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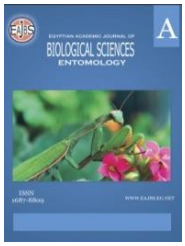

Physiological Studies of Some Insecticides on *Spodoptera littoralis* Larvae

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ABSTRACT

The present study aims to focus on the effect of the sublethal rates of Lambda-cyhalothrin +Thiamethoxam and Lambda-cyhalothrin, which belonging to groups 3 and 4 on the 4th larval instar of *Spodoptera littoralis* field strain under laboratory conditions, and their effect on some physiological aspects, post-treatment with rates 50 and 100 ml/200L for 48 hrs. The results cleared that highly physiological disturbance was recognized as marked stimulating in total protein, total lipids, trehalase, AchE, and acid phosphatase synthesis however, inhibit amylase, invertase and alkaline phosphatase for lambda-cyhalothrin + Thiamethoxam. The tested sublethal rate of lambda-cyhalothrin, also be highly affected by stimulating total protein, invertase, trehalase, AchE, acid and alkaline phosphatases. On the other hand, inhibits total lipids and amylase synthesis in insect cells.

INTRODUCTION

The cotton leafworm, *Spodoptera littoralis* is the most serious, destructive, and sever pests in Egypt which belonging to (Leipedaptera: Noctuidae) and attacked cotton crop and vegetable as potatoes, tomatoes, and other crops (Mohamed *et al*., 2005), causing great destruction to the different parts of the plant by feeding on leaves, flower buds or fruiting points. That requires the applications of several insecticides to control these pests; depending on extending and preserving the insecticide efficacy which is based on rotating numerous insecticides including carbamates, organophosphates, IGRs, pyrethroids, and others every year. The successive application of chemical insecticides associated with pest's resistance that may be due to changes in insect genes, contamination of the environment, or pesticidal residues in the agriculture environment and industries (Temerak, 2002). The using of recent insecticides group as neonicotinoids with a unique mode of action are belonging to the fast-growing class of insecticides in recent pest defense post the conventional insecticide group than other insecticide groups which acting as agonists to the nicotinic acetylcholine receptor (Ahmed and Matsumura 2012 and Sandor *et al*. 2015)Therefore, lambda-cyhalothrin 10.6 % + Thiamethoxam 14.1% (SC) is a mixture of two active ingredients of groups 3 and 4 with highly effective for controlling insect because it contains Lambda-cyhalothrin group 3; non-systemic and Thiamethoxam group 4; systemic insecticides with repellent properties, in addition to contact, stomach actions and long residual activity with rapid knockdown were studied. Thiamethoxam is a neonicotinoid insecticide, where their serious toxicity is mainly approved to their action on insect nicotinic acetylcholine receptors It has high selectivity

with low mammalian toxicities to fish and birds and good use to control the lepidopterous insects that led to thiamethoxam evaluated as seed treatment of various field crops (Arthur *et. al.* 2004).

This work aimed to evaluate the efficiency of the sublethal rates of Lambda-cyhalothrin and Lambda-cyhalothrin+ Thiamethoxam against the cotton leafworm larvae and some physiological changes as results of treatment of these insecticides in the whole body of *Spodoptera littoralis* larvae.

MATERIALS AND METHODS

Experiment Insects:

The *Spodoptera littoralis* field strain was obtained from Giza government and reared on castor bean leaves *Ricinus communis* in the laboratory of the cotton leafworm Department, Plant Protection Institute, Dokki, Giza. *S. littoralis* reared under laboratory conditions of 25 ± 2°C and 60 ± 5% RH according to El Defrawi, *et al.,* (1964) for several generations to obtained sufficient larvae to carry out experiments without contamination with any insecticides.

Tested Insecticides:

Two commercial insecticides belonging to different groups were used; Lambada cyhalathrin (5% EC), groups 3; a synthetic pyrethroid as (Affact power) obtained by Aid for insecticides and chemicals. Lambada cyhalathrin (10.6%)+ Thiamethoxan (14.1) (24.7%SC), groups 3 and 4; Neonicotinoid as (Anjio) obtained by Syngenta, Co.

