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IMPACT CERTAIN PLANT EXTRACTS ON TOXICITY, BIOCHEMICAL EFFECTS AND SOME BIOLOGICAL MEASUREMENTS OF PEACH FLY, *Bactrocera zonata* (SAUNDERS)

[22]

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ABSTRACT

Bactrocera zonata (Saunders) flies are the dangerous insect pests of fruit, vegetables, and nuts over the world. This study provides the published information on toxicity, biochemical effects and some biological measurements of the peach fly, *B. zonata* by using some plant extracts (phytochemicals) namely *Moringa oleifera* oil, lemon peel oil and *M. oleifera* leaf extract, which would be more informative for publication facilitating related to integrated pest management (IPM) strategies of *B. zonata*.

Effect of different concentrations of *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract on biochemical effects (total proteins, total carbohydrates and acetylcholine esterase enzyme) and some biological aspects (pupal mortality, pupal duration, adult emergence, emerged deformed adult and malformation score) of the peach fly, *B. zonata* were studied. Results showed that *M. oleifera* oil is highly toxic to pupae of the peach fly, *B. zonata* with LC_{50} of 2.569, 2.773and 2.370ml/L and LC_{90} of 85.459, 92.171 and 18.314ml/L in yellow, sandy and clay soils respectively. Whereas lemon peel oil come in the second position in order of toxicity and *M. oleifera* leaf extract was the least toxic compound.

These results cleared that concentrations of total proteins, total carbohydrates and acetylcholine esterase enzyme activity markedly decreased in pupae of *B. zonata* after exposure to *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract with highly significant effects compared with control. Obtained results showed that an inhibitory action of *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract at all each of concentration levels when mixed with three types of soils namely, yellow soil, sandy soil and clay soil compared with untreated .These results suggest that three tested plant extracts has the probably to be used as a natural plant productions to control of the peach fly, *B. zonata*.

Keywords: Plant extracts; Biochemical effects; Biological aspects; *Bactrocer azonata*

INTRODUCTION

Peach flies, *Bactrocera* spp. (Diptera: Tephritidae) prevalent in the tropics and subtropics (**Drew & Hancock, 1994**), and are considered as one of the most serious insect pests of fruits and vegetables world over. However, the maintain and protection of food crops from insect pest especially *Bactrocera zonata* (Diptera: Tephritidae) are most important in agricultural sectors (**Paul et al 2009**; **Ekesi et al 2016**). Peach fruit fly is considered polyphagous insect, which infested numerous types of fruit species such as peach, mango, guava and apple (**Hashem et al 2001**). Direct fruit damage, falling fruit, and loss of markets of export through quarantine constraints are the mechanisms by which infestation of fruit fly causes economic losses to the farmers. Due to dispersal capacity, high mobility, and fecundity, a lot of fruits and vegetables viz., peach, mango, guava, citrus, tomato, cucurbits etc. are infested by fruit flies which affecting the produce both qualitatively and quantitatively. *B. zonata* was recorded in Egypt in 1999, and caused several losses to a wide range of fruits including peach, mango, guava and apricot (**El-Minshawy et al 1999**).

Natural products in the form of plant solvent extracts have been suggested for the fruit flies control, however some of them have weak activity thus. Preserving above in view, the present investigation was proposed with the following objectives:

1) To know toxicity and biochemical effects of the three plant extracts against peach fly pupae, *B. zonata*.

2) To evaluate the same plant extracts mixed with three types of soils in the laboratory against peach fly pupae, *B. zonata*.

