Toxicological properties and biochemical achievement studies of Pyridalyl on *Agrotis ipsilon* (Hufn.) (Lepidoptera: Noctuidae)

Hanan Salah El-Din Taha

Toxicity of Pesticides on Pest Population Dynamic Research Department, Central Agricultural Pesticide Laboratory, Dokki-Giza-Egypt.

Abstract: The widespread occurrence of some severe pests like greasy cut worm that consume our crops particularly vegetables were considered in any new insecticide effectiveness evaluations. Thus two patches of *Agrotis ipsilon* 2nd instar larvae exposed to pyridalyl insecticide LC_{30} and LC_{50} concentrations previously defined and mortality counts at 3 times of exposure intervals ,and some enzyme analysis were achieved. *AChE* activity percentage of control was increased from -2.6 to 14.2 then 12.1 for pyridalyl LC_{30} and from 23.7 to 147.4 then 90.4 for pyridalyl LC_{50} survived larvae compared at the three exposure intervals respectively. However chitinase activities in *A. ipsilon* larvae exposed to the same condition mentioned before were decreased from 12.0 to 10.4 then 0 for LC_{50} exposure and from 18.7 to 12.4 then -1.4 for LC_{50} at the three exposure intervals. The activities of phenoloxidase was worked within narrow space and decreased from 17.9 to 11.4 for LC_{30} and from 29.5 to 17 for LC_{30} respectively as percent of contol. The GST activity was in progress at 24h but began to decline at 48 and 72 h of activity, where 43.9 to -10.3 and 91.2 to -10.3 were recoded for both concentrations respectively. The activity of α-estearase were began and remained very weak, values as a percentage of control were record negative values were -73.5 to -50.2 then -49.6 times and -69.2 to - 25.2 and - 30.3 respectively for the tested α -naphthylacetate at the same conditions of the candidate enzymes. The efficacy of the tested insecticides after days of field application began from 0 day till 20 at 5 days intervals were degraded through the length of the residues time, proved no efficacy differences were found. The total reduction percentage was ranged between 30.7, 45.7 and 34.8 % for pyridalyl, chlorfluazuron and lufenuron, respectively.

Keywords: *Agrotis ipsilon* - pyridalyl, acetylcholin and glutathione esterases - chitinases - phenol oxidases.

1.Introduction

A new insecticide were introduced to the markets has a phenoxy pyridaloxy derivative structure (the cuticle formation interference) **(Sakamoto *et al.*, 2003)** were pyridalyl, formerly mentioned as excellent control against lepidopteran and thysanoperan without effect on plant or beneficial arthropods **(Nishimura *et al.*, 2007)**. Pyridalyl is considered retain a different insecticidal chemical structure than others, exemplified as unclassified insecticide, and thus exemplified a mode of action different from the conventional. The insect exposed to the sublethal dosage of these compound exhibit distinctive symptoms seem to burn scar on the epidermis of *Spodoptera litura* larvae integuments. Thus show excellent activity against lepidopteran pests and thrips species by contact or ingestion, also towards the pests that resistance to existing pesticides **(Saito *et al.*, 2004).** The insect growth regulators (IGRs) conventionally affect the hormone regulation, production including ecdysteroid of the immature insect growth or emergence and its metamorphosis and hold slightly effect beneficials, (**Ishaaya and cassida, 1974)**.

Agrotis ipsilon (Hufn.) (Lepidoptera: Noctuidae) entitled the greasy cut worm, is a critical pest for the seedlings of a large number of vegetable and yields. **Busching and Turpin (1977).** The pesticides extensive use problems and their residues were enlarged the need to the investigation for new types of insecticides that non persistent in the environment, relatively biodegradable, safe to natural enemies and greater efficiency and selectivity **(Isayama, *et al.*, 2005)**. These new insecticide occupations at new mechanisms that are different from traditionally defined, thus a variety of laboratory biochemical analysis assessments must be need to promote many information about this new product of chemistry. In addition to the effect of this pesticide biochemically on larval enzyme investigations, an efficacy trial toward this split pest were carried out on this studies.

2.Materials and Methods

2.1.Rearing Insects:

A big culture of *A.ipsilon* was nurtured on castor bean leaves in the Central Agricultural Pesticide Laboratory for many years under reared chamber environments were 25 ± 2 °C, 65 ± 5% R.H. and light: dark period was 12 hours. Larvae reared in a big glass containers with sawdust in the bottom and for adult's emergence and oviposition, pupae were putted in ventilated cage. Adults were fed on a 10% sucrose solution soaked in piece of cotton; Laid eggs were collected and kept in glass container for hatching. This culture was used for the toxicological, biochemical studies and field and semi field experiments.

