralis* larvae were obtained from the permanent culture of susceptible strain of the Plant protection Institute, Dokki , Gizza . The culture was reared in the laboratories of Plant Protection Depart. , Fac. Of Agric., Al-Azhar Univ, Cairo , under constant condition at 25 ± 2^0 C,65± 5 % R.H. and photoperiod 12:12 L.D. according to a method described by El-Defrawi *et al*., (1964).

Newly moulted fourth-instar larvae of *S .littoralis* with an average weight of 13-16 mg each were used during this experiment. Five replicates for each concentration of treated and untreated larvae (10 larvae / rep.). Leaves of castor-bean were dipped in each concentration of the tested pesticides for 20 second and dried under laboratory conditions. Leaves which dipped in water served as control. For each replicate, ten larvae were put in glass jar (350 ml) and provided with treated castor-bean leaves. After 48 h. dead larvae were discarded, the survived larvae were transferred to clean jars and fed continuously on untreated fresh castor-bean leaves until pupation and adult stage. while the fresh weights of survivors, untreated castor leaves and introduced leaves were recorded daily and related to the number of surviving in each replicate. Fresh leaves were kept in a similar glass jars under the same conditions to estimate the natural loss of moisture to correct weights of consumed leaves. Nutritional induces determined in this experiment were calculated by method described by Waldbauer (1968) as follow:

Consumption index (C.I.) is a measure of amount of food eaten per unit time relative to mean weight of larvae during the feeding period.

$C.I = C/ [(Tx A)]$

Where:

C = Fresh weight of leaf consumed.

T = Duration of feeding period.

A = Mean fresh weight of the larvae during the feeding period.

Growth rate (GR) measure amount of weight gained per unit time relative to mean weight of larvae during the feeding period

$GR = G / (TxA)$.

Where:

G = Fresh weight gain in the larvae.

At adult stage, pairs of male and female from either treated and untreated larvae were transferred to glass jars covered with muslin and containing filter paper for mating of the emerged moths. Emerged moths were fed on 10 % sugar solution throw a dipped piece of cotton. The glass jars were supplied with fresh leaves of *Nearium oleander r*(L.), that served as an oviposition site. Deposited eggs were collected and counted daily. Newly hatched larvae were recorded to calculate the hatchability percent. Sterility Percent was calculated according to equation of Toppozada *et al*.,(1966) as follow :

Sterility % = 1-[a x b/ A x B] x 100

Where:

a= Number of eggs laid /female in control.
b= Percent of hatchability in treatment.
A=Number of eggs laid /female in control.
B= % of hatch / female in control.

% of pupation, % of deformed pupation and % of emergence were calculated using the following formula:

% of pupation = [Number of pupae /Total number of larvae] x 100

% of deformed pupation= [Number of deformed pupae/Total number of pupae] x 100

% of emergence= [Number of moths / Total number of larvae]x 100.

Data Analysis:

The data were subjected to analysis of variance (ANOVA) and means were separated by Duncans (Duncan, 1995).

RESULTS AND DISCUSSION

Date presented in Table (1) showed that effect of profenofos, bromoxynil and mancozeb on consumption index (C.I.) and growth rate of fourth instar larvae of Egyptian cotton leaf worm, *S.littoralis*. Results indicated that profenofos significantly decreased C.I. in 4^{th} larvae at all the testes concentration compared with control, the C.I. were 1.37 , 1.31 , 1.19 , 1.08 0 .96 and 0.90 at 40 , 45, 50 , 60 , 75 and 90 ppm , respectively, of profenofos . However , there were no significant differences between larvae fed on bromoxynil treated leaves at 500 , 750 , 1000 , 1250 and 1500 ppm, but there were found at the higher concentration 2000 and 2500 ppm compared with that in untreated larvae. Mancozeb decreased C.I. at the highest concentration, but there were no significant differences with another tested concentrations and control. Profenofos gave the highest reduction in C.I. at all tested concentrations.

Table (1): Consumption index (C.I) and growth rate ~~by~~ of 4th instar *S.littorals* fed on leaves treated with profenofos, bromoxynil and mancozeb at different concentrations.

