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MAGNETIC FIELD AND INSECTICIDE INTERACTIONS FOR LETHAL ALTERED TOXIC ACTION AND STUDY OF NEGATIVE IMPACT ON *Earias insulana* PARAMETERS (BOISD) (LEPIDOPTERA: NOLIDAE)

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AUTHORS' CONTRIBUTIONS

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ABSTRACT

The purpose from current experiment was to increase the activity of insecticides after exposure to magnetic power field (increased in toxicity with able to kill the pest insect by low dose). *Earias insulana* (Lepidoptera: Nolida) insect behavior and physiology have been shown to be affected by both tested compounds (Uphold and Tracer) before and after exposed to magnetic fields. We're curious about the effects of compounds magnetization on *Earias insulana* larvae. The goal of this study was to better understand the interaction between magnetic field (180 mlt for 1 hour) and two insecticides, Uphold and Tracer, in order to quantify the increase of their lethal toxicity after exposure. Two insecticides were tested for toxicity against *E. insulana* 2nd, 3rd, and 4th instar larvae, as well as their effects on larvae and pupae stages. According to the data, the LC_{50} values for Uphold and Tracer were 0.582, 0.690, 1.022 and 4.949, 9.356, 13.753 ppm respectively, while, after magnetization of the same insecticides the LC_{50} values for Uphold and Tracer were 0.331, 0.607, 0.859 and 3.823, 7.779, 10.590 ppm respectively. After magnetization some enzymes and biochemical contents have changed. AchE and Alk-Ph increased significantly, while, total proteins and free amino acids decreased significantly.

Keywords: *E. insulana*; magnetic field; insecticides uphold and tracer; biology and physical.

1. INTRODUCTION

The new classification of superfamily Noctuoidea made by; Abdel Fattah and Eltorkey, 2017) who reclassified Noctuoidea families based on morphological and molecular analysis, whereas all previous publications in Egypt utilized Noctuidae as a family for *E. insulana*. New Classification of Superfamily Noctuoidea in Egypt is: Order: Lepidoptera, Superfamily: Noctuoidea, Family: Nolidae, Subfamily: Eariadinae include: *Earias Hubner*, (1825), *Earias insulana* (Boisduval, 1833) - *Earias nubica* (Stran, 1915) - *Earias biplaga* (Walker, 1866). Family Nolidae is categorized as a subfamily within the family Noctuidae in all previous Egyptian publications; nevertheless, [1] recorded the subfamily Nolidae as a family under the molecular study.

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Noctuoidea is the most species rich superfamily of Lepidoptera in Egypt. *Earias insulana* (Lepidoptera: Nolidae) is one of the most destructive major pest on many vegetable cultivated and cotton crops in Egypt. Family Nolidae is a family of moths formerly, was included in the Noctuidae. Six families were recorded belonging to Noctuoidea superfamily: (Oenosandridae, Notodontidae, Nolidae, Euteliidae, Erebidae, and Noctuidae). Despite all those changes, in Egypt, the classification has not been revised since long time.

From 2nd to 4th instar larvae of *E. insulana* feed directly on flower, square, and bolls of cotton plants, resulting in a substantial yield loss. In Egypt, bio-insecticides or insecticide mixtures are useful for investigating the high toxicity and mortality of various insects, as well as playing a key role in reducing insect population, generation numbers and pesticide resistance.

The toxic effect of active ingredient for these insecticides against insects with different mechanisms of insecticide inter body and physiology pest depends on the insecticides modes of action [2]. In several lepidopterous pests, it cues inhibitors of protein, amino acid, and lipid production for cell [3,4,5].

When pesticides are introduced into ecosystems, they undergo transformations based on their physical and chemical qualities, as well as their interactions with other environmental elements. Temperature, pH, salinity, radiation, and the presence of other substances or physical properties such as magnetic in the microenvironment, for example, have an impact [6].

