J. Plant Prot. and Path., Mansoura Univ., Vol.9 (3): 231 - 236, 2018

Comparative Effect between of Teflubenzuron, *Bacillus thuringiensis* and *Serratia marcescens* Individually and Combined on Transaminase Activities of *Spodoptera littoralis* (Boisd)

Abd EL- Naby, S. M.; Saheir F. EL-Lakwah and T. A. A. Elsheikh
Plant Protection Research Institute, Agriculture Research Center, Dokki, Giza

ABSTRACT

The second instars *S. littoralis* larvae were exposed to the LC_{50} of Teflubenzuron, ***Bacillus*** *thuringiensis Var. kurstaki.* , and the concentration (MC_{50}) of *Serratia marcescens* causes 50% malformation for pupae, separately and in sequential combined of both *B. thuringiensis/ S.marcescens* (*Bt/Sm*) and Teflubenzuron/*S.marcescens* to compare the effect of the tested pesticides on the aspartate aminotransferase (AST) activity and alanine aminotransferase (ALT) activity during pupal stage of *Spodoptera littoralis* Boisd. Treatment with *B. thuringiensis* or *S. marcescens* alone revealed generally significant decreases to AST through pupal stage relative to control. The highest levels of (AST) aspartate aminotransferase activities were clearly found in individual treatment with Teflubenzuron. On the other hand , when the sequential combined effect treatment *B. thuringiensis/ S. marcescens* (*Bt/Sm*) was used , there were more reduction in the AST activity at 2nd , 4th and 10th days than that of *S. marcescens* and generally ,during the pupal stage, the sequential *Bt/Sm* had less effect than individual *B. thuringiensis* . The effect of Teflubenzuron / *S. marcescens* ((Teflu/*Sm*) commonly was higher than individual *S. marcescens* but less effective than Teflubenzuron alone. Also, Teflubenzuron had an effect on alanine aminotransferase (ALT) activity higher than *B. thuringiensis* which was effective than *S.marcescence.* In contrast, in the sequential combined effect treatments, *Bt/Sm* exhibited more decreasing effect at 2nd , 12th and 14th day of pupation (-72.93% , -82.86% and -89.56% , respectively) than treatment with *B. thuringiensis* alone. Teflu/Sm caused significant reduction in alanine aminotransferase activity except at 4th and 6th days, where there is significant increase. The increase at 6th day (203.56%) was higher than that of Teflubenzuron alone (126.18%) or *S. marcescens* (47.60%). But overall, Teflubenzuron alone had the highest effect.

INTRODUCTION

Spodoptera littoralis Bosid (Lepidoptera: Noctuidae), the Egyptian cotton leaf worm, is a polyphagous foliage feeding insect. It considered as one of the most serious pests of many different Egyptian crops (Magd El- Din & El-Gengaihi, 2000). It attacks plants in 44 families containing at least 112 species of plants of varying economic importance (Sarto and Monteys, 1988). Now it has become necessary to search for alternative means of pest control which can minimize the use of the synthetic chemicals that cause harmful residues in the food chain and pollution of the surrounding natural enemies and pest resistance. The necessity to find alternative insecticides such as, use insect growth regulators (IGRs). IGR's had been recently grouped in chitin synthesis inhibitors (CSIs) and substances that interfere with the action of insect. hormones (i.e. juvenile hormone analogues, and ecdysteroids) (Tunaz and Uygun, 2004) IGRs are considered to have little human toxicity because humans do not make chitin and do not make or use the hormones insects use in moulting (Schmutterer, 1985)

The present study was undertaken to investigate the effect of Teflubenzuron, *Bacillus thuringiensis Var. kurstaki.* , and *Serratia marcescens* separately and in sequential combined of both *B. thuringiensis/ S.marcescens* (*Bt/Sm*) and Teflubenzuron/*S.marcescens* on the aminotransferase ((AST/GOT)) activity and alanine aminotransferase (ALT/GPT) activity during pupal of *Spodoptera littoralis*

MATERIALS AND METHODS

Rearing technique

A stock culture of the cotton leaf worm, *Spodoptera littoralis* Boisd was obtained from a laboratory strain maintained in the Cotton Pest Research Section, Plant Protection Research Institute, Agriculture Research Center, Dokki, Giza, for several generations without any insecticidal and /or microbial pressure. The insect was reared on castor-oil leaves, *Ricinus communis,* under laboratory conditions at 25±2°C and 60±5% R.H. 2nd and late 6th instar larvae were used in the present investigation.