The Toxicity Experiments of *Spodoptera littoralis:*

The two tested compounds Lambada cyhalathrin +Thiamethoxan (Anjio) and Lambada cyhalathrin (Affact power) were diluted with water to prepare sublethal rate freshly before treatments of *S. littoralis*. The toxicity experiments were carried out on the 4th larval instars of *S. littoralis* using the dipping technique. The castor bean leaves were dipped in the sublethal concentrations 50 and 100 ml /200L water of Anjio and Affect power, respectively for 20 sec. then left to dry at room temperature. The starved larvae fed on the treated leaves for 48 hrs, other groups as control fed on untreated leaves, which dipped in dist. water. The larval samples of *S. littoralis* were collected after 48 hrs from treatment and kept frozen at -20C^{o}till analysis, total protein, lipid, amylase, invertase, trehalase, AchE, acid, and alkaline phosphatase.

Preparation of Samples for Analysis:

The whole-body tissues of the 4th larval instars samples of treated and untreated *S. littoralis* were homogenized with saline solution 0.9% (1g/ ml) by using a pestle and a mortar then kept in a clean Eppendorf tube. The samples were centrifuged at 5000 rpm for 10 min using a refrigerated centrifuge the supernatant of each sample was kept in a deep-freezer at -20C^{0} until used for biochemical analysis using three replicates for each.

Biochemical Studies:

All the biochemical tests were determined in the Physiology Department, Plant Protection Research Institute, Dokki, Egypt. Total protein measured colorimetrically using kits obtained from Biodiagnostic Comp, Giza, Egypt, depending on the Biuret reaction (Gornal *et al.,* 1949). The total lipid content of the homogenate is determined according to the phosphovanillin method of Baronos and Blackstock (1973). Invertase and amylase activities determined according to Ishaaya and Swirski (1970) and Isahaaya *et al.* (1971) using 3,5-dinitrosalicylic acid reagent intended for determining the free aldehydic groups of glucose formed after sucrose or starch digestion. Trehalase enzyme is determined according to Noelting and Bernfeld (1948). The activity of acetylcholine esterase enzyme (AChE) was measured according to Simpson *et al*., (1964) using acetylcholine bromide (AChBr) as a

substrate. Acid and alkaline phosphatases activities were determined according to the method described by Laufer and Schin (1971).

Statistical Analysis:

All samples were replicated three times (insect homogenates), and the results of biochemical determination were pooled and the statistic analysis of variance was determined by using a one-way ANOVA test. Significant differences between treatments were determined using Duncan's test ($P<0.05$) (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of Sublethal Rate Of Tested Insecticides On Total Protein And Total Lipids of *S. littoralis*:

Data in Table (1) and Fig (1) recorded the effect of sublethal rate 50 and 100 ml /200L of Lambda-cyhalothrin+Thiamethoxam (Anjio) and Lambda-cyhalothrin (Affact power) respectively, on total protein content and total lipids in the 4th instar larvae of S. *littoralis* post 48 hrs of treatment. A highly significant increase was observed in the total protein content in the whole-body tissues (9.69 and 5.18g/dl) for Lambda-cyhalothrin + Thiamethoxam and Lambda-cyhalothrin treatments, respectively compared with untreated control (3.7g/dl).

From the previous results, *S. littoralis* protein was activated as a result of treatment with Lambda-cyhalothrin+Thiamethoxam by (161.89%) and Lambda-cyhalothrin (40%). Which equivalent to (2.62) folds in the case of Lambda-cyhalothrin+Thiamethoxam treatment and (1.4) folds in Lambda-cyhalothrin treatments.

Table 1: Total protein and total lipids in the 4th larval instars of *S. littoralis* post-treatment for 48 hrs. with sublethal rate of Lambda-cyhalothrin +Thiamethoxam and Lambda-cyhalothrin.