Because it is a significant one of many important environmental factors that play a significant role in a significant influence on living or some organisms, and it can cause changes in many biological systems, the focus in research and experiment laboratories on the effect of magnetic fields for controlling some insects has grown in importance, with many authors studying it continuously from 1959 to 2018, because it is a significant one of many important environmental factors that play a significant role in a significant influence on living or some organisms, and it can cause changes in many biological systems.

Spinosad is an insecticide based on chemical compounds found in the bacterial species *Saccharopolyspora spinosa*. Spinosyn A resembles a GABA antagonist and is comparable to the effect of avermectin on insect neurons [7]. Spinosyn A is highly active against different Lepidoptera insects. Also, it was recorded and used for the control different pests on several crops [8,5,9]

Insecticide mixtures with different modes of action may postpone the development of resistance in pest populations and can be very helpful in pest management, especially in cases where synergistic. Uphold 36% SC (Spinetoram 6% + Methoxyfenozide 30%) when exposed larvae it stop feeding immediately but can take up to 3 days to mortality.

In the previous half-century, exposure to magnetic fields (MFs) has increased [10]. There is substantial evidence that EMFs are a significant abiotic source, can have biological impacts on species with ecological consequences. It exists and has existed from the beginning of life on Earth [11]. Magnetic fields affect many animals and insects [12]. In some research and laboratory studies, the light has been on using contemporary fundamental physical approaches such as magnetic fields (MF) to control insects. Since 1959, the use of magnetic fields in numerous studies has grown in importance, with many authors continuing to do so until 2020. Said et al., [13-16] they studied the direct effect of different magnetic power (4.2, 12, 24 and 180 mt) on different immature and adult stages of *Pectinophora gossypiella and Earias insulana*. it clear that some biological aspects increased; such as time development, malformation formed for different stages, generation times with decreased the fecundity and fertility [17,18]. Because it considerable one of many important environmental factors that have a big impact on earth and life behavior [19]. All insects can be exposed to MF in the environment, and the impact of this factor on many behavioral, biochemical, and physical insets is currently being studied. Investigating the effects of MF on insects can reveal whether or not it is a hazard to them. Few studies have been done on the influence of magnetic power on lethal toxicity of insecticides and their effects on biochemical or physiological functions of insects [20]. Studied the Effect of magnetic power and radiant compound on some biological and biochemical aspects of *Earias insulana* also, [21] observed changes in biochemical parameters of *Apis mellifera* insects exposed to (50 Hz E-field at 5.0 kV/m, 11.5 kV/m, 23.0 kV/m, and 34.5 kV/m for 1, 3, 6, and 12 h).

The aim of our work, as well as our understanding of the interactions between MF and insecticides, may lead to useful and helpful strategies for insect management.

2. MATERIALS AND METHODS

2.1 Insect Used

The three instars larvae of *Earias insulana* used were freshly newly molted of each 2nd or 3rd or 4th instar larvae from the susceptible strain that reared on a modified artificial diet as described by Amer [22] under laboratory conditions of 26 ± 1 °C and 65 ± 5 % R.H.

2.2 The Location of Rearing the Pest

Bollworms Department, Plant Protection Research Institute, branch, El-Zagazig AL-Sharkya.

2.3 Insecticides Used

Commercial formulations of the following insecticides were used; (Tracer ® 24% SC and Uphold 36% SC).

1- Tracer 24% SC (Spinosad) obtained from Corteva Agriscience company by rate of application: 50 cm^3/Feddan.
2- Uphold 36% SC (Spinetoram 6% + Methoxyfenozide 30%) obtained from Corteva Agriscience company by rate of application: 125 cm^3/Feddan.

2.4 Toxicity Tests of Two Insecticides

Preliminary experiments were performed to determine the approximate concentrations of two insecticides tested caused about 10 – 95% mortality for each 2nd or 3rd or 4th instar larvae of *E. insulana.*

2.5 Preparation of Insecticides Concentration Prior to Magnetic Field Application

A series numbers of concentrations for each Tracer 24% or Uphold 36% insecticide was prepared (in water) on the active ingredient based on ppm by diluting the commercial formulation. After preliminary for each insecticide, five concentrations (30, 15, 7.5, 3.75 and 1.875ppm) for Tracer and (2.23, 1.115, 0.557, 0.278 and 0.129 ppm) for Uphold were prepared and used.