Insecticidal

Insect growth regulator (IGR)

Common name: Teflubenzuron, Trade name: No molt, 15 % S.C., Chemical name: N-[(3, 5-dichloro-2, 4-difluorophenyl) aminocarbonyl]-2, 6-difluorobenzamide, Empirical fromula: C14 H6 Cl2 F4 N2 O2, Molecular weight: 381.1, this IGR belong to chitin synthesis inhibitors group and has been obtained from Sumitomo Chemical Co., Ltd.

Protecto

It is a wettable powder formulation, based on *Bacillus thuringiensis Var. kurstaki.*. It contains lepidopteran toxin 9.4 % produced by the Plant Protection Research Institute, Agricultural Research Center, Dokki, and Cairo, Egypt.

Serratia marcescens

Chitinase producing bacterial strain belong to genus *Serratia* was used throughout the current work. The bacterial strain was isolated from Egyptian soils and identified as *Serratia marcescens,* which was formulated as a biological agent for plant parasitic nematodes. The bioagent is produced and distracted on a commercial scale (Trade name, Nemaless) by Soils, Water and Environ. Res. Inst. ARC, Giza, Egypt.

Toxicity assay

Determination of LC_{50} values of both Teflubenzuron & *Bacillus thuringiensis*

To assess the activity of the two pesticides ; Teflubenzuron & *B. thuringiensis* under investigation, a series of six aqueous concentrations were prepared which were 0.625 , 0.312 , 0.156 , 0.078, 0.039 and 0.0195 ppm for Teflubenzuron and 1410 , 705 , 352 , 176 , 88 and 44 % for *B. thuringiensis* .Treatment was conducted by the dipping technique according to *Abo El-Ghar et al., 1994* where castor oil leaves, *Ricinus communis* were immersed in one of the prepared concentrations of each of the two tested agents. The leaves then left to dry at room

temperature before being offered to newly ecdysis 2nd instars *S. littoralis* larvae. Larvae were fed on treated leaves for 48 h, subsequently larvae were fed on untreated castor oil leaves for the following duration of the larval stage. Each treatment comprised 30 larvae and was replicated three times. A similar number of larvae were considered as a control in which larvae were offered castor oil leaves dipped in water. Mortality was recorded daily and accumulative larval mortality was determined at the end of the larval stage. The data were subjected to probit analysis (Finney, 1971) to give LC_{50} values of both Teflubenzuron and *B. thuringiensis* in probit analysis the raw data of concentration versus mortality % were transferred to a linear form of log concentration verses % mortality probability by LDP line program which then transferred the log concentrations to original concentrations. From the plot we can obtain the LC_{50} values of Teflubenzuron and *B. thuringiensis*. The Toxicity index of the tested compounds was determined according to Sun (1950).

Determination of MC_{50} of *Serratia marcescens*

For detection the minimal concentration caused 50% adult malformation (MC_{50}), series dilutions of *Serratia marcescens* (10^9, 10^8, 10^7, 10^6 and 10^5 colony forming unit, cfu / ml.) were prepared. Sawdust was treated with *S. marcescens* (g/ml) then left to dry at room temperature and offered to late 6th instar larvae, to pupate on it. Larvae pupated on untreated sawdust were used as control. 30 larvae late 6th instar of *S. littoralis* were placed in each glass jar. These jars were incubated at 25°C for 14 days. Three replicates per each jar were carried out. The adult malformation percentages were determined.The data were then subjected to probit analysis *(Finney, 1971)* to obtain the concentration which causes 50% adult malformation (MC_{50}) for *S. marcescens*. The procedure for obtaining MC_{50} of *S. marcescens* is similar for obtaining LC_{50} of Teflubenzuron and *B. thuringiensis* except that the concentration was plotted versis % adult malformation**.**

Bioassay

The biological experiments were conducted separately with Teflubenzuron, *B. thuringiensis* or *S. marcescens* and in combination to study the sequential combined effect of the tested pesticides. In the individual experiments, castor oil leaves treated with the determined LC_{50} of each of the two tested compounds were offered newly ecdysis second instar larvae, Teflubenzuron or *B. thuringiensis Var. kurstaki.* for 24 h., after that time larvae were reared on untreated leaves. Whereas, in case of *S.marcescens* , sawdust treated with the determined MC_{50} was offered to the late 6th instar larvae to pupate on it . In the sequential expriments, the combined effect of *S. marcescens* either with *B. thuringiensis* (*Bt/Serr*) or Teflubenzuron (Teflu /*Serr*) were carried out by treatment of the 2nd instar larvae with the obtained LC_{50} either of *B. thuringiensis* or Teflubenzuron then, at the end of larval stage, the late 6th instar larvae were allowed to pupate on sawdust treated with *S. marcescens* at the $MC_{50.}$ Three replicates were used each replicate include 120 larvae. Pupal samples for biochemical assay were collected after 2, 4, 6, 8, 10, 12 and 14 days of prepupation.