2.2.Insecticides:

Pyridalyl, 2,6-dichloro-4-(3,3-dichloroallyloxy) phenyl 3-[5-9 trifluoromethyl]-2- pyridyloxy] propyl ether is a compound was discovered by Sumitomo Chemical Co. Ltd **(Sakamoto *et al.*, 2002).** Insecticide formulated materials Pyridalyl 50% SC (Pleo) were obtained from central agricultural pesticide laboratory under Kam Egyptian agricultural chemical company afforded from Jiangyin Suli chemical co. - China supplier of the active ingredients. Chlorfluazuron 5% SC,400 cm3 /fedd (Efcoron) also known as Atabron and Lufenuron 5% EC, (Owner) 50cm3/100Lwater, are two insecticide formulations also used for field efficiency evaluations.

2.3.Laboratory Studies:

2.3.1.The toxicity bioassay:

The initial bioassay was finished by using castor bean leaves dipped in the insecticide concentration preparations. The treated leaves left to dry, introduced to 2nd instar larvae in 3 replicates petri dish and water only used for control. Then the mortality percent was recorded after 96 h after treatment and subjected to Abbott's formula correction **(Abbott, 1925).** Probit analysis for mortality data were completed using **(Finney, 1971)** and $LC_{30, 50}$ were calculated. Subsequently a quantity of 2nd larvae culture was treated with LC_{30} and other quantity treated with LC_{50} that achieved from the previous bioassay by dipping castor bean leaf. Three replicate for each concentration and divided into three

exposure duration were 24, 48, and 72 h, and after treatment the survived larvae were collected for each time and kept freezing for enzyme activities determination.

2.3.2.Determination of enzymes activities:

a-Acetylcholinesterase (*AchE*) activity:

The method of **Simpson *et al.* (1964)** were used in this extent where acetylcholine bromide (AchBr) was the substrate that decreases in by *AchE* hydrolysis and subsequently read at 515 nm.

b- Glutathione S-transferase (GST) activity:

The conjugate of glutathione with 1-chloro 2, 4-dinitrobenzene (S-(2, 4-dinitro-phenyl)-L-glutathione) was detected using the method of **Habig *et al.* (I974).** The increment in absorbance at 340 nm to the enzyme and reagents (that incubated at 30˚C for 5 min) against the blank was recorded to determine the nano-mole substrate conjugated/min/larva using 'a molar extinction coefficient' of 9.6 / mM /cm.

c-α-esterases (EST):

Van Asperen (I962) Method using α-naphthyl acetate as substrates were followed. The reaction mixture was a solution of 5ml substrate (3x10-4M α-naphthylacetate, acetone 1% and phosphate buffer 0.1M at pH7) and 20µl of larval homogenate. The substrate hydrolysis produced color was read at 600 nm.

d- Determination of chitinase activity:

The substrate preparations of the chitinase determination and was prepared (Colloidal chitin) according to **Bade and Stinson (1981)** were completed, the reaction mixture of the enzyme assay according to **Ishaaya and Casida (1974)** was carried out and N-acetylglucoseamine was assessed by the sensitive method of **Waterhouse *et al.* (1961).** Optical density was read against the buffer blank at 540 nm. The enzyme activity was expressed as µg N-acetylglucoseamine (NAGA) ×103/min/gm fresh weight.

e - Phenoloxidase activity:

A method of **Ishaaya (I971)** were followed where the reaction mixture incubated at (25˚C) containing the substrate and other ingredients. After 1 min of the enzyme reaction began by adding catechol solution, the optical density was determined through zero tuning against blank read at 405 nm.

2.3.3.Field experiments:

Three plots (each measured 25m²) were represent pyridalyl treatment and control with three replicates, were cultivated with potato *Solanum tuberosam* tubers at March-2017 and after thirty days from sowing fertilization were applied. The plots were irrigated every 10 days intervals. Soil surface were covered by herbicide and acaricide application to control weed and mite after 50 days from planting. The control plot was cultivated and maintained at a safe side. Treatments were applied by insecticide commercial formulations definitely by the standard recommendation dose for potato plant in Egypt Pleo EC (50% pyridalyl), Efcoron (chlorfluazuron 15% SC), and Owner (Lufenuron 5% EC) were implemented. Plants were artificially infested with laboratory mass reared second instar larvae of *A.ipsilon* (20 larvae per plot) two weeks before spraying of insecticides. Applications were applied using a knapsack sprayer 20 L Size using a spray volume of 0.4 L/m^2 after 50 days of plantation. Insecticide efficacy was calculated comparing with untreated plots (control) using the formula of **Henderson and Telton (1955):**

% reductions = 1- (treatment after × control before/ treatment before × control after x100).