MATERIALS AND METHODS

The present investigation was conducted under laboratory condition. The materials used and methodology adopted for these experiments are described below:

1- Raising and Maintenance of Laboratory Culture

The general culture of fruit fly, *B. zonata* was raised from the laboratory colony reared in the Horticulture Insects Department, Plant Protection Research Institute, Dokki, Giza, Egypt. Peach fly was reared under laboratory conditions of 25 ± 3°C and 60 ± 5 % R.H. Larvae were reared on an artificial diet consisting of 500 ml water, 3 g sodium benzoate, 3 g citric acid, 84.50 g sugar, 84.50 g brewer's yeast and 330 g wheat bran. These constituents of were carefully mixed in a large plastic container. Then eggs were scattered on the surface of the diet which was placed in plastic plates of 175mL plastic cups (4.5 cm base diameter, 7.0cm top diameter, and 8.5cm height) that were tightly covered with muslin. After that, the plates were placed in a wooden cage with sand at the bottom to allow the jumping larvae to pupate (**Shehata et al 2006**). Adults of *B. zonata* were reared in a cage (100 × 30 × 30 cm) with wooden frames covered on each side with a metal screen. Flies were fed on sugar and enriched protein hydrolysate at a ratio of 3:1, respectively. The cage was supplied with plastic fruits that had several small pores (as an oviposition vessel). These plastic fruits were filled with about 3 ml water to receive and prevent drying of the eggs. Also, at the top of these plastic fruits, small plastic vials containing cotton priming soaked with guava juice were put to enhance egg laying within these false fruits. In order to meet their water requirements the flies were also provided with water saturated cotton swabs in a 20 ml plastic phial filled with water inside the cages. Plastic cups filled with water were placed below the legs of cages to avoid the entry of ants.

2. Laboratory evaluation of *Moringa oleifera* oil, Lemon peel oil and *M. oleifera* leaf extract as singly tested against pupal stage of peach fly, *Bactrocera zonata*

Different plant extracts, namely *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract were evaluated against *B. zonata* pupae in the laboratory. The list of products along with the other details of source of availability is given in **Table (1)**.

Table 1. List of different test materials used in the present study

Test material	Source
Lemon peel oil	Institute of Food Technology, Agricultural Research Center
Moringa oleifera oil	National Research Center, Moringa Production Unit
Moringa oleifera leaf extract	

3. Extraction

The collected plant parts (seeds, peels and leaves) of *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf, respectively were washed under tap water followed by distilled water and dried under shade. Dried samples were powdered in mixer/grinder. Powder of leaves was mixed with distilled water in a ratio of 1:1 (w/v) and left overnight to allow the constituents to get dissolved in water, then filtered through muslin cloth and 100% plant extract solution was prepared according to **El–Mohamedy and Abdalla (2014)**. Extraction of seeds and peels oil were prepared according to **Harvey and John (1898)** protocol. Each was used with three concentrations. 1.5ml of *M. oleifera* oil and lemon peel oil dissolved in 1L. distilled water to prepare a concentration of 1.5ml/L by adding tween 80 to disperse the oil in the solution and 3ml to prepare a concentration of 3ml/L; and so the remaining concentration to 6ml/L. By the same way the other concentrations of *M. oleifera* leaf extract (1.5, 3 & 6ml/L), were prepared without tween 80.

4. Biochemical Assays

Four hundred and five individuals of 1-dayold pupae were dipped for 10 seconds in three concentrations of each three tested extracts (*M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract) were collected and immediately kept in a deep freezer for biochemical analysis. Biochemical assay has been carried out to determine the effect of the concentrations of the three tested plant extracts on (total proteins, total carbohydrates and acetylcholine esterase enzyme) of, *B. zonata* pupae.

Total proteins were determined according to the method described by **Bradford (1976)**. The total carbohydrates were estimated in acid extract of pupae by the phenol-sulphuric acid reaction of **Dubois et al (1956)** and were extracted and prepared for assay according to **Crompton and Birt (1967)**. AchE (acetylcholine esterase) activity was measured according to the method described by **Simpson et al (1964)**, using acetylcholine bromide (AchBr) as substrate**.**

Data of latent effects and biochemical analysis were statistically analyzed according to completely randomized design (**Finney, 1971 & Snedecor and Cochran, 1972**).