Tested insect	***S. littoralis* larvae**					
Enzyme activities	**Total protein g/dl**			**Total lipids(ug/ml)**		
Insecticides	Mean ± SE	Change %	Activity ratio	Mean ± SE	Change %	Activity ratio
Lambda-cyhalothrin+ Thiamethoxam	9.69±0.17[a]	+161.89	2.62	228.2±6.8[a]	+4.87	1.05
Lambda-cyhalothrin	5.18±0.95[b]	+40	1.4	203±5.05[b]	-6.71	0.93
control	3.7+0.11[c]			217.6±2.55[a]		
F-value	0.0006***			0.332*		
L-S-D	1.901			17.33		

Means with the same letter are not significantly different at $p<0.05$.
SE: Stander error. Change %= test -control/control x100.
Activity ratio: enzyme activity of tested compound/enzyme activity of control

The treatment with Lambda-cyhalothrin+ Thiamethoxam caused a significant increase in total lipids of *S. littoralis* to 228.2 ug/ml, while Lambda-cyhalothrin caused a significant decrease to 203 ug/ml to compare with 217.6 ug/ml in the untreated control. The change% in total lipids of *S. littoralis* recorded a significant increase by + 4.87 and a significant reduction of -6.71% as a result of treatment with Lambda-cyhalothrin+ Thiamethoxam and Lambda-cyhalothrin, respectively. The total lipids were activated by (1.05) folds in the case of Lambda-cyhalothrin+ Thiamethoxam treatment while reduced in Lambda-cyhalothrin treatment by (0.93) fold.

The natural activities of insects such as reproduction, development, movement, and all others depend on their nutrition. Their food must contain proteins, lipids, and carbohydrates with various amounts according to the insect species. Carbohydrates play important roles to

produce lipids for food ingestion with different roles as the first type of lipids are the membrane lipids, which are digested by phospholipases and including phospholipids and glycolipids. Second types; Storage lipids are triglycerids, especially in the tissue plants which are converted in the larval midgut to di- and monoglycerids for absorption and stored in metabolic processes till needed (Terra and Ferriera, 2005 and Zibaee *et al.,* 2008). Knowledge of digestion and absorption of lipid is very scarce in insects. The lipids have an important role in energy metabolism. The food amount of ingestion increases gradually as larval developed from earlier stages to pre-pupae. That proved by the activity of lipase in midgut was the lowest in the 1st instar larvae of *N. aenescens* with low feeding rate while the 3rd instar was the highest with feeding on rice leaves that mean it depends on food consumption (Zibaee *et al.,* 2011, Zibaee and Fazeli-Dinan, 2012). The same observation obtained by Daniels *et. al*. 2009, that proved the treatment with thiamethoxam led to reducing weight and food consumption of treated aphids than untreated. Our results are corroborated with earlier workers Rawi, *et al.,* (2011) highly significant decrease in the total lipid of the 4th instar larvae of *S. littoralis* treated with sublethal concentrations of *A. indica and C. colocynthis* extracts, where the change % reached to (-30.23 and -41.19%) after 10 days, respectively. Also, increasing the protein content of *S. littoralis* was recorded by (Basiouny *et al.,* 2016). Changes in protein content of the treated insects were associated with disturbance in the structure and enzymatic system of the insect, which is answerable for protein and lipid metabolism. So increasing or decreasing in the protein content of the homogenate treated larvae was related to the toxic and disturbance effect of the tested insecticides intrusive with the protein synthesis. The disturbance in protein by decreasing or increasing associated with inequity in the natural hormones of the insects treated. Protein production in an insect body is controlled by the endocrine glands and the hormonal system. Changes in protein level may be representing the balance between protein synthesis, transportation, storage, and deprivation of structural and nutrients function throughout ontogeny in addition to the response to exact physiological conditions (Shoukry *et al.,* 2003).