Biochemical assay

Preparation of haemogenate samples of *S.littoralis*

The collected pupae were homogenized in distilled water at 500 rpm using a Teflon homogenizer - (MECHIANIKA PRECYZYJNA Warszawa type MPN-309-Poland) - surrounded with a jacket of crushed ice for 3 minutes. Homogenates were collected in cold tubes (on ice) previously coated with crystals of phenylthiourea to prevent melanization, then centrifuged at 6000 rpm for 10 min at 5°C using (BECKMAN GS-6R Centrifuge). After centrifugation, the supernatant fluid was divided into small aliquots (0.5 ml) and stored at –20 °C until analysis of enzyme activities and determination of main component. Three replicates were carried out for each biochemical determination.

Determination of enzymes activities

The aspartate aminotransferase (AST/GOT) activity and alanine aminotransferase (ALT/GPT) activity (Transaminases activity) were determined according to *(Reitman and Frankle, 1957)*

Statistical analysis:

The results of biochemical determinations were pooled from triplicate determinations. The results were analyzed by one – way analysis of variance (ANOVA) using constant statistical software (cohort software, Berkeley). When the ANOVA statistics were significant ($P < 0.01$), means were compared by the Duncan's multiple range test.

RESULTS

Toxicity of *Bacillus thuringiensis* and Teflubenzuron and adult malformation caused by *Serratia marcescens* to *Spodoptera littoralis*

In Table (1) the toxicity of Teflubenzuron or *B. thuringiensis* to the 2nd instars of *S. littoralis* is evaluated by determination of toxicity parameters (LC_{50}) and toxicity index). Based on LC_{50} values, it is obvious that both agents caused considerable toxic effects against the 2nd larvae of *S. littoralis* particularly in case of Teflubenzuron which had drastical toxic effects comparing to *B.thuringiensis* toxicity. The toxicity index indicates that Teflubenzuron was about 1481.54 times as toxic as *B.thuringiensis*. The LC_{50} of Teflubenzuron is 0.114 ppm whereas it is 168.89 ppm in case of treatment with *B.thuringiensis*, On the other hand, data presented in Table (2) revealed that the minimal concentration caused 50% adult malformation (MC_{50}) to the late 6th instars of *S.littoralis* in sawdust was treated with *S. marcescens* was 3.09x108 cfu/ml.

Table 1. Toxicity values of *Bacillus thuringiensis* and Teflubenzuron to *Spodoptera littoralis* treated as 2nd instar larvae

No	Line name	LC_{50}	LC_{90}	Slope	RR	Index	Lower limit	Upper limit
1	Teflubenzuron	0.114	0.736	1.581	1	100	0.084	0.155
2	*bacillus thuringiens*	168.89	2313.30	1.128	1481.54	0.067	138.176	203.083

Index compared with teflubenzuron **Resistance Ratio (RR) compared with teflubenzuron**

Table 2. *Serratia marcescens* minimal concentration which causes 50% adult malformation to *Spodoptera littoralis* (Boisd).

Agent	*MC_{50} **(cfu/ml)	95% Fiducial Limits	Slope ± S.E.	$X^2_{(df)}$
S. marcescens	$3.09x10^8$	$7.7x10^7$ $3.81x10^9$	0.29 ± 0.055	$0.966_{(4)}$