2.6 Preparation of Magnetic Treatment

The apparatus of magnetic field used in the experiment consists of two components: Inside each one component were eight magnetic pieces; each piece equal 30mlli-tesla power were arranged inside each row in an attractive position. The two rows were put together by parallel (with 2 cm distance between) and in repulsion position, measured by using mille-tesla meter, the magnetic power equal 180 mlt (magnetic local time). The apparatus measured by using mille-tesla meter in faculty of Engineering, Menofiya University.

2.7 Prepared the Tested Insecticides Magnetization (Exposed to Magnetic)

To investigate the potency of the magnetic on two tested insecticides (magnetization) against *E. insulana* 2nd, 3rd, and 4th instar larvae after exposure to 180 mlt (magnetic local time). The same serial concentrations (without magnetization) were prepared in water. Furthermore, the concentrations from both insecticides prepared by exposed to the magnetic field power (180 mil-tesla) between the apparatus magnetic field have the same serial number.

2.8 Toxicity Assessment

To estimate the toxicity of each tested insecticide before and after magnetization, against *E. insulana* 2nd, 3rd and 4th instar larvae: a serial number of concentrations for two insecticides before and after exposed to magnetic field of 180 mlt were prepared and sprayed on the surface of an artificial diet in Petri dishes. For each concentration/treatment, 45 larvae were used; three replicates were used, each replicate containing 15 larvae of each *E. insulana* instar were allowed to feed on the treated diet for each concentration/ each treatment and the same number of larvae left without treatment as control. It kept under constant conditions of 26 ± 1°C and 60±5 %RH. The three instar larvae observed after 24 hours for recorded the larvae alive numbers and mortality to estimate toxicity at LC_{25}, LC_{50} and LC_{90} values.

2.9 Effect of the Two Insecticides on Some Parameters Assay

After estimated the LC_{25}, LC_{50} and LC_{90} values for each tested insecticide before and after exposure to (180ml) magnetic field; the LC_{50} of each tested treatment was prepared and spraying on upper surface the diet in Petri-dishes (5gm.). The 2nd or 3rd or 4th instar larvae of *E. insulana* were treated with each LC_{50} value for each treatment, kept under the constant conditions of 25±1°C and 60±5%RH and observed daily. The alive larvae resulted from diet treatment with LC_{50} of each insecticide were transferred individually to the diet tubes (2.5 x7.0 cm) each containing about 3 gm artificial diet (without any treatment) by camel hairbrush and another group of larvae used as control. The tubes were capped with cotton stopper and kept in an incubator under 26±1°C and 60±5% RH and inspected daily until pupation.

2.10 Biochemical Studies

This part of experiment was conducted in order to determine the latent effect of LC_{50} values of the selected insecticides [*i.e.* Uphold (36% SC) and Tracer (24% EC)] before and after magnetizations on total protein, free amino acids and some enzymes activities in *E. insulana* treated larvae compared with untreated laboratory larvae as control to reach a better understanding of some physiology of digestive.

The total protein content, in hemolymph fourth instar larvae was determined according to Bradford [23], free amino-acid activity was determined according to modification of Ishaaya [24], the alkaline phosphatase (ALK-P) activities were determined according to the method described by Powell & Smith [25]. The activity of acetylcholine esterase (AchE) was measured described by Simpson et al. [26].

2.11 Samples Preparation for Biochemical Assay

Samples of *E. insulana* larvae were collected after treatment with LC_{50} for Tracer and Uphold before and after exposed to magnetic field. The larvae collected from treated or untreated after 6 days of treatment were centrifuged at 5000 r. p. min. in refrigerated at 5C°, and kept in deep freezer at -20C° until use for biochemical assays. Samples of *E. insulana* adults were analyzes chemically in Physiological Research Department of plant Protection Researches Institute.