Effect of Sublethal Rate of Tested Insecticides on Some Digestive Enzymes in *S. littoralis* larvae:

The activity of the digestive enzymes amylase, invertase, and trehalase of treated *S. littoralis* larvae with the two sublethal concentrations 50 and 100ml /200L of Lambda cyhalathrin +Thiamethoxan and Lambada cyhalathrin, respectively were presented in Tables (2&3) and Fig(1).

a-Amylase

The activity levels for both tested insecticides (Table 2) recorded significant inhibition in amylase activities of the 4th instars larvae of *S. littoralis*. The most reduced was Lambda-cyhalothrin +Thiamethoxam 73.14 ug glucose/min/ml while Lambda-cyhalothrin recorded 85.98 ug glucose/min/ml compared with 108.3 ug glucose/min/ml in control. A significant inhibitory effect on amylase synthesis as a result of treatment was recorded where Lambda-cyhalothrin + Thiamethoxam was significantly higher -32.47 than Lambda-cyhalothrin -20.61%.

The amylase activity (0.68) fold reduced in Lambda-cyhalothrin + Thiamethoxam treatment and 0.79-fold by Lambda-cyhalothrin treatments.

b-Invertase:

The activity levels for Lambda-cyhalothrin in (Table 2) was significantly higher 53.02 ug glucose/min/ml than Lambda-cyhalothrin+Thiamethoxam that for which inhibits invertase synthesis to 43.72 ug glucose/min/ml compare with 47.21 ug glucose/min/ml in control. The change in invertase activity was significantly higher +12.31 % for Lambda-cyhalothrin while significantly lower by -7.39% for Lambda-cyhalothrin+ Thiamethoxam.

The invertase activity in the larvae treated with the two tested insecticides was

fluctuated where (0.93) fold reduced in Lambda-cyhalothrin + Thiamethoxam and activated (1.12) folds by Lambda-cyhalothrin treatment.

Table 2: Changes of Amylase and Invertase activities in the 4th larval instars of *S. littoralis* post-treatment for 48 hrs. with sublethal rate of Lambda-cyhalothrin+Thiamethoxam and Lambda-cyhalothrin.

Tested insect	***S. littoralis* larvae**					
Enzyme activities	**Amylase(ug glucose/min/ml)**			**Invertase (ug glucose/min/ml)**		
Insecticides	Mean ± SE	Change %	Activity ratio	Mean ± SE	Change %	Activity ratio
Lambda-cyhalothrin+ Thiamethoxam	73.14±4.61[b]	-32.47	0.68	43.72±0.99[b]	-7.39	0.93
Lambda-cyhalothrin	85.98±5.42[a]	-20.61	0.79	53.02±2.37[a]	+12.31	1.12
control	108.3±2.44[a]			47.21+1.59b		
F-value	0.0257*			0.023*		
L-S-D	18.84			5.932		

Means with the same letter are not significantly different at $p < 0.05$
SE: Stander error. Change %= test -control/control x100
Activity ratio: enzyme activity of tested compound/enzyme activity of control

c-Trehalase:

The effect of Lambda-cyhalothrin+Thiamethoxam and Lambda-cyhalothrin on trehalase activity is represented in Table (3) and Fig (1). The data showed highly significant stimulation on trehalase to reach 42.09 and 33.25 ug glucose/min/ml, respectively compare with 25.12 ug glucose/min/ml in control. The change % of trehalase had a highly significant increase recorded with Lambda-cyhalothrin+ Thiamethoxam +67.56 % and +32.36 % for Lambda-cyhalothrin.

The trehalase enzyme activated in larvae treated with both tested insecticides (1.68) folds in Lambda-cyhalothrin +Thiamethoxam and 1.32 folds in Lambda-cyhalothrin treatments.

The observed results agree with the data reported by Abo El Ghar, *et al*., (1995) Abd -El –Aziz *et al.,* (2017) and Hatem *et al.,* (2017) cleared that feeding *S. littoralis* larvae on abamectin,coragen, clothianidin and metaflumizone are significant reduced the amylase, invertase, trehalase activities and total carbohydrates that confer to the antifeedant effect and inability larvae to digest diet which necessary for growth and reproduction. The higher activity of digestive enzymes usually reflects the pH of the environment. Wherever pH affects the rates of reactions to change the charge state of the active site of the enzyme or substrate. Also, can disrupt the hydrogen bonds to facilitate holding the enzyme and denaturing the protein (Zheng and Cohen, 2000). Usage of inhibitors against digestive enzymes must be measured to decrease damages of insect pests on agricultural products Zibaee and Fazeli-Dinan (2012).