*** MC_{50} :Minimal concentration caused 50% adult malformation. ** (cfu) : colony forming unite .**

Effect of treatments on aspartate aminotransferase activity in pupal stage

From results presented in Table (3), it could be seen that aspartate aminotransferase (AST) activity of *S. littoralis* pupae treated with *S. marcescens* have the same trend during pupation time as control. Thus, it was decreased from 46.677 to 2.436 and from 22.184 to 2.565 µg oxaloacetate/ min/ g body weight with untreated pupae and treated pupae with *S. marcescens*, respectively. In addition, *S. marcescens* caused significant decrease at 2nd, 4th and 10th days (-52.47%, -28.14% and -22.17%, respectively), while, significant increase at 8th day (50.83%) of pupation was found relative to control. Also, treatment with *B. thuringiensis* alone revealed significant decreases through pupal stage (maximum of -84.62% at first time) except at 6th and 8th days of pupation (70.21% and 62.40% increase). The highest levels of aspartate aminotransferase activities were clearly found in individual treatment with Teflubenzuron. On the other hand , when the sequential combined effect treatment *B. thuringiensis/ S. marcescens* (*Bt/Sm*) was used , there were more reduction in the activity at 2nd , 4th and 10th days (-72.11% , -50.66% and -39.62 % , respectively) than that of *S. marcescens* and generally ,during the pupal stage, the sequential *Bt/Sm* had less effect than individual *B. thuringiensis* . The sequential combined effect treatment Teflubenzuron/ *S. marcescens* (Teflu/*Sm*) gave significant decreases during pupal stage whereas there was significant increase (221.28%) just at 6th day which was higher than that of individual treatment with Teflubenzuron (197.87%) but still clearly less effective at the other times as compared to control. Generally, the effect of Teflu/*Sm* was higher than individual *S. marcescens* but less effective than individual Teflubenzuron.

Effect of treatments on alanine aminotransferase activity in pupal stage

Data presented in Table (4), show changes in alanine aminotransferase (ALT)activity during pupal of *S. littoralis* treated with *S. marcescens* at concentration causes 50% malformation(MC_{50}), LC_{50} of *B. thuringiensis*, Teflubenzuron and their sequential combined effects treatments of both *B. thuringiensis/ S.marcescens* (*Bt/Sm*) and Teflubenzuron/*S.marcescens*.

Table 3.Changes of aspartate aminotransferase activity in pupal stage of *Spodoptera littoralis* treated with *Serratia marcescens* (at MC_{50}), *B. thuringiensis* and Teflubenzuron (at LC_{50}) and their sequential combined effects (Mean ± SE).

Time in day	Aspartate aminotransferase activity (µg oxaloacetate /min/g body weight) (Mean ± SE)*. Treatments										
	Control	*S. marcescens*	% + or - control	*B. thuringiensis*	% + or - control	Teflubenzuron	% + or - control	*Bt / Sm*	% + or - control	Teflu / *Sm*	% + or - control
	c	gh		st		c		mn		i	
2	46.677 ± 1.797	22.184 ± 0.899	-52.47	7.181 ± 0.170	-84.62	45.779 ± 1.238	-1.92	13.016 ± 0.449	-72.11	19.556 ± 0.670	-58.10
	ij	lm		nop		c		pqr		nop	
4	19.361 ± 0.560	13.913 ± 0.501	-28.14	10.836 ± 0.280	-44.03	46.164 ± 1.420	138.44	9.553 ± 0.340	-50.66	11.220 ± 0.390	-42.05
	mno	lm		hi		e		kl		d	
6	12.054 ± 0.340	13.657 ± 0.556	13.30	20.517 ± 0.670	70.21	35.905 ± 1.141	197.87	15.523 ± 0.560	28.78	38.727 ± 1.408	221.28
	kl	fg		f		a		opqr		jk	
8	15.516 ± 0.560	23.403 ± 0.892	50.83	25.198 ± 0.729	62.40	72.901 ± 2.696	369.84	10.259 ± 0.390	-33.88	17.119 ± 0.619	10.33
	lm	opq		nop		b		rs		pqrs	
10	13.593 ± 0.449	10.579 ± 0.401	-22.17	10.900 ± 0.340	-19.81	60.077 ± 1.773	341.97	8.207 ± 0.231	-39.62	9.233 ± 0.294	-32.08
	qrs	pqrs		uvw		c		vwx		tu	
12	8.333 ± 0.340	9.297 ± 0.280	11.57	4.424 ± 0.111	-46.91	45.074 ± 1.009	440.91	3.078 ± 0.111	-63.06	5.835 ± 0.170	-29.98
	wx	vwx		uvw		nop		x		tuv	
14	2.436 ± 0.340	2.565 ± 0.170	5.30	4.681 ± 0.170	92.16	11.028 ± 0.390	352.71	1.795 ± 0.064	-26.31	4.873 ± 0.170	100.04
LSD						2.3131					

***Means with the same letter(s) are not significantly different. (P<0.05) ; LSD : least significant difirence.**
Bt/Sm* : *B. thuringiensis / S. marcescens* ; Teflu / *S.m* : Teflubenzuron / *S. marcescens
MC_{50}: concentration caused 50% adult malformation.