3. RESULTS

3.1 Effect of Two Insecticides Before and After Exposure to Magnetic Field (MF 180 mlt Power) on Three Instars Larvae of the Spiny Bollworm under Laboratory Conditions

Data recorded in Table 1 clearly revealed that the two insecticides after exposure to magnetic field (MF 180 mlt power) become more effective and have impact on mortality of *E. insulana* three instars larvae (2nd, 3rd and 4th) than before exposure to MF.

The potency of the two tested insecticides against the three instars (2nd, 3rd and 4th) larvae of *E. insulana* following exposure to a magnetic field of 180 mlt (Uphold+ magnetization) represented as mortality number and percentage at different concentrations (2.23, 1.115, 0.557, 0.278, and 0.129 ppm). According to the current study, when the three instars larvae were treated with the insecticide before being exposed to magnetic, the percent mortality decreased to 86.66, 71.1, 44.4, 33.3, and 13.3 for the 2nd instar larvae, respectively, compared to 2.0 percent mortality in the control, while, for the 3rd instar larvae percent mortality decreased to 80.0, 62.22, 46.66, 28.8, and 6.66, respectively, compared to 0.0 percent in the control. Mortality in fourth instar larvae decreased to 73.3, 49.9, 37.7, 13.3 and 4.4% respectively.

Results showed that larval mortality was positively correlated with different concentrations that depend on the efficacy of the Uphold + Mg, with mean mortality percent in different instars increasing with increased concentrations, with percent mortality being 100.0, 91.1, 71.1, 42.2 and 17.77 percent for 2nd instar larvae, respectively, compared to 2.2 percent mortality in control, and 88.8, 73.3, 48.88, 28.8, and 6.66 percent for 3rd instar larvae, At the same time, current mortality in fourth instar larvae reduced to 82.2, 57.7, 35.5, 15.5 and 2.0, respectively, compared to 0.0 in control.

The data presented in Table 2 recorded that Tracer after exposure to magnetic field (MF 180 mlt power) become more lethal with high effect on mortality of *E. insulana* three instars larvae than before exposure to MF. It showing that mean mortality percent in different instars increased with concentrations increased, mortality percentages were 91.1, 84.4, 77.7, 55.5 and 22.2% compared to 2.2% in control for 2nd instar larval, and 80.0, 68.8, 51.1, 35.6, 11.1, for 3rd instar larvae, respectively, while it mortality decreased in fourth instar larvae to 75.5, 66.6, 40.0 and 22.2% compared with 0.0% in control.

After treatment with Uphold and Tracer LC_{50} was 0.582, 0.690 and 1.022 ppm for Uphold, while after magnetized Uphold the LC_{50} was 0.331, 0.607 and 0.859 ppm for *E. insulana* 2nd, 3rd and 4th instar larvae. After treatment with Tracer LC_{50} was 4.949, 9.356 and 13.753 ppm for Tracer, while after magnetized Tracer the LC_{50} was 3.823, 7.779 and 10.590 ppm for *E. insulana* 2nd, 3rd and 4th instar larvae, Table 3.

3.2 Larval and Pupal Malformed

Table 4 showed that using LC_{50} of Uphold or Tracer insecticides after exposure to MF (insecticide magnetization) resulted in a significant decrease in larval and pupal weight as well as a significant increase in malformation for both stages. These malformation were recorded by 16 and 14 percent for larvae from the two insecticides exposed to MF, respectively, and decreased to 11 and 9 percent malformed larvae with two insecticides exposed to MF, respectively. According to the results, 21 and 17 percent of pupae (Uphold and Tracer subjected to MF treatment) had the largest morphological distortion. In the case of two insecticides before magnetization, however, this proportion dropped to 9 and 11%, respectively. The majority of the pupae were dead and seemed to be modest in size.