5. Treated types of soils

Three concentrations of each *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract were used in toxicity determination. Concentrations, 1.5, 3 and 6 ml/L of the three tested extracts were mixing with three types of soils namely, yellow soil, sandy soil and clay soil. The concentrations were replicated 3 times. Each type of soil (150g) was thoroughly mixed with 15 mL of previously prepared concentration as mentioned above. Each soil with the previously indicated concentrations were individually transferred into 175 mL plastic cups(4.5 cm base diameter, 7.0 cm top diameter, and 8.5cm height) provided with perforated lids. The treated soil made a height of 5 cm in cups with 15gr.Ten pupae of *B. zonata* were exposed to each concentration. All concentrations were replicated 3 times. Untreated soil was used as a control with the same number of pupae and replicates. Numbers of pupae died were recorded after adult emergence. Mortality percentages were corrected for each concentration with control according to **Abbott (1925)**.

6. Morphogenetic Action of The Tested Plant Extracts Against Pupae of *B. zonata*

The morphological deformities resulted from treatment assessed as morphological deformities pupal- adult intermediates. The obtained malformations were evaluated as graded scoring system. The degree of morphological action (score) was evaluated by multiplying the number of pupae or adults by their numerical activity ratings and dividing the sum by the total number of treated pupae. An unaffected stage should receive a zero score; maximum observed response and not the maximum theoretical response should set the highest number. The total score were computed using the formula of **Redfern et al (1970).**

$$\frac{\textit{The treated individuals x degree of score}}{\textit{The total number of individuals}}$$

7. Statistical analysis

Regression toxicity lines were established for the tested plant extracts and the slope, LC_{50}, and LC_{90} values were estimated using Probit analyses (**Finney, 1971**). For biochemical investigations, calculated lethal concentrations of 50% of *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract were used for pupal treatments. The data recorded under laboratory condition was subjected to statistical analysis to find out the significance of the results obtained. SPSS 14 for windows software package was used for statistical analysis of biological aspects using least significant difference (LSD)

RESULTS AND DISSCUTION

In the present study, evaluation of some plant products as biopesticides were carried out in the laboratory against peach fly pupae. The results so obtained are presented hereunder:

1. Toxicity bioassays

This experiment was conducted to study the effect of *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract for their toxicity against pupal stage when mixed with three types of treated soil under laboratory conditions.

The results presented in **Table (2)** indicated that *M. oleifera* oil was the most potent plant extract to the pupal stage since the calculated values of LC_{50} and LC_{90} were 2.370, 2.569 & 2.773 and 18.314, 85.459 & 92.171 ml/L. in clay, yellow and sandy soils respectively. Whereas lemon peel oil come in the second position in order of toxicity recording the values of 3.754, 5.609 & 5.758and 17.142, 66.017& 48.429 ml/L. as $LC_{50}$and LC_{90}in clay, sandy and yellow soils respectively. *M. oleifera* leaf extract was the least toxic compound where the LC_{50} and LC_{90} values were 3.915, 5.549 & 7.429 and 77.142, 62.239 & 52.509 ml/L. in clay, sandy and yellow soils respectively. The toxicity index of three compounds at both levels of LC_{50} was calculated which could be arranged descendingly as follow: *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract. These results are in agreement with those of **Mosallam (1993)** who evaluated some pesticides as soil treatment (sand, silt and clay) against pupae of the *Ceratitiscapitata.* Pyriproxyfen was the most potent against the pupal stage of treatment.

Table 2. Toxicity of *Moringa oleifera* oil, lemon peel oil and *M. oleifera* leaf extract on pupae of *B. zonata* when mixed with treated soil

Treatment	N *	Lethal concentrations**		Slope ± SE	Toxicity index at LC_{50}
		LC_{50}	LC_{90}		
Moringa oleifera **oil**					
Yellow soil	30	2.569	85.459	4.654	-
sandy soil	30	2.773	92.171	4.627	-
Clay soil	30	2.370	18.314	4.459	-
Lemon peel oil					
yellow soil	30	5.758	48.429	3.946	2.241
sandy soil	30	5.609	66.017	4.104	2.023
clay soil	30	3.754	17.141	3.883	1.584
Moringa oleifera **Leaf extract**					
yellow soil	30	7.429	52.509	3.685	2.892
sandy soil	30	5.549	62.239	4.687	2.001
clay soil	30	3.915	77.142	4.413	1.652