The obtained data showed that, the treatment with *S.marcescence* exhibited significant increases in alanine aminotransferase activity during pupation times (maximum of 168.63% and114.56% at 10th and 14th days, respectively) except at 2nd and 8th days (-30.25% and -34.54%, respectively). Also, *B. thuringiensis* caused a stimulating effect on alanine aminotransferase activity by about 246.42% and 123.19% at 6th and 8th days of pupation, respectively.

Table 4.Changes of alanin aminotransferase activity in pupal stage of *Spodoptera littoralis* treated with *Serratia marcescens* at (MC_{50}), *Bacillus thuringiensis* and Teflubenzuron (at LC_{50}) and their sequential combined effects (Mean ± SE).

Time in day	Alanin aminotransferase activity (µg pyruvate /min/g body weight) (Mean ± SE)*. Treatments										
	Control	*S. marcescens*	% + or - control	*B. thuringiensis*	% + or - Control	Teflubenzuron	% + or - control	*Bt / Sm*	% + or - control	Teflu / *Sm*	% + or - control
2	gh 26.288 ± 1.003	k 18.337 ± 0.571	-30.25	lm 12.118 ± 0.294	-53.90	e 32.251 ± 1.178	22.68	qr 7.117 ± 0.222	-72.93	lmno 11.028 ± 0.357	-58.05
4	lm 13.206 ± 0.560	j 21.543 ± 0.619	63.13	lm 13.144 ± 0.390	-0.47	f 28.724 ± 1.009	117.51	lmn 11.477 ± 0.231	-13.09	nop 9.682 ± 0.280	-26.68
6	rs 5.386 ± 0.222	pq 7.950 ± 0.340	47.60	k 18.658 ± 0.401	246.42	lm 12.182 ± 0.390	126.18	lmno 10.969 ± 0.222	103.66	k 16.350 ± 0.510	203.56
8	lm 12.439 ± 0.340	pq 8.143 ± 0.280	-34.54	fg 27.763 ± 0.971	123.19	ij 23.146 ± 0.789	86.08	pqr 7.438 ± 0.231	-40.20	qr 7.053 ± 0.231	-43.30
10	mno 10.836 ± 0.390	f 29.109 ± 1.051	168.63	lm 12.759 ± 0.280	17.75	c 46.485 ± 1.250	328.99	opq 8.912 ± 0.170	-17.76	opq 8.912 ± 0.280	-17.76
12	k 18.332 ± 0.679	hi 25.070 ± 0.899	36.76	qr 6.925 ± 0.222	-62.22	d 43.407 ± 1.687	136.78	s 3.142 ± 0.064	-82.86	l 13.272 ± 0.294	-27.60
14	f 29.494 ± 1.119	b 63.283 ± 2.004	114.56	pqr 7.373 ± 0.280	-75.00	a 88.609 ± 3.106	200.43	s 3.078 ± 0.111	-89.56	d 42.830 ± 1.009	45.22
LSD	2.4103										

***Means with the same letter(s) are not significantly different. (P<0.05) ; LSD : least significant difirence.**
Bt/Sm* : *B. thuringiensis / S. marcescens* ; Teflu / *S.m* : Teflubenzuron / *S. marcescens
MC_{50}: concentration caused 50% adult malformation.

Whereas Significant decreases at 2nd, 12th and 14th days of pupation were recorded. Teflubenzuron clearly induced high levels of alanine aminotransferase activity during pupal stage particularly at the last three times (328.99%, 136.78%, 200.43%, respectively). Thus, Teflubenzuron had an effect on alanine aminotransferase activity higher than *B. thuringiensis* which was effective than *S.marcescence* . On the other hand , in the sequential combined effect treatments, *Bt/Sm* exhibited more decreasing effect at both first and last two times of pupation (-72.93% , -82.86% and -89.56% , respectively) than that of individual treatment with *B. thuringiensis* (-53.90% , -62.22% and -75.00% , respectively) . Teflu/Sm caused significant reduction in alanine aminotransferase activity except at 4th and 6th days, where there is significant increase. The increase at 6th day (203.56%) was higher than that of individual Teflubenzuron (126.18%) or individual *S. marcescens* (47.60%). Generally, individual Teflubenzuron had the highest effect.