2.4.Statistical analysis:

Data of pyridalyl toxicity were analyzed using probit regression analysis by Ehab-Soft program according to Finney 1971 and Abbott 1925 methods, and the LC_{50}, and LC_{90} values and their 95% confidence limits were calculated. The statistically differences between between the means of the three exposure point 24, 48 and 72 h, and the two concentration of all candidate enzyme, were analysed by one-way ANOVA test using Satterth white's methods. Means separated by LSD, Levene's test for homogeneity of variance and Dunnett's mean comparison and control was calculated with Duncan involvement. Also the field experiments treatments were analyzed by ANOVA. All by using the SPSS-19 statistical programmed 2010. Means were separated using the least significant different at 5% level

3.Results and Discussions

3.1.Toxicity response data of pyridalyl against 2nd instar larvae of *A.ipsilon*:

Toxicity values were determined by leaf dip method and subjected as initial assays at mortality percent was recorded after 96 h after treatment. The LC_{30} and LC_{50} values were 6.6 ppm and 12.15 ppm respectively, data were in Table 1.

Table 1: Pyridalyl Toxicity response to 2nd instar larvae of *A. ipsilon* after 96h of treatmnent.

Response parameters of the pyridalyl probit assay				
Slope±SE	**LC_{30} (FL)**	**LC_{50} (FL)**	**LC_{90} (FL)**	**χ^2**
1.928 ± 0.314	6.6 (4.39-10.1)	12.155 (8.9-16.1)	56.13 (36.8-118.17)	0.0955

Data in Table 1 show the basic sensitivity status of the *A. ipsilon* confirmed toward this insecticide after 96 exposure hours and approved high toxicity and efficiency. This data were in approval with some data searches as follows: **Saghfi and Valizadegan (2014),** The LC_{50} of *S. exigua* treated with pyridalyl larvae were grown on sugar beet plants, 1st, 2nd and 3rd larvae at 72h were estimated 485, 791 and 1280 ppm, respectively, then control of this pest in primary ages will be recommendable. **Isayama, *et al.* (2005),** pyridalyl was very effective against all development stages of *S. litura*, and against *F. occidentalis* was similar to acrinathrin, and greater than acrinat, but no acute toxicity were observed to the natural enemies, *Orius stringicollis* and the pollinators. **Cloyd and Raudenbush (2014),** Pyridalyl combinations with insecticides or fungicides fenhexamid and azoxystrobin resulted in 80% mortality of western flower thrips. Another searches presented data explain highly synergistic activity of this insecticide with others as well as **Abd El-Razik and Mostafa (2013)** they Found positive co-toxicity coefficient in pyridalyl mixing with 8 compounds methomyl, chlorpyrifos-e, deltamethrin, hexaflumeron and pyriproxyfene, piperonyl butoxide olic and sesame oil against *S. littoralis*.

3.2.Enzymes activities results:

3.2.1.Acetylcholinesterase (*AchE*) activity:

The inhibitory effect of pyridalyl on second instar larvae of *A. ipsilon AChE* activity results are presented in Tables (2 and 3). Data are expressed as percentage inhibition and activity as (ug AchBr/ min/g.b.wt.). Only 24h of exposure time treatments brought a decrease in *AChE* activity against control proved inhibitory effect on *AChE* activity in the survived larvae. However, there is a significant difference between the activity of *AChE* of the two ppm concentration (6.6 and 12.5 ppm) were (F=0.174, df=1 and p= 0.681) and between the three exposure period were (F=0.123, df=2 and p=0.885). The activity was found to be 92.3, 156.6 and 132 (ug AchBr/ min/g.b.wt.) for pyridalyl LC_{50} and 72.6, 72.3 and 85.3(ug AchBr/ min/g.b.wt.) for pyridalyl LC_{30}. This result proved that in this instance at the increase of the concentrations from 6.6 to 12.5ppm significantly tend to decrease the activity of *AChE* at the levels of exposure time. These results were similar to **Rabea *et al.* (2010)**, they said that the oxymatrine

Table 2: Changes in some enzymes activities after 2nd instar larvae of *A. ipsilon* treatment by LC_{30} of pyridalyl insecticides.