2. Effect of The Tested Plant Extracts on Some Biochemical Effects of *Bactrocera zonata* Pupae

2.1. Total proteins

Data in **Table (3)** show that in all treatments of the 1-day old pupae of *B. zonata* with tested plant extracts caused a reduction in the level of total proteins where 12.11 mg/g. b. wt in the highest concentration that obtained with *M. oleifera* oil compared with 17.28and 17.49 mg/g. b. wt in the same concentration in lemon peel oil and *M. oleifera* leaf extract respectively while in case of control was 24.13 mg/g. b. wt. Regard to the respecting pupae total proteins show highly significant difference between control and the tested plant extracts. These results are in agreement with those of **Halawa et al (2013)** who showed that the level of total proteins were decrease in the activity in *B. zonata* pupae resulted from Beticol, Biosad, Elsan, Lufox, Mani, Match and Radiant during all tested periods as compared to control. Recently (**Farag et al 2017**) reported that both Biomectin and Tracer showed toxic effects to *B. zonata* flies, the amount of protein level decreased in treated flies compared to control.

2.2. Total carbohydrates

For total carbohydrate concentrations in *B. zonata* pupae, the tested plant extracts were highly significant reduced the total carbohydrates concentrations (0.72, 1.47 and 2.01 mg/g. b. wt) at the highest concentrations of *M. oleifera* oil, *M. oleifera* leaf extract and lemon peel oil, respectively comparing with untreated pupae (3.10 mg/g. b. wt) **Table 3**. These results are in agreement with those of **Sharma et al (2011)** cleared that the Carbohydrate (glucose) levels were increased to 27.87% and 46.8%, respectively in anopheline larval tissues after treatment with petroleum ether extract of *Artemisia annua* and methanolic extract of *Azadirachta indica*. In culicine larvae, glucose levels were reduced to 58.96% and 24.65%, respectively.

Table 3. The effect of certain plant extracts on biochemical constituents of *B. zonata* pupae after dipping for 10 seconds

Treatment	Concentration ml/L	Total proteins (mg/g.b.wt)	Total carbohydrates (mg /g.b.wt)	AchE enzyme (µg Ach Br/min/g.b. wt))
***Moringaoleifera* oil**	1.5	18.28	2.63	64.15
	3.0	16.68	1.38	64.01
	6.0	12.11	0.72	60.96
lemon peel oil	1.5	19.48	2.81	69.87
	3.0	18.60	2.31	63.20
	6.0	17.28	2.01	53.39
***Moringaoleifera* leaf extract**	1.5	22.22	1.98	66.13
	3.0	20.79	1.60	66.43
	6.0	17.49	1.47	60.86
Control	-	24.13	3.10	75.96
F. test		**	**	**
L.S.D		0.428	1.149	2.931

2.3. AchE enzyme activity

Data tabulated in **Table (3)** show that the activity of AChE enzyme in pupae of *B. zonata* was highly significant decreased in the tested plant extracts compared to control. It was 53.39, 60.86 and 60.96µg Ach Br/min/g.b. wt at the highest concentration of lemon peel oil, *M. oleifera* leaf extract and *M. oleifera* oil than that obtained with control 75.96µg Ach Br/min/g.b. wt, respectively. Ach E is a key enzyme which terminates never impulses by catalyzing the hydrolysis of neurotransmitter acetylcholine, in the nervous system of different organisms. Additionally, it's known that, the altered Ach E activity, is one of the main resistance mechanisms in many insects **(Wang et al 2004 and Nathan, 2013).** The obtained results are in agreement with those of **Halawa et al (2013)** who showed that the activity of AChE enzyme in the 2-day pupae of peach