Table 1. Mortality of three instar larvae of spiny bollworm when fed on Uphold before and after exposed to magnetic field under laboratory conditions

Used insecticides	Initial No/each conc.	Conc. (%)	2nd		3rd		4th instar	
			Number and percentages of mortality after 24 hours					
			No.	%	No.	%	No.	%
Uphold	45	**2.23**	39	86.66	36	80.0	33	73.3
		1.115	32	71.1	28	62.22	22	48.9
		0.557	20	44.4	21	46.66	17	37.7
		0.278	15	33.3	13	28.8	6	13.3
		0.129	6	13.3	3	6.66	2	4.4
Control			1	2	0.0	0.0		
Uphold+ Mg	45	**2.23**	45	100	39	88.8	37	82.2
		1.115	41	91.1	33	73.3	26	57.7
		0.557	32	71.1	22	48.88	16	35.5
		0.278	19	42.2	13	28.80	7	15.5
		0.129	8	17.77	3	6.66	1	2.0
Control			1	2.2	1	2.2	0.0	0.0

Table 2. Mortality of three instars larvae of *E. insulana* when fed on Tracer before and after exposed to magnetic field under laboratory conditions

used insecticides	Initial No/each conc.	Conc. (%)	2nd		3rd		4th instar	
			Number and percentages of mortality after 24 hours					
			No.	%	No.	%	No.	%
Tracer	45	**30**	34	82.2	33	73.3	31	68.8
		15	29	64.4	30	66.66	25	55.6
		7.5	24	53.3	22	48.88	16	35.6
		3.75	15	67.5	11	24.4	8	17.7
		1.875	7	15.5	6	13.3	0.0	0.0
Control			1	2.2	0.0	0,0	0.0	0.0
Tracer + Mg	45	**30**	41	91.1	36	80.0	34	75.5
		15	38	84.4	31	68.8	30	66.6
		7.5	35	77.7	23	51.1	18	40.0
		3.75	26	55.5	16	35.6	10	22.2
		1.875	10	22.2	5	11.1	2	4.4
Control			1	2.2	0.0	0.0	0.0	0.0

Table 3. Toxicity of two insecticides against three instars larvae of the spiny bollworm under laboratory conditions

Ages of Larvae	used insecticides	Toxicity: 95%Confidence limits			
		LC_{10}	LC_{50}	LC_{95}	Slope± SE
2nd	Uphold	0.114	0.582	4.70	1.81±0.234
3rd		0.126	0.690	6.093	1.74±0.232
4th		0.203	1.022	8.118	1.83±0.248
2nd	Uphold+Mg	0.108	0.331	1.387	2.64±0.305
3rd		0.152	0.607	3.581	2.13±0.252
4th		0.226	0.859	4.758	2.21±0.268
2nd	Tracer	0.156	4.949	416.62	0.85±0.205
3rd		1.345	9.356	112.819	1.52±0.224
4th		2.962	13.753	98.702	1.92±0.255
2nd	Tracer+Mg	0.723	3.823	32.387	1.77±0.248
3rd		1.259	7.779	80.574	1.62±0.227
4th		2.236	10.590	77.940	1.90±0.244

Table 4. Effect of LC_{50} on weight and malformed of *E. insulana* larvae after treatment with LC_{50} of each tested insecticide under laboratory conditions

Used insecticides		Conc. (%)	Larvae		Pupae		% Malformed larvae	% Malformed and dead pupae
			Weight	Reduction %	Weight	Reduction %		
E. insulana	Uphold		0.0243^{ab}	- 42.95	0.0197^{c}	- 51.36	11	9
	Uphold+ Mg		0.0206^{b}	-51.64	0.0122^{d}	- 69.87	16	21
	Tracer		0.0310^{ab}	- 27.23	0.0274^{b}	- 32.34	9	11
	Tracer+ Mg		0.0203^{b}	-52.34	0.0096^{e}	- 76.29	14	17
Control			0.0426^{a}	0.00	0.0405^{a}	0.00	2	3
LSD			0.0197		0.0022		0.536	1.411
P			0.0133*		0.0000^{***}			
F			5.495		309.996			