Enzyme(activity)	Treatment period		
	24h±SE	48h±SE	72h ±SE
Chitinase (ug NAGA/ min/g.b.wt.)	303±1.73	292±2.67	281.3±2.64
Control±SE	270.33±5.04	264.3±2.7	281±1.7
% of control	12.0	10.4	0
Phenol oxidase (O.D.units/min/ g.b.wt.)	109.3±1.8	103±2.1	91.6±1.2
Control±SE	92.6±1.46	89.6±0.99	82.3±1.5
% of control	17.95	14.9	11.37
AchE (ug AchBr/ min/g.b.wt.)	72.66±1.46	72.33±0.73	85.33±1.68
Control±SE	74.6±1.54	63.3±1.2	69.3±.0.99
% of control	-2.6	14.2	23.08
GST (m mole sub.cojugated/ min/g.b.wt.)	175.6±3.2	60.6±1.94	122.3±1.21
Control±SE	122±2.5	128.6±1.9	136.3±1.54
% of control	43.9	-52.8	-10.27
Alpha esterases (ug α-naphthol/ min/g.b.wt.)	26.6±1.21	55.3±2.16	64.3±1.8
Control±SE	100.6±2.89	111±1.7	127.6±2.7
% of control	-73.5	-50.18	-49.6

% of control = (Test - Control)/Control × 100

(chlorfluazuron which have similar activity to pyridalyl) concentrations significantly decreased the specific activity recorded in bee thorax. *AchE* activity constantly differs between species themselves as cited by **Varo *et al.* (2002)** his survey result indicates that the *ChE* of *Artemia salina* is different from that of *A. parthenogenetica* and both enzymes can't be classified neither as acetylcholinesterase or butyrylcholinesterase. Scientist eternally suggests that *AchE* is not the mechanism of the specific insecticide as that established by **Swain *et al.* (2009),** that observed the *iAChE* was not the mechanism of malathion resistance. However, insensitive *AChE*-based mechanisms have been recorded in *C. pipiens* from France and Italy **(Raymond *et al.*, 1985a, b); Villani and Hemingway 1987).** Finally the lack of sensitivity of any insecticide target site, suggests another metabolic mechanisms existence responsible for resistance detected and the metabolic resistance mechanisms depend on qualitative or quantitative changes in any of enzyme system pathways.

3.2.2.Chitinase enzyme in *A. ipsilon* survived larvae body:

Insecticides might act to stimulate the production of chinolytic enzymes in the affected integuments. Results in Table (2 and 3) show a slightly increase in the chitinase of *A. ipsilon* larvae using two concentration of pyridalyl insecticide at three exposure period 24, 48 and 72 h, values were (303, 292 and 281 of chitinase (ugNAGA/min/g.b.w.t.), respectively at LC_{30} concentration compared to (321, 297 and 277 chitinase (ugNAGA/min/g.b.w.t.), respectively at LC_{50} concentration. These results refer to pyridalyl ability to inhibit chitin formation and complete metamorphosis deformation. There is a significant differences between the two concentration of pyridalyl were (f=1.85, df=1 and p=0.188) and between the three exposure periods (F=1.291, df=2 and p=0.297). These results in line with that enlarged by **Ishaaya and cassida (1974)** found that the increase in pesticide concentration, the chitinase in houseflies *musca domestica* affected larvae fed diflubenzuron containing diet.

3.2.3.Activity of phenoloxidases (PO) of *A.ipsilon* survived larvae:

PO plays important roles in insect development, immunity and play role in multiple processes as cuticular sclerotization, melanization, and wound repair (Lavine and Strand 2002). In this study, the activities of *A.ipsilon* survived larvae PO exposed to two concentrations at three exposure periods were 109.3, 103 and 91.6 for LC_{30} and 120, 101.6 and 96.3 for LC_{50} (O.D. units/min/ g.b.w.t.), respectively (Table 2,3). Comparing treatment activities with the control attained that PO activity at cuticle was greater. A significant differences between the two concentration of pyridalyl were found to be (F= 0.005, df =1, P =0.942) and between the three exposure periods were (F= 0.001, df =2, P =0.989). This indicates that pyridalyl is an effective inhibitor of *A.ipsilon* PO activity. **Cornet *et al.* (2013),** found interaction between insecticide resistances, the age 7 to 14 days old sex of

Table 3: Changes in some enzymes activities after 2nd instar larvae of *A. ipsilon* treatment by LC_{50} of pyridalyl insecticides.