Concentrations		C. I.	Growth rate
Control		2.75	0.48
Profenofos	40	1.37**	0.28**
	45	1.31**	0.26**
	50	1.19**	0.26**
	60	1.08**	0.23**
	75	0.96**	0.20**
	90	0.90**	0.18**
Bromoxynil	500	2.63	0.44
	750	2.57	0.41
	1000	2.41	0.38**
	1250	2.36	0.36**
	1500	2.27	0.35**
	2000	1.89*	0.33**
	2500	1.78*	0.31**
Mancozeb	500	2.72	0.46
	750	2.70	0.40**
	1000	2.63	0.39**
	1250	2.47	0.36**
	1500	2.33	0.36**
	2000	2.10	0.35**
	2500	1.90*	0.33**
L.S.D at 5 %		0.58	0.013
L.S.D at 1 %		0.98	0.017

*= significant **= highly significant

Concerning the growth rate (GR), results clearly showed that profenofos was the most potent chemicalon 4th instar larvae of *S. littoralis*, it caused high inhibition in GR at all the used concentrations compared to control, while, bromoxynil didn't cause significant decrease in GR in 4th instar larvae with 500 and 750 ppm, however, it significantly reduced GR at all the other concentrations. Similarly, mancozeb caused significant decrease in GR in larvae at all concentrations tested , except the lowest one, it gave 0.40 , 0.39 , 0.36 , 0.36 , 0.35 and 0.33 at 750 , 1000 , 1250 , 1500 , 2000 and 2500 ppm , respectively. Thus, there was a positive correlation between consumption index and growth rate which was in accordance with in cused concentration. Application of antifeedant chemicals has been rare, because these chemicals not be effective as a recommended insecticide (Meisner *et al*., 1987). Profenofos gave the highest potency on cotton leaf worm larvae at all concentrations, because profenofos is an insecticide and recommended for control ling *S. littoralis* and this is considered to be the target effect of it. The reduction of growth rate was due to lower efficiency of conversion of ingested food to body substances for larvae with these treatments (Abo-El-Ghar, 1994).

Table (2): Effects of tested pesticides at different concentrations on larval weight and duration, pupal weight and duration of *S. littorals.*

Treatments		Larval weight (mg/larva)	Larval duration (day)	Pupa weight (mg/pupa)	Pupa duration (day)
Control		0.557	10.57	359.44	9.81
Profenofos	40	0.324**	9.87*	330.27*	10.33*
	45	0.309**	9.76*	315.61**	10.37*
	50	0.289**	9.78*	294.45**	10.50**
	60	0.276**	9.66*	275.58**	10.66**
	75	0.265**	9.63*	260.63**	10.21*
	90	0.240	9.40**	245.60**	10.18
Bromoxynil	500	0.514	10.63	347.21	9.95
	750	0.494*	10.60	337.29*	10.022
	1000	0.452**	10.65	330.99*	10.23*
	1250	0.441**	10.73	324.75**	10.16*
	1500	0.420**	10.79	307.40**	10.31*
	2000	0.410**	10.89	291.22**	10.46*
	2500	0.407**	11.13*	280.36**	10.50
Mancozeb	500	0.391**	10.58	325.47**	10.00
	750	0.383**	10.64	339.78	10.17*
	1000	0.377**	10.66	332.88*	10.25*
	1250	0.356**	10.62	325.78**	10.37*
	1500	0.354**	10.77	314.93**	10.40*
	2000	0.345**	10.81	297.98**	9.96
	2500	0.329**	10.97	288.31**	10.20*
L.S.D at 5 %		0.58	0.48	20.73	0.36
L.S.D at 1 %		0.77	1.08	32.90	0.68

***= significant **= highly significant**

Data shown in Table (2) illustrated the effect of tested pesticides on larval weights, larval duration, pupal weights and duration of 4th instar larvae of cotton leaf worm, *S. littoralis* under laboratory conditions. Obtained results indicated that all the tested pesticides significantly affected larval and pupal weights. Profenofos recording 0.324, 0.309 ,0.289 , 0.276 , 0.265 and 0.240 mg / larvae at 40 , 45 , 50 , 60 , 75 and 90 ppm , respectively , while , it gave 0.330 , 0.315 , 0.294 , 0.275 0.260 and 0.245 mg / pupae , respectively.

Bromoxynil and mancozeb also significantly affected larval and pupal weights at all tested concentrations. Thus profenofos gave the highest reduction of larval and pupal weights followed by mancozeb and bromoxynil. In addition, profenofos had the strongest effect on larval and pupal duration , larval duration was decreased with increased profenofos concentrations. On contrary , it caused increased in pupal duration. However, bromoxynil gave significant increase in larval duration at all tested concentration, except the first one . Morever, mancozeb significantly increase pupal duration at all slected concentrations. Larval weight gain of *S. littoralis* fed on leaves treated with different concentrations of herbicides was significantly lower than that on untreated control (Meisner *et al*., 1987), they also reported that residual effect of some herbicides showed some antifeedant activity.