Table 5. Enzymes activity and biochemical contents in hemolymph of *E. insulana* larvae after treatment with LC_{50} of each tested insecticide under laboratory conditions

Used insecticides		Mean enzyme activity			
		AchE (µg Br/min/g.b.wt) ± SE.	(Alk-Ph.) ($U*10^{n}$ /g.b.wt) ± SE	Total proteins mg/g.b.wt.± SE	Free amino acids (µg dl alanine /g.b.wt).± SE
E. insulana	Uphold	146.3^{d}±6.8	13.7^{ab}±7.3	10.3^{b}±0.51	112^{b}± 6.1
	Uphold+ Mg	199.6^{b}±9.6	23.1^{a}±9.1	7.0^{b}±0 .3	65.5^{d}± 3.3
	Tracer	201.3^{b}±11.3	10.4^{ab}±16.3	11.5^{ab}±1 .2	121^{b}± 7.5
	Tracer+ Mg	351.6^{a}±9.7	17.6^{ab}±8.2	14.4^{ab}± 1.3	85.7^{c} ± 7.6
Control		173.7^{c}±5.9	6.4^{b}±9.5	19.54^{a}±.5	168.5^{a}± 9.5
LSD		14.038	9.655	5.797	8.455
P		319.06***	4.459	6.675	215.452
F		0000***	.0251*	.0070**	0000***

3.3 Changes in Enzymes and Biochemical Contents

Data in Table 5 showed that the tested two insecticides after magnetization were the most powerful and effective when compared to before magnetization and control, resulting in a considerable increase in acetyl cholinesterase enzyme activity (AchE). The acetyl cholinesterase activity in adults from 2^{nd} instar larvae treatment was 351.6 µg Br/min/g.b.wt in Tracer+ Mg treatment and 199.6 µg Br/min/g.b.wt in Uphold+ Mg treatment, respectively, while the lowest increase in enzyme activity was observed in Uphold and Tracer without magnetization by 146.3 and 201.3 µg Br/min/g.b.

The obtained data reveal that there was a high significant increase in the activity of alkaline phosphatase (Alk-P) in larvae resulted from treated with each insecticide + magnetization. The two tested insecticides led to increase in alkaline phosphatase (Alk-Ph.) which more obvious after magnetization than un-magnetization insecticides. It was 23.1 and 17.6 ($U*10^{n}$ /g.b.wt) for Uphold and Tracer magnetization respectively, as compared with 6.4 ($U*10^{n}$ /g.b.wt) in control.

When *E. insulana* larvae were treated with Uphold +Mg and Tracer + Mg, respectively, total proteins content was significantly reduced by 7.0 and 14.4 mg/g.b.wt.) compared to (10.3 and 11.5 mg/g. b.wt.) when *E. insulana* larvae were treated with Uphold and Tracer, respectively, compared to 19.54 mg/g. b. wt. in control.

Furthermore, free amino acids contents reduced after magnetizing treatments Uphold+Mg and Tracer+Mg by 65.5 and 85.7 µg dl alanine/g.b.wt respectively, compared to treatments with insecticide without magnetization by 112 and 121 µg dl alanine/g.b.wt in Uphold and Tracer treatments, respectively, compared to 168.µ g dl alanine/g.b.wt in control.

The protein content is one of the most biochemical components, changes in protein production caused problems in insect body. Because it is required for the insects' metabolism to be completed.

4. DISCUSSION

The purpose from experiment was to increase the activity of insecticides after exposure to magnetic power field to management target pest adequately (increased in toxicity with able to kill the pest insect by low dose).