Effect of Sublethal Rate of Tested Insecticides on Acetyl Cholinesterase in *S. littoralis* Larvae:

The data tabulated in Table (3) and Fig (1) revealed highly significant stimulation in Acetyl cholinesterase activity of S. littoralis post-treatment with the two tested insecticides. The most activated one was Lambda-cyhalothrin to record 3193.2 µg Acetyl-cholinebromide/min/ml while Lambda-cyhalothrin+ Thiamethoxam recorded 2179.1 µg Acetyl- cholinebromide/min/ml compare with 858.7 µg Acetyl- cholinebromide/min/ml in control.

The changes % in Acetyl cholinesterase confirmed a significant stimulation as a result of treatment. A highly significant activity +271.86% recorded for Lambda-cyhalothrin and by +153.77 for Lambda-cyhalothrin+ Thiamethoxam compare with control.

The acetyl cholinesterase activated with both insecticides by (3.72 and 2.54) folds in Lambda-cyhalothrin and Lambda-cyhalothrin +Thiamethoxam treatments, respectively. The highly significant stimulation in AchE of *S. littoralis* might be the main detoxification mechanism with pest due to hydrolysis. That agrees with (Abd -El –Aziz *et al.,* 2017) on *S. littoralis* and Hatem *et al.,* (2017) no significant change in AchE activity of larvae treated with sublethal concentrations of clothianidin and metaflumizone

Acetylcholinesterase (AChE) is a very important enzyme in the insect's nervous system. The nerve impulses transmitted from one nerve axon to another in insect at the synapses through a chemical mediator known as acetylcholine (Ach), which hydrolyzed by AchE to inhibit its accumulation at nerve synapses led to a disturbance in nerve transmission Or AchE blocking hydrolysis of the neurotransmitter acetylcholine build up and lead to the repeated firing of neurons and ultimately death of the insect (Hemingway,2004). Changes in the enzyme activity of acetylcholinesterase of *S. littoralis* as a result of treatment may be due to the immune system to overcome the active stress response to the overreaction. That involved as defense reactions and/or in the physiological important processes for the insect's survival, which often lead to the death of the host insects that agree with (Dahi *et al*., 2009) on *S. littoralis* and Shairra *et al.,* (2016) on *A. ipsilon*.

Table 3: Changes of trehalase and Acetyl cholinestrase activities in the 4th larval instars of *S. littoralis* post-treatment for 48 hrs. with sublethal rate of Lambda-cyhalothrin+Thiamethoxam and Lambda-cyhalothrin.

Tested insect	***S. littoralis* larvae**					
Enzyme activities	**Trehalase (ug glucose/min/ml)**			**AChE (µg Acetyl-cholinebromide/min/ml)**		
Insecticides	Mean ± SE	Change %	Activity ratio	Mean ± SE	Change %	Activity ratio
Lambda-cyhalothrin+ Thiamethoxam	42.09±1.63[b]	+67.56	1.68	2179.1±54.61[a]	+153.77	2.54
Lambda-cyhalothrin	33.25±1.08[a]	+32.36	1.32	3193.2±10.6[b]	+271.86	3.72
control	25.12±0.91[c]			858.7±33.16[c]		
F-value	0.0002***			0.000***		
L-S-D	4.238			242.701		

Means with the same letter are not significantly different at p <0.05.
SE: Stander error. Change %= test -control/control x100.
Activity ratio: enzyme activity of tested compound/enzyme activity of control.

Acid and Alkaline Phosphatase:

The activities and the changes % in the acid and alkaline phosphatases of *S. littoralis* whole body tissues are presented in tables (4) and Fig (1). The results exhibited a significant increase in the activity of the acid phosphatases *S. littoralis* post-treatment for 48 hrs with Lambda-cyhalothrin +Thiamethoxam and Lambda-cyhalothrin 12.14 and 16.72 ug/min/ml, respectively compared with untreated control 12.13 ug/min/ml.