Enzyme(activity)	Treatment period		
	24h±SE	48h±SE	72h ±SE
Chitinase (ug NAGA/ min/g.b.wt.)	321±2.67	297.6±2.37	277±2.1
Control±SE	270.33±5.04	264.3±2.7	281±1.7
% of control	18.74	12.37	-1.4
Phenol oxidase (O.D.units/min/ g.b.wt.)	120±2.4	101.6±1.99	96.3±1.54
Control±SE	92.6±1.46	89.6±0.99	82.3±1.5
% of control	29.5	12.7	17.0
AchE (ug AchBr/ min/g.b.wt.)	92.3±2.3	156.6±3.6	132±2.1
Control±SE	74.6±1.54	63.3±1.2	69.3±.0.99
% of control	23.7	147.4	90.4
GST (m mole sub.cojugated/ min/g.b.wt.)	233.3±3.99	85.3±1.8	122.3±1.8
Control±SE	122±2.5	128.6±1.9	136.3±1.54
% of control	91.2	-33.7	-10/27
Alpha esterases (ug α-naphthol/ min/g.b.wt.)	31±0.96	83±1.27	89±1.27
Control±SE	100.6±2.9	111±1.7	127.6±2.7
% of control	-69.2	-25.2	-30.25

%of control = (Test –Control)/Control × 100

mosquitoes and PO activities were higher in resistance strains than susceptible. In case of botanical insecticides PO represent a target of inhibition **(Hu *et al.* (2017)** PO activity of *Apis millefera* treatments were lower than control after two weeks of feeding on sugar solution containing imidacloprid but some treatments produce similar PO activities with control **(Zhu *et al.*, 2017).**

3.2.4.Glutathion-S-Transferase activity in *A.ipsilon* survived larvae:

The activity of GST from the spectrophotometric assay in the pyridalyl survived *A. ipsilon* larvae at two concentrations treatment and three exposure periods was found in Table (2 and 3). The GST activity were 175.6, 60.6 and 122.3 (ηM sub.conjugated/min/g.b.wt.) to the LC_{30} survived treatment 233.3, 85.3 and 122.3ηM (sub.conjugated/min/g.b.wt.), to the LC_{50} survived larvae. From the results there is a slightly increased in GST activity over the two concentration treatment. A significant differences between the two concentration of pyridalyl were (F= 0.47, df =1, P =0.49) and between the three exposure periods were (F= 0.368, df =2, P =0.697). **Zhu *et al.* (2017)** found that domark (fungiside) that only suppressed GST activity in honey bee workers, while all other treatments (alone and in binary mixtures with imidacloprid) generated higher or similar GST activities to control.

3.2.5.Alpha Esterase activity in *A.ipsilon* survived larvae:

Data expanded round the larvae of *A. ipsilon* survived pyridalyl two concentration treatments at three exposure time EST activities were found in (Tables 2 and 3). Elevated esterase was found in the exposure period 26.6, 55.3 and 64.3 and 31,83and 89 for the two concentrations respectively. The increase in estearase activity through increases in exposure time ranged from 2.1 to 2.4 times for the tested α-naphthylacetate. A significant differences between the two concentration of pyridalyl were (F= 1.24, df =1, P =0.274) and between the three exposure periods were (F= 1.239, df =2, P=0.31). These results were similar to **(Zhu *et al.*, 2017),** found that imidacloprid at 4.3 mg/L showed increases in EST activity by 50%, and while acephate at 0.168 mg/L were suppressed EST activity by 40% in honey bee workers. But the mixture of them had EST activity in the middle and similar to that of control. **Bakr *et al.* (2010),** proved that the treated 2nd and 4th larval instars by the sublethal doses LC_{25}, LC_{50} and LC_{90} showed a decrease in enzyme activities of acid phosphatase and the non- specific esterases, α,β esterases at different times intervals post treatments. **Teleb *et al.* (2012)**, reported that pyridalyl LC_{50} of treated 4th larval instar of *Anopheles pharoensis, Culex pipens* and *Culista longiareolata,* were 0.6, 5.5 and 37.7 ppm and increases in free amino acid detected and in the total protein content after 24 and 48hrs of treatment.

3.3.Bio-residual activity results:

The Bio-residual activities of field experiment data were presented in Table (4):