Data listed in Table (3) demonstrated the effects of profenofos, bromoxynil and mancozeb at different concentrations on % of pupation , % of deformed pupation , % of emergence , fecundity , % of hatchability and % of sterility on cotton leaf worm, *S. littoralis*. Results showed that profenofos significantly reduced % of pupation, % of emergence, fecundity level and % of hatchability, whith it significantly increase % of deformed pupae, and % of sterility at all tested concentration compared to untreated control. The same trend was observed also with peamxinal and mancozib. Moreover peamxinal and mancozib. In addition, bromoxynil and mancozeb gave a effect of these parameters. Profenofos gave highest inhibition in these parameters compared with control. Bromoxynil and mancozeb were gave similar effect on these parameters at all tested concentrations. Korrat *et al*. (2012) found that mixture of insecticides containing profenofos gave the highest effect on biological parameters of *S. littoralis*. The antifeedant properties of some herbicides may be udeful against lepidopterous insects. The prolonged exposure and feeding on those herbicides resulted in deterrent effects (Abo-El-Ghar, 1994). El-Ibrashi (1971) and El-Ibrashi and Abou-Zeid (1972) reported that EPTC was a sterilant for *S.littoralis* in the laboratory and in the field.

Table (3):Effect of tested pesticides at different concentrations on biological aspects of *S. littorals* larvae.

Treatments		% of Pupation	% of Deformed Pupation	% of Emergence	Fecundity	% of Hatch.	% of Sterility
Control		90.43	0.00	87.26	1140.66	97.45	0.00
Profenofos	40	59.83*	22.24**	64.47*	774.80	70.65*	27.25
	45	46.65**	22.24**	63.66*	724.10*	61.83*	37.63
	50	46.65**	39.85**	55.70*	613.65**	54.44**	48.45
	60	33.89**	51.14**	48.69**	559.56**	47.81**	57.69
	75	30.26**	58.51**	39.85**	505.78**	40.56**	67.23
	90	22.45**	68.42**	30.33**	467.67**	34.86**	78.83
Bromoxynil	500	78.33	0.00	85.45	980.33	90.15	7.50
	750	71.66	0.00	85.45	965.33	85.65	10.75
	1000	65.24*	11.11*	78.66	940.61	80.44	15.60
	1250	61.45*	16.66**	74.44	880.90	74.16*	20.63
	1500	57.23*	23.35**	67.91*	862.70	70.41*	25.50
	2000	50.66**	30.43**	65.43*	837.66	64.77*	29.50
	2500	47.78**	37.37**	60.87*	786.44	60.65*	32.44
Mancozeb	500	82.28	0.00	93.59	990.33	91.37	5.65
	750	77.10	0.00	90.00	977.65	86.76	8.75
	1000	72.93	0.00	90.00	949.98	82.43*	13.65
	1250	67.57	15.57**	82.57	910.41	77.40*	19.97
	1500	62.33*	20.78**	77.25*	878.66	70.98*	19.97
	2000	56.26*	27.30**	71.67*	843.97	66.13*	25.18
	2500	52.78**	31.33**	67.11*	811.28	64.78*	30.25
L.S.D at 5 %		12.65	7.47	16.65	250.18	25.65	
L.S.D at 1 %		24.20	11.96	27.20	340.29	23.20	

*= significant **= highly significant

REFERENCES

Abou El-Ghar, G.E.S.(1994) : effect of herbicides on consumption, growth and food utilization by cotton leaf worm *S.littoralis* (Boisd) larvae. Anz. schadligskde., Pflanzenschutz, umweltschutz67: 143-146

Abou El-Ghar, G.E.S.; Khalil, M.E., and Eid,T. M. (1996): Some biochemical effect of plant extracts in the black cutworm, *Agrotis ipsilon* (Hufinagel) (Lepidoptera: Noctuidae). J. Appl. Entomol.120 (8): 477.

Berlinger, M.J.; Miller, M . Tal and Tamin M. (1997): Resistance mechanisms of *Lycopersicon pennellii* accessions to *S. littoralis* (Boisduval) (Lepidoptera : Noctuidae). J. Econ. Entomol.90: 1690-1696.