The changes % in the acid phosphatases of *S. littoralis* demonstrated a significant stimulation as a result of treatment 35.93 and 0.81% with Lambda-cyhalothrin and Lambda-cyhalothrin + Thiamethoxam, respectively. The acid phosphatase activated in both treatments by (1.0 and 1.38) folds in Lambda-cyhalothrin + Thiamethoxam and Lambda-cyhalothrin treatments, respectively.

Acid phosphatase is lysosomal enzyme marker. It actives in guts, soluble in the cytosol of midgut cells, membrane-bound or appear in the lumen of midgut contents Zibaee and Fazeli-Dinan (2012). The increasing enzyme activity post-treatment with tested insecticide may be due to the destructions of midgut epithelial, which may lead to an intensive release of enzymes. Li and Liu, (2007) the enzyme detoxification in insects play

significant roles for maintain their physiological functions normally as a defense against foreign compounds.

Table 4: Changes of Acid and Alkaline phosphatase activities in the 4th larval instars of *S. littoralis* post-treatment for 48 hrs. with sublethal rate of Lambda-cyhalothrin+Thiamethoxam and Lambda-cyhalothrin.

Tested insect	***S. littoralis* larvae**					
Enzyme activities	**Acid phosphatase (ug phosphate /min/ml)**			**Alkaline phosphatase (ug phosphate /min/lm)**		
Insecticides	Mean ± SE	Change%	Activity ratio	Mean ± SE	Change %	Activity ratio
Lambda-cyhalothrin+ Thiamethoxam	12.14±0.81[b]	+0.81	1.00	128.33±18.68[a]	-26.32	0.74
Lambda-cyhalothrin	16.72±0.31[a]	+35.93	1.38	247.51±16.17[b]	+42.11	1.42
control	12.13±1.39[b]			174.17± 24.7[a]		
F-value	0.0214*			0.0148*		
L-S-D	3.22			68.523		

Means with the same letter are not significantly different at p <0.05
SE: Stander error. Change %= test -control/control x100
Activity ratio : enzyme activity of tested compound / enzyme activity of control

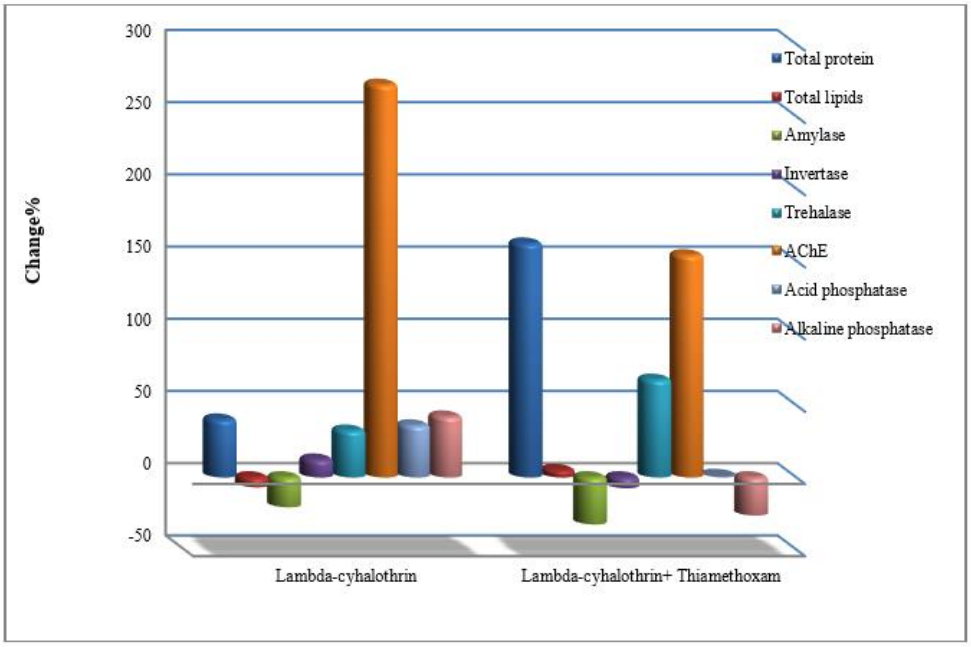

Fig.1: Changes % of the enzyme activities in the 4thlarval instars of *S. littoralis* post-treatment for 48 hrs. with sublethal rate of Lambda- cyhalothrin + Thiamethoxam and Lambda-cyhalothrin