The efficacy of the tested insecticides after days of application began from the first day till the day 20 at 5 days intervals were degraded rendering to the length of the residues. Data in table proved that the efficacy of this insecticide were not differ in longevity and stability on plants under field conditions and the total reduction percentage after 20 days of the first application were ranged between 30.7, 45.7 and 34.8 for pyridalyl, chlorfluazuron and lufenuron, respectively. There is a slight significant differences between insecticides tested were (F=0.009, df=2 and p=0.924), and between sampling intervals were (F= 1.15, df=4 and p=0.35). **Manjula and Kotikal (2015)** mentioned that the bio efficacy of emamectin benzoate, indoxacarb and fipronil reduced the *Agrotis segetum* larval population and foliage damage throughout the experiment and produced high yield. **Shakur *et al.*, 2007** reported that damage by *A. ipsilon* on potato field was (11.5%) in the check plot, while the lowest (1.3%) in poison bait diptrix followed by methomyl (1.6%) and by indoxacarb (1.8%). **Abdel-Rahim 2011,** found the efficiency of pyridalyl and methomyl against *S. littoralis* larvae have the same effect, but methomyl treatments were more potent bio-residual effect than pyridalyl against extended to 12 days and both retain latent effect where increases larval and pupal duration, decrease on pupal weighs and adult emergence were found. **Chakraborty, and Somchoudhury (2011),** found that cabbage yield recorded with pyridalyl treatment at 75g a.i. ha· 1, where Lowest yield was recorded in control plots**. Food safety authority (EFSA),** reported that, the pyridalyl acceptable daily intake (ADI) of was determined to be 0.028 mg/kg bw/day in rats, goats and plant, then there is no carcinogenicity, genotoxicity, reproductive toxicity, or teratogenicity could be arisen. **Isayama, *et al.* (2005),** proved that pyridalyl exhibit high toxicity to insect cell line, but no to mammalian and considered highly selective to insects. **Yoon *et al.* (2013),** found that the biological half-lives of pyridalyl were 7.74 days for the standard dose, and 7.44 days for the double dose that below the Korean maximum residue limits for broccoli**.**

References

Abbott, W.S. (1925). A method of computing the effectiveness of an inseticide. J. Econ. Entomol., 18,265-267.

Abdel-Rahim, E. F. M. (2011). Comparative bio-residual activity of pyridalyl and methomyl insecticides against larvae of the cotton leafworm, *Spodoptera littoralis* (Boisd.). Egypt. J. Agric. Res., 89 (1),55-71.

Abd El-Razik, M.A.A. and Mostafa, Z.M.S. (2013). Joint action of two novel insecticides mixtures with insect growth regulators, synergistic compound and conventional insecticides against *Spodoptera littoralis* (Boisd.) larvae. American journal of biochemistry and molecular biology, Vol.3 (4), 369-378.

Bade, M.L. and Stinson, A. (1981). Biochemistry of insect differentiation. A system for studying the mechanism of chitinase activity in vitro. Archs. Biochem. Biophyscs. 206, 213-221.

Bakr, R.F.A.; El-barky,N.M.; Abd Elaziz,M.F.; Awad,M.H. and Abd El-Halim,H.M.E. (2010). Effect of Chitin synthesis inhibitors (flufenoxuron) on some biological and biochemical aspects of the cotton leaf worm *Spodoptera littoralis* Bosid (Lepidoptera, Noctuidae). Egypt. Acad. J. biolog. Sci., 2 (2), 43- 56.

Busching, M.K. and Turpin, F.T. (1977). Survival and development of black cutworm (*Agrotis ipsilon*) larvae on various species of crop plants and weeds. Environ. Entomol. 6, 63-65.

Table 4: Field performance of pyridalyl against laboratory strain of *ipsilon* on sugarbeet.

Treatment	Dose	% of residual mortality after (Day) treatments					
		1DAA	5DAA	10DAA	15DAA	20DAA	Reduction
Pyridalyl	50cm3/100L	99.8±1.20	90.2±1.73	53.6±1.46	50.0±2.09	10.8±1.81	30.7%
Chlorfluazuron	400cm3/fedd	100	80.3±1.54	69.8±1.99	44.6±1.46	17.5±2.16	45.7%
Lufenuron	30cm3/100L	100	84.5±1.68	66.7±2.36	51.2±1.27	11.3±2.73	34.8%

Chakraborty, G. and Somchoudhury, A.K. (2011). Effect of pyridalyl against *Plutella xylostella* (L.) on cabbage and natural enemies. Journal of Crop and Weed 7(1),142-145.

Cloyd, R.A. and Raudenbush, A.L. (2014). Efficacy of Binary Pesticide Mixtures Against Western Flower Thrips. Hortechnology 449-456.

Cornet, S.; Gandon, S. and Rivero, A. (2013). Patterns of phenoloxidase activity in insecticide resistant and susceptible mosquitoes differ between laboratory-selected and wild-caught individuals. Parasites and Vectors 6,315.

Finney, D.J. (1971). Probit Analysis. Cambridge University Press, London.

Food safety authority (EFSA) (2004). Pyridalyl. In Food safety commission pesticide expert committee evaluation report by Masaaki Terada, Tadao Terao, Naoko Koizumi, Motoko Sakamoto, Yasuhiko Nakamura, Seiichi Honma, Takeshi Mikami 29 pages.

Habig, W.H.; Pabst, M.J. and Jakoby, W.B. (I974). Glutathione S-transferase, the first enzymatic step in mercapturic acid formation. J.Biol.Chem., 249,7130-7139.