Generally, in this experiment it clear that *E. insulana* 2nd instar was more sensitive when exposed to magnetization or non-magnetization tested insecticides than untreated larvae. *E. insulana* mortality varies depending on the mode of action of the two insecticides and toxicity lethal of active ingredient for these insecticide**s** [2,27,28,29] studied the direct toxicity and effect of *Beauveria bassiana* and emamectin benzoate on *Pectinophora gossypiella.*

The effectiveness' of two tested insecticides before and after exposed to magnetic field (180 mlt) on *E. insulana* three instars larvae, varied tremendously. According to the small size and reduced weight. It occurs as a result of slowly in feeding during the larval stage. Furthermore, it resulted in deformed larvae and pupae at all stages perhaps may be due to the differed in chemical structures of the tested insecticides used and/or the toxic impact increased following exposure to a magnetic field (180mlt). All resulted agree with Kandil, et al. [15,14] noticed that when both *P. gossypiella* and *E. insulana* has been exposed to magnetic fields (28.6 & 2.21 mt) it caused increasing in the time of different development stage and increased in mortality stages. Also, Matar, et al. [20] showed that when pupal stage of *E. insulana* exposed to magnetic field levels of: (2.0, 10.0 & 24 mt) it caused elongation in duration of pupal time and high reduction in adult emergence with increased the malformed. Moreover, Kandil, et al. [14] indicated that there was a significant negative effect on the some biological parameter process of *P. gossypiella* when exposed to magnetic.

The biochemical insecticides appeared that the high decreased and different in protein, free amino acid, alkaline phosphatases (ALP) and acetylcholine (AChE) in *E. insulana* cells. This effect may be due to the reduction or different between protein and amino acids, which necessary to synthesize l detoxifying enzymes which used in the detoxification of toxic enter blood body of *E. insulana*. Which, lead to high toxic insecticides on different stages with reduction of energy and resulted population. The same similar findings were also reported by [30] they observed that when Lepidopteran insects treatment with different insecticides, has directly affected on protease, amino acid and total protein. Also, Valizadeh et al. [31] they observed that a significant decrease in the total protein in the body of *Xanthogaleruca luteola* treated with azadirachtin. Also, many studies recorded that all Insecticides can influence in the activity of metabolic protein content [32,33]. In all Insects use protein and amino acids, with carbohydrates and lipids, necessary for energy to retain functions of bodily for development and participate in the metabolic processes of different biochemical reactions, which can be variable within the detoxification of different insecticides groups [34]. [3,4] Studies demonstrate that combinations of different insecticides may lead to the inhibition of enzymes in many pests result after treatment than control [35,36]. [37,38] recorded that the ALPs are involved in several biological processes and respond to stress, pathogenesis, or infection. ALP is one important synthesizing enzyme of tyrosine, the precursor of dopamine and octopamine, which are known to take part in the control of levels of insect developmental hormones, juvenile hormone [39], also, [40,41] they recorded that the two insecticides of pyrethroid and carbamate may contribute to an increase in acetylcholine (AChE) concentration to a critical level. El-Sheikh, [42] recorded that the using spinetoram cussed a significant decrease in alkaline phosphatases (APh). Yuan et al. [36] recorded that the tannic acid on acetyl choline esterase (AChE) in fourth-instar larvae of *Hyphantria cunea* (Drury), it had a significant decreased the activity of ACh E in the larvae.

Insecticides can influence the activity of metabolic enzymes such as esterase and the content of total protein [35]. Insects use protein and amino acids, along with carbohydrates and lipids, as energy content, which can be variable within the detoxification of chemical insecticides [32,43,33].

5. CONCLUSION

The interaction of a magnetic field with two pesticide treatments against *E. insulana* 2nd, 3rd and 4th instar larvae was studied in order to determine how much their toxicity increased after exposure. The LC_{50} values for Uphold after magnetization were 0.331, 0.607 and 0.859, whereas, LC_{50} values for Tracer were 3.823, 7.779 and 10.590 ppm, respectively. Some enzymes and biochemical contents have altered as a result of magnetization. Total proteins and free amino acids decreased significantly, while AchE and Alk-Ph increased significantly, resulting in a slower rate of feeding, decreased in weight larval and pupal stages and elongated development time with high increase in malformation.

Recent studies has highlighted the need for more research into the interaction of magnetic treatments with insecticides and *E. insulana*.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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