The analysis of alkaline phosphatases activity of *S. littoralis* revealed significant decline to 128.33 and elevation to 247.51 ug/min/l for the treatment with Lambda-cyhalothrin + Thiamethoxam and Lambda-cyhalothrin, respectively compared to 174.17 ug/min/l for control.

The changes % in the alkaline phosphatases of *S. littoralis* demonstrated a significantly different effect for the treatment with Lambda-cyhalothrin +Thiamethoxam reduced by -26.32 while Lambda-cyhalothrin caused a significant activity by + 42.11% compared with control.

The activity of alkaline phosphatase was relatively reduced (0.74) fold in the larvae treated with Lambda-cyhalothrin+Thiamethoxam while activated (1.42) folds by Lambda-cyhalothrin.

Alkaline phosphatase is a marker enzyme which active in tissue with active membrane transport, in brush border membrane, midgut microvillar membrane in lepidopteran and dipteran species, even if it may arise in midgut basolateral membranes and regular as enzyme secretary (Ferreira and terra 1980 and Zibaee and Fazeli-Dinan (2012).

Our results reported that the production of the enzyme was significantly reduced as control. The reduction in alkaline phosphatase reflects the harmful effect on the digestive system by disability the larvae to metabolize food for all the biological processes. That in harmony with Fahmy, (2005), Ibrahim and Abd El-Kareem (2018) on *S. littoralis* showed different activity in alkaline phosphatase where reduced and increased significantly, in addition to a non-significant change in the acid phosphatase with the treatments. Therefore, the disturbance in acid and alkaline phosphatase led to a disturbance in the midgut structure, which causes disruption in the digestion and absorption process. That could use as a factor for antifeeding activity. That agrees with (Hatem *et al.,* (2017) Clothianidin and Metaflumizone caused a reduction in total carbohydrates and ALP in treated *S. littoralis* larvae. The detoxifying enzymes include phosphatases that react against insecticides exhibiting its activities (Zibaee *et al*., 2011). The decrease in enzyme activity may be related to the treatment that makes alkaline media to the enzyme so inhibit it. However higher activities of digestive enzymes mostly reflect the environmental pH. It affects the reaction rates by changing the charge state of the active site of the substrate or enzyme and /or disturbs the hydrogen bonds to facilitate denaturing the protein and holding the enzyme (Zheng and Cohen, 2000).

From these findings, can conclude that Lambda-cyhalothrin +Thiamethoxam demonstrates highly significant insecticidal activity as selectively stimulating total protein, AchE, trehalase, and significantly of total lipids and acid phosphatase synthesis. On the other hand, inhibits significantly amylase, alkaline phosphatase, and trehalase in insect cells as descending order.

Lambda-cyhalothrin caused highly significant stimulation in AchE and total protein, in addition to a significant stimulation of acid phosphatase, trehalase, and invertase synthesis, while had significant inhibition in total lipids and amylase production in descending order.