Henderson, C.F.; and Tilton, F.W. (1955). Tests with acaricides against the brown wheat mite. J. Econ. Entomol. 48,157-161.

Hu, W.; Du, W.; Bai, S.; Lv, S. and Chen, G. (2017). Phenoloxidase, an effective bioactivity target for botanical insecticide screening from green walnut husks. Natural product research, Sep 20,1-4.

Isayama, S.; Saito, S.; Kuroda, K.; Umeda, K. and Kasamatsu, K. (2005). Pyridalyl, a Novel Insecticide, Potency and Insecticidal Selectivity. Arch.Insect Biochem.Physiol., 58,226 233.

Ishaaya, I. (I971). Observations on the phenoloxidase system in the armored scales *Aonidiella aurantii* and *chrysomphalus aonidum*. Comp.Biochem.physiol., V39B, 935-943.

Ishaaya, I. and Casida, J.E. (1974). Dietary TH- 6040 alters composition and enzyme activity of housefly larval cuticle, pestic. Biochem. Physiol., 4,484-490.

Lavine, M.D. and Strand, M.R. (2002). Insect hemocytes and their role in immunity. Insect biochem.Mol.Biol., 32,1295-1309.

Manjula, K. N. and Kotikal, Y. K. (2015). Evaluation of different insecticides against *Agrotis segetum* (Denis and Schiffermuller) and *Spoladea* (=Hymenia) *recurvalis* (Fabricius) on amaranthus. Karnataka J. Agric. Sci., 28 (2), 197-201.

Nishimura, S.; Saito, S.; and Isayama, S. (2007). Pyridalyl, A novel compound with excellent insecticidal activity, high selectivity, and unique mode of action. Japanese journal of plant science 1(2), 85-94.

Rabea, E.I.; Nasr, H.M.,; Badawy, M.E.I. (2010). Toxic Effect and Biochemical Study of Chlorfluazuron, Oxymatrine, and Spinosad on Honey Bees (*Apis mellifera*). Arch Environ Contam Toxicol, 58:722–732.

Raymond, M.; Gaven, B.; Pasteur, N. and Sinegere, G. (1985b). Etude de la resistance au chlorpyrifos a patir de quelques souches du moustique *Culex pipiens* L. du Sud de la France. Genetics in Selection and Evolution 17,73–83.

Saito, S.; Isayama, S.; Sakamoto, N.; and Umeda, K. (2004). Insecticidal activity of Pyridalyl, acute and sub-acute symptoms in *Spodoptera litura* larvae. J. Pestic. Sci. 29 (4),372–375.

Saghfi, M. and Valizadegan, O. (2014). Study the effects of pyridalyl on larvae of *Spodoptera exigua* (hubner) at first, second and third ages during 72 hours in laboratory conditions. Int. J. Curr. Microbiol. App. Sci 3(4), 310 -315.

Simpson, D.R.; Bulland, D.L. and Linquist, D.A. (1964). A semimicrotechnique for estimation of cholinesterase activity in boll weevils. Ann. Ent.Soc. Amer., 57, 367-371.

Shakur, M.; Ullah, F.; Naem, M.; Amin, M.; Saljoqi, A.U.R and Zamin, M. (2007). Effect of various insecticides for the control of potato cutworm (*Agrotis ipsilon* Huf., Noctuidae, lepidoptera) at kalam Swat. Sarhad J. Agric. Vol. 23, No. 2,423-426.

Sakamoto, N.; Saito, S.; Hirose, T.; Suzuki, M.; Matsuo, S.; Izumi, K.; Nagatomi, T.; Ikegami, H.; Umeda, K.; Tsushima, K. and Matsuo, N. (2003). The discovery of pyridalyl, a novel insecticidal agent for controlling lepidopterous pests. Pest Management Sci., 60,25–34.

Sakamoto, N.; Saito, S.; Hirose, T.; Suzuki, M.; Umeda, .K; Tsushima, K. and Matsuo, N. (2002). Synthesis and insecticidal activity of pyridalyl and its derivatives. 10th IUPAC Int. Congr. Chem. Crop. Protect. Basel. 1,254.

SPSS (2010). Statistical program (SPSS 19.0 Copyright). SPSS Inc.k

Swain, V.; Seth, R.K.; Raghavendra, K. and Monhanty, S.S. (2009). Characterization of biochemical based insecticide resistance mechanism by thermal bioassay and variation of esterase activity in *Culex quanquefasciatus*. Parasitology research, 104-1307.

Teleb, S.S.; Rashad, E.M. and Ahmed, F.A. (2012). Insecticidal and Biochemical Activities of Pleo 50% Ec and Nomolt 15%Sc on Some Mosquito Species. Journal of American Science, 8(10),235-240.