DISCUSSION

By studying the Toxicity of *Bacillus thuringiensis* , Teflubenzuron and adult malformation caused by *Serratia marcescens* to 2nd instar larvae *Spodoptera littoralis* noticeable that, the LC_{50} value of chitin synthesis inhibitor (CSI) Teflubenzuron was similar to that obtained by *Thabit (2011)* who recorded LC_{50} of 0.177ppm for Teflubenzuron towards 2nd instar larvae of *S. littoralis*. Teflubenzuron in the present study had drastical toxic effect comparing to *B.thuringiensis*, this was similar to *Abd El- Aziz (2007)* who found that Lufenuron (CSI) had drastical toxic effect comparing to *B.thuringiensis* on 2nd instar larvae of *S. littoralis.* The obtained results are supported by the work of *Seleem (2012)* who reported that the LC_{50} value of *B. thuringiensis var Kurstaki* was 242.297 ppm against the 2nd instar larvae of *S. littoralis* . On the other hand, the minimal concentration which causes 50% adult malformation of *S. littoralis* was similar to *Tolba (2006)* and *EL-Sheikh et al.(2005)* working on *Agrotis ipsilon*.

The data showed conspicuous changes in alanine aminotransferase (ALT)activity and aspartate aminotransferase (AST) activity during pupal of *S. littoralis* treated with *S. marcescens* at concentration causes 50% malformation(MC_{50}), LC_{50} of *B. thuringiensis*, Teflubenzuron and their sequential combined effects treatments of both *B. thuringiensis/ S.marcescens* (*Bt/Sm*) andTeflubenzuron/*S.marcescens*.

The results obtained either for *S. marcescens* or Teflubenzuron treatment are similar to those of *Tolba (2006)* who found decreases in aspartate aminotransferase activity during pupal stage of *A. ipsilon* treated with *S. marcescens* in contrast to increases with Flufenoxuron , Moreover, ALT (alanine aminotransferase) was increased in both treatments . *Abou-Taleb et al.(2009)* recorded an increase in AST and ALT activity of *S. littoralis* larvae as a result of emamectin benzoate treatment. In another study, *Ramaswamy et al. (1999)* reported that the activity of these enzymes was elevated when *Sorotherodon mossambicus (Peters)* had been exposed to *Carbaryl.*

In insects, the amino transferases are the key enzymes in the formation of non-essential amino acids, in the metabolism of waste nitrogen products and in gluconeogenesis *Pant and Kumar, 1980.* The same authors stated that the change in transaminase levels have been correlated with anabolism or catabolism of protein. Maintenance of the balanced "amino acid pool" in insects is the result of various biochemical reactions carried out by a group of enzymes called amino-transferases *(Meister, 1957).* Transaminases (ALT and AST) enzymes help in the production of energy and serve as a strategic link between the carbohydrates and protein metabolism and are known to be altered during various physiological and pathological conditions *(Eltebari et al., 2005).* The varying effects on the level of GPT (glutamate pyruvate aminotransferase) activity in decreasing or increasing levels may be due to

the effect on the synthesis or functional levels of this enzyme directly or indirectly by altering the cytomorphology of the cells *(Nath, 2000)*.The increasing GOT (glutamate oxaloacetate aminotransferase) activity, generally after treatment suggest the mobilization of amino acids during the insecticidal stress exerted by certain toxic components to meet the energy demands *(Zeba and Khan, 1995).* The decrease in AST and ALT may be attributed to the binding of the tested compounds with protein that leads to inhibition in aminotransferases activity which is known to be intimately related to protein synthesis *(El- Sheikh et al. 2005).* Also, *El-Shershaby et al. (2008)* found fluctuated changes in the activity of GPT and GOT of *S.littoralis* larvae infected with *B. thuringiensis*. , GOT slightly increased after 2 days and then decreased at 5days post-treatment. The GPT activity was clearly decreased after 48 and 72 hrs of treatment than in untreated; GPT enzyme activity detected the highest positive changes. They suggested that this may be attributed to the occurrence of reversible binding between pesticides and enzymatic site of action on the enzyme surface. *(Abou-Taleb et al., 2015)* suggested that the changes of ALT and AST activity in the *S. littoralis* larvae following lufenuron and chlorfluazuron exposures showed adaptive elevation in the activity of the two aminotransferase enzymes, thereby , probably aiding gluconeogenesis through transamination of glucogenic amino acids to meet the energy demand under lufenuron and chlorfluazuron toxicity. Also *Zibaee et al. (2011)* mentioned that AST and ALT activity significantly increased in *Eurygaster integricps* after exposure to pyriproxyfen .They concluded that possible damages of this insecticide to haemocytes and fat bodies are the reason in elevation of their activity. This correlation could be attributed to regeneration of haemocytes by hematopoietic organs and fat bodies that definitely needs to different amino acids prepared by transamination process.