So, our findings suggest that the use of sub-lethal rates of Lambda-cyhalothrin +Thiamethoxam and Lambda-cyhalothrin against S. *littoralis* larvae will make both as an excellent control option in a general integrated pest management system. The effect of sublethal rates may be important as lethal rates in pest control as a result of feeding repression, reduced development, and reproduction. Therefore, it plays a grating role in regulating the pest population. Where the pest didn't die immediately but the insecticide interfering with the function and all physiological processes. In addition to it disturbed, all tested biochemical parameters and the inhibition effect on digestive enzyme activities led to prevent the consumption of food by the larvae. Once the digestive enzymes and total lipids are inhibited, the nutrition of insects is impaired, growth and development are retarded and eventually, death occurred due to starvation, In addition to, highly stimulation effect on AchE, which led to build up and repeat firing of neurons. So all these reasons may be caused by larval death. That reflects that reported by Fahmy, (2005) the treated larvae try to overcome the pathological effect by extra secretion of enzymes to avoid the insecticidal impression through ingestion which suffering paralysis in the muscles of mouthparts led to stop feeding and loss of weight. Nauen, *et al.,* (2003) Thiamethoxam is a neonicotinoid insecticide causing paralysis of the insect muscles and affected on the central nervous system, with LC_{50} value 82.889 ppm and LC_{90} 320.727 ppm. Using insecticides with various modes

of action may be delay development of insecticide resistance. Toxicity, growth inhibition and antifeedant effects of thiamethoxam on *S. littoralis* larvae in cotton field, decreased the food consumption, relative growth rate. It gives 67.5 and 95.0 at 1/2 recommended field rates during seasons 2011 and 2012, respectively and the toxicity increase as day exposure increased Barrania (2013).Our results may confirmed with other histological studies to explain the disturbances in the larval midgut structure treated with lambda-cyhalothrin and lambda-cyhalothrin +Thiamethoxam. That reflects the mess in the enzyme emission, shapes and its function that led to necrosis the cells. In addition to, appearance lack of fat cell may explain the larvae could use it as a source of energy to get rid old cuticle as in starvation which essential for all biological process (Abd-El-Aziz *et al.*, 2019 and 2020) on *A. ipsilon* and *S. littoralis*. Kumar *et al.* (2009) Lambda cyhalothrin was the most effective as either spray or soak. Khan *et al.,* (1997) all the tested insecticides include lambda-cyhalothrin, thioluxon and deltamethrin had equal effect against cutworm. In addition, the efficiency of sub-lethal effect of some neonicotinoids and synthetic pyrethroids against cutworm was discussed by (Joshi, *et al.,* 2020). Bažok *et al.,* (2016) the mixture of chlorpyriphos and cypermethrin had significant improved than lambda-cyhalothrin expressed very low efficiency against sugar beet weevil.

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ARABIC SUMMARY

دراسات فسيولوجيه لبعض المبيدات على يرقات اسبودوبيترا ليتوراليس

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تمت دراسه تأثير التركيزات المنخفضه لمبيدات اللمبادا ثالوهاليثرين و اللمبادا ثالوهاليثرين مع الثياميثوكسام واللذان ينتميان الى مبيدات المجموعة 3 و4 علي العمر اليرقي الرابع للسلاله الحقليه لدودة ورق القطن على بعض الجوانب الفسيولوجيه بعد معاملتها بالمعدلات تحت المميته100 و50 ملى/ 200 لتر ماء على التوالى لمده 48 ساعه تحت الظروف المعمليه وتاثيرها على بعض الدلالات الفسيولوجيه .حيث اظهرت النتائج اضطرابات فسيولوجيه شديدة المعنويه فى تحفيز النشاط الانزيمى للبروتينات الكلية والاستيل كولين استيراز ومعنويه للتريهاليز الفوسفات الحامضى بالاضافه الى الدهون الكليه بالنسبه الى اللمبادا ثالوهاليثرين مع الثياميثوكسام و الانفرتيز مع اللمبادا ثالوهاليثرين على التوالى على الجانب الاخر كان لهم تاثير معنوى مثبط للاميليز بجانب الفوسفات القاعدى والتريهاليز بالنسبه الى اللمبادا ثالوهاليثرين مع الثياميثوكسام والدهون الكليه مع اللمبادا ثالوهاليثرين المحتوى الكلى للبروتين والدهون الكليه وكذلك بعض انزيمات الهضم الاميلاز و الانفرتيزو التريهاليزوالفوسفاتيز الحامضى والقاعدى وكذلك الاسيتيل كولين استراز