Van Asperen, K. (I962). Astudy of house fly esterase by means of sensitive colourimetric method. J. Insect physiol., 8,401-416.

Varo, I; Navarro, J.C.; Amat, F. and Guilhermino, L. (2002). Characterization of cholinesterases and evaluation of the inhibitory potential of chlorpyrifos and dichlorvos to *Artemia salina* and *Artemia parthenogenetica.* Chemosphere 48, 563–569.

Villani, F. and Hemingway, J. (1987). Biochemical test to determine the interaction of organophosphate and carbamate insecticide resistance gene in field population of *Culex pipiens* from Italy. Pestic Biochem Physiol 27,218 –228.

Waterhouse, D.F.; Hockman, R.H. and Mckellar, J.W. (1961). An investigation of chitinase activity in cock-roach and termite extracts. J. Insect physiol., 6,96-112.

Yoon, J.-Y.; Park, J.-H.; Moon, H.-R.; Han, G.-T. and Lee, K.-S. (2013). Residue patterns of indoxacarb and pyridalyl in treated cauliflower. Agric. Sciences, 4, .3, 111-116.

Zhu, Y.C.; Yao, J. ; Adamczyk, J. and Luttrell,R. (2017). Feeding toxicity and impact of imidacloprid formulation and mixtures with six representative pesticides at resi-due concentrations on honey bee physiology (*Apis mel-lifera*). PLoS ONE 12(6),1-19.

دراسات عن الخصائص التوكسيكولوجيه والاستنتاجات البيوكيماويه لمبيد البيريداليل علي الدوده القارضه

حنان صلاح الدين طه

قسم بحوث سميه المبيدات لمجتمعات الآفات - المعمل المركزي للمبيدات - مركز البحوث الزراعيه, دقي - جيزه, مصر

الملخص العربي

يتطلب الانتشار السريع لبعض الافات الهامه التي تقضي علي بعض المحاصيل الضروريه خاصه الخضروات ومنها الدوده القارضه السودا عمل تقديرات بيوكيماويه لنشاط بعض الانزيمات ضمن خطوات التقييم الحيوي للمبيدات لتكشف الحقائق عن التغييرات الحادثه داخل جسم الحشره بعد التعرض لاي من المبيدات الحديثه و منها مبيد البيريداليل. تم اخذ عينتان من يرقات الافه التي تعرضت علي ثلاث فترات مختلفه الي جرعتين القاتله للثلاثين والقاتله للخمسين من العشيره.

كان نشاط انزيم الاسيتيل كولين إستيريز مقارنه بالكنترول كالتالي معبرا عنه بالنسبه المئويه : 2.6- و 14.2 و 12.1 لليرقات التي تعرضت للجرعه الثلاثينيه و 23.7 و 147.4 و 90 لليرقات التي تعرضت للجرعه النصفيه . بينما نشاط انزيم الكيتيناز مقارنه بالكنترول كالتالي: قد زاد من 12 الي 10.4 ثم 0 لليرقات التي تعرضت للجرعه الثلاثينيه من 18.7 الي 12.4 ثم الي -1.4 لليرقات التي تعرضت للجرعه النصفيه . وقد تم نشاط انزيم الفينول اوكسيداز في حيز ضيق كاتالي: حيث انخفض من 17.9 الي 11.4 و من 29.5 الي 17 علي التوالي للحشرات النجيه من التعرض للجرعتين المذكورتين سابقا علي التوالي .

و كان نشاط انزيم الجلوتاثيون اس ترانسفيراز بادئا و مستمرا في الصعود عند 24 ساعه ولكنه بدا في الانخفاض بعد 48 ساعه 72 ساعه حيث سجل انخفاض من 43.9 الي -10.3 و 91.2 الي – 10.3 للحشرات الناجيه من التعرض للجرعتين المذكورتين .اظهرت قيم نشاط انزيم الفا استريز انخفاض ملحوظ متاثره بمده تعرض اليرقات الناجيه من الجرعات المذكوره حيث سجلت نسب مئويه سالبه كالتالي: -73.5 الي -50.2 ثم -49.6 و -69.2 الي - 25.2 ثم - 30.3.

بينما كانت الفعاليه الحقليه للمبيد المختبر مع المبيدات الاخري المختبره وهي الكلورفلوازيورون واللوفنيورون علي محصول البطاطس و تاثيرهم في نسب خفض تعداد الحشرات وكانت كالتالي 30.7 و45.7 و 34.8 % لمبيد البيريداليل ثم الكلورفلوازيورون ثم اللوفينيورون علي التوالي.