REFERENCES

Abd El-Aziz, M.M. (2007). Controlling of the cotton leafworm, *S. littoralis* (Boisd.) by using environmentally safe (nontraditional) methods. M.Sc. Thesis, Dep. Of Environ. Agric. Sci., Institute of Environ. Studies and Research Ain-Shams Univ., Egypt. pp: 38-41.

Abo El-Ghar, G.E.S.; H.S.A. Radwan Z.A. El-Bermawy and L.T.M. Zidan (1994). Histopatholgoical effects of abamectin, thuringiensin and diflubenzuron on the midgut of Spodoptera littoralis (Lepidoptera: Noctuidae) larvae. Bull. Ent. Soc.Egypt, 21: 41-52.

Abou-Taleb,H. K.,Zahran,H.M. and GAD,A.A. (2015).Biocmemical and Physiological Effects of lufenuron and Chlorfluazuron on *Spodoptera littoralis* (Boisd.) (Lepidoptera Noctuidae) J. Entomol. 12 (2):77-86.

Abou-Taleb, H.K., A.S.A Saad, H.A. Mesbah, S.M. Abdel Rahman and D.A. El-Deeb, (2009). Toxicity of emamectin benzoate against laboratory and field strains of cotton leaf worm with reference to its effects on the AST, ALT and ALP activity. Proceedings of the 6th international Symposium of Mediterranean Group on Pesticide Research, October 27-29, 2009, Cairo, Egypt.

El-Sheikh, T.A.; A.A. Abdel-Khalik; A.A. Farghali and A.E. Abdel-Aal (2005).Biochemical and histological effects of Flufenoxuron and two biocides on the cotton leafworm, *Spodoptera littoralis* (Boisd.). Egypt J. Agric. Res. 2 (2): 799-809.

El-Shershaby, M.; Farag, N. A. and Ah med, A. A. I. (2008). Impact of *Bacillus thuringiensis* on protein content and enzymes activity of Spodoptera littoralis . Res. J. of Agric. and Biol. Sci.,4(6): 861-865.

Etebari, K.; Mirhodeini, S. Z. and Matindoost, L., (2005). A study on intraspecific biodiversity of eight groups of silkworm (Bombyx mori) by biochemical markers. Insect Science, 12: 87-94.

Finney, D.J. (1971).Probit Analysis, A statistical treatment of the sigmoid response curve.7th Ed., Cambridge Univ. Press, Cambridge, England.

Magd El-Din and El-Gengaihi, S.E. (2000). Joint action of some botanical extracts against the Egyptian cotton leafworm *Spodoptera littoralis* Bosid (Lepidoptera: Noctuidae). Egypt. J. Biol. P. Cont. 10 (1): 51-56.

Meister, A.(1957) Biochemistry of the amino Acids, Academic Press, New York.

Nath, B. S. (2000). Changes in carbohydrate metabolism in hemolymph and fat body of the silkworm, Bombyx mori L., exposed to organophosphorus insecticides. Pestic. Biochem. Physiol., 68: 127–137.

Pant R. and Kumar S. (1980). Significance of some enzymes and metabolites during aging of the dipteran fleshfly, *Sarcophaga ruficornis*. Curr. Sci. 49, 10–13.

Ramaswamy, M., P. Thangavel and N.P. Selvam, (1999). Glutamic Oxaloacetic Transaminase (GOT) and Glutamic pyruvicTransaminase (GPT) enzyme activities in different tissues of *Sarotherodon massambicus* (Peters) exposed to acarbamate pesticide, Pestic.Sci., 55:1217-1221.

Reitman, S. and Frankel S. A. (1957). Colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. *Am J Clin Pathol.* Jul;28(1):56–63

Sarto, I. and Monteys, V. (1988). Lepidopterous species recognised as pests in Catalina and the affected crops. Resumnese I JournadaIberica de Lepidopterologia Madrid 19 Nov.

Schmutterer, H. (1985): Which insect bests can be controlled by application of neem seed kernel extracts under field conditions? Z.ang. Ent., 100: 458-475.

Seleem, R.A.A. (2012). Effect of different handling and storage coditions of some bio-insecticides on their toxicological and bio-chemical activity. M.Sc. Thesis, Fac. Agric.,Ain Shams Univ.,126-130.

Sun, Y. P. (1950). Toxicity index-An improved method of comparing the relative toxicity of insecticides. J. Econ. Entomol., 43: 45-53.