Bradbury, S. J. (1973): The effect of parathion on crustacean skeletal muscle – I. The mechanical threshold and dependence on Ca2+ ions. Comp. Biochem. Physiol. 44A, 1021–1032.

Duncan, D. B. (1995): Multiple range and multiple F tests. Biometrics 11: 1-42.

E l-Ibrashi, M.T. (1971) : The herbicide Eptam: a selective female chemosterilant for the Egyptian cotton leaf worm , *S. littoralis* . Experientia 27, 808-809.

El-Ibrashi, M.T. and Abou-Zeid, E. N. (1972) : preliminary field evaluation of the sterilant activity of the herbicide EPTC against the Egyptian cotton leaf worm , *S. littoralis* . Appl. Ent. Zool. 7, 168-1710.

El-Defrawi,M.F.; Toppozada, A.T.; Salama, A. and El-Kishen, S.A.(1964) :Toxicological studies on the Egyptian cotton leaf worm *prodenia litura* F.11. Reversion of Toxaphine resistance in the Egyptian cotton leaf worm.J.Econ.Entom. 57: 593-595.

Meisner, J. Lifshitz, N. and Ascher, K. R. S.(1987) : Antifeedant properties of herbicides against S. littoralis larvae (Lepidoptera, Noctuidae), with special reference to pronamide.J. Econ. Ent.870 , 724-727.

Kandil, M. A.; Abdel-Aziz , N. F. and Sammour, E. A. (2003): Comparative toxicity of chlorfluazuron and leufenron against cotton leaf worm, S. littoralis(Boisd) . Egypt. J.Agric.Res. NRC,2 : 645-661.

Korrat, E.E.E.; Abdelmonem, A.E. ; helalia, A.A.R. and Khalifa, H.M.S. (2012) : Toxicological study of some conventional and non-conventional insecticides and their mixtures against cotton leaf worm,*S.Littoralis* (Boisd) (Lepidoptera : Noctuidae). Annals of Agric. Sci., 57: 145-152.

Jansen, J. P. (1996): Side effects of insecticides on Aphidius rhopalosiphi (Hym: Aphidiiae) in laboratory. Entomophaga41, 37–43.

Toppozada,A.; Abdallah, S. and El-Defrawi,M. E. (1966): Chemosterilization of larvae and adults of the Egyptian cotton leafworm *Prodenia litura*, by apholate, metepa and tepa.J.Econ.Entom.59 : 1125-1128.

Waldbauer, C. R. (1968): The consumption and utilization of food by insects .Advan.Insect Physiol.5: 229-288.

تأثير ثلاث من مبيدات الآفات علي بعض القياسات البيولوجية لدودة ورق القطن (*Spodoptera littoralis*, Boisd).

عماد الدين أحمد مرزوق* . محمد محمد محمد مجاهد *. وليد لطفي أبوعامر * و محمود محمد البمبي.**

***قسم وقاية النبات – كلية الزراعة – جامعة الازهر – القاهرة.**

****** قسم البيئة والزراعة الحيوية – كلية الزراعة – جامعة الازهر – القاهرة.**

دراسة تأثير ثلاثة من المركبات (البروفينوفوس – البوميكسونيل – المانكوزيب) وذلك علي بعض الجوانب الحيوية لدودة ورق القطن المصرية. تم تغذية العمر اليرقي الرابع لدودة ورق القطن علي ورق الخروع والمعامل بتركيزات مختلفة وهي كالتالي: بروفينوفوس (40 ، 50، 60، 75 و 90 جزء في المليون) – البرموكسنيل والمكانكوزيب (500 – 750 – 1250 – 2000 و 2500 جزء في المليون). وقد أوضحت النتائج ان هناك إنخفاض واضح في وزن اليرقة والعذراء في المعاملات المختلفة و مقارنة بالكنترول، وكذا إنخفاض في معدل الاستهلاك الغذائى– ومستوي الخصوبة – النسبة المئوية للفقس – النسبة المئوية لخروج الفراشات. ومن ناحية أخري حدثت زيادة في فترة الطور اليرقي وكذا في فترة التعذير عند المعاملة بمركب البروفينوس في حين لم يحدث ذلك في المعاملتين الاخرتين. وبذا تظهر النتائج تأثير مركب البوفينوفوس علي دودة ورق القطن في العمر اليرقي الرابع.

قام بتحكيم البحث

أ.د / عبد البديع عبد الحميد غانم — كلية الزراعة – جامعة المنصورة

أ.د / فؤاد احمد فهمى — كلية الزراعة – جامعة الازهر