Thabit, A. (2011). Effect of insect growth regulators combined with Nuclear Polyhedrosis Virus treatments against *S. littoralis* (Boisd.). M.Sc. Thesis, Fac. of Agric. Cairo, Univ. 55-61.

Tolba, H.I. (2006). Biochemical studies on *Serratia marcescens* for controlling the black cutworm, *Agrotis ipsilon* (Huf.) Ph. D. Thesis, Faculty of Agriculture, Cairo University, Egypt. pp. 57-72.

Tunaz, H. and Uygun, N. (2004). Insect growth regulators for insect pest control. Turkish J. Agricultural. Forestry, 28: 337-387.

Zeba A. and Khan M.A. (1995). Effect of fenvalerate on protein and amino acid contents and enzyme activities in the Ostracod, *Chrissica halyi*. Pestic. Sci., 45, 279-282.

Zibaee, A., I. Zibaee and J.J. Sendi, (2011). A juvenile hormone analog. Pyriproxyfen, affects some biochemical components in the hemolymph and fat bodies of *Eurygaster integriceps* Puton (Hemiptera: Scutelleridae). Pestic. Biochem. Physiol., 100: 289-298.

التأثير المقارن بين تيفلوبنزورن ، باسيلس ثورينجينسيس ، و السراتية الذابلة بشكل فردي ومجتمعة على أنشطة الترانس امينيز فى دودة ورق القطن

سامح مصطفى عبد النبى ، سهير فيصل اللقوة و طارق عفيفى عبد الحميد الشيخ

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة

تم تعريض يرقات العمر الثانى لدودة ورق القطن إلى التركيز النصف مميت (LC_{50}) من تيفلوبنزورن و باسيلس ثورينجينسيس نوع كورستاكى ، والتركيز الذى يسبب تشوه ٥٠ ٪ للعذارى من السراتية الذابلة (MC_{50}) للعذارى بشكل منفصل او مجتمعة كل من باسيلس ثورينجينسيس و السراتية الذابلة (Bt / Sm) و التيفلوبنزورن و السراتية الذابلة لمقارنة تأثير المبيدات المختبرة على نشاط الأسبارتات (AST) و الالانين امينو ترانسفيريز (ALT) على النشاط أثناء التعذير لدودة ورق القطن. وكشفت المعاملة بالباسيلس ثورينجينسيس و السراتية الذابلة منفردة، انخفاض كبير بشكل عام على AST خلال مرحلة التعذير مقارنة بالكنترول. وتم العثور على أعلى مستويات من نشاط (AST) فى المعاملة الفردية للتيفلوبنزورن. من ناحية أخرى ، عندما تم استخدام التأثير المشترك للباسيلس ثورينجينسيس و السراتية الذابلة (Bt / Sm) ، كان هناك انخفاض كبيرفي نشاط AST في اليوم الثاني والرابع والعاشر من المعاملة عن المعاملة بالسراتية الذابلة عموما خلال مرحلة التعذير ، كان تأثير باسيلس ثورينجينسيس و السراتية الذابلة (Bt / Sm) مجتمعة أقل من تأثير باسيلس ثورينجينسيس منفردة. وكان تأثير التيفلوبنزورن و السراتية الذابلة (Teflu / Sm) مجتمعة أعلى من المعاملة بالسراتية الذابلة منفردة وأقل فعالية من التيفلوبنزورن منفرد ، كما كان للتيفلوبنزورن تأثير على نشاط (ALT) أعلى من باسيلس ثورينجينسيس الذي كان فعالاً وقد أظهر Bt / Sm تأثيرًا أكثر انخفاضاً في اليوم الثاني والثاني عشر والرابع عشر من التعذير (- ٧٢.٩٣٪ ، - ٨٢.٨٦٪ و - ٨٩.٥٦٪ على التوالي) عن المعاملة الفردية للباسيلس ثورينجينسيس. المعاملة ب (Teflu / Sm) سببت انخفاض كبير في نشاط (ALT) فيما عدا اليوم الرابع واليوم السادس حيث كانت هناك زيادة معنوية ، وكانت الزيادة في اليوم السادس (٢٠٣.٥٦٪) أعلى من المعاملة بالتيفلوبنزورن منفرد (١٢٦.١٨٪) ، والسراتية الذابلة (٤٧.٦٠%) منفردة. ولكن بشكل عام ، كان Teflubenzuron منفردا الأعلى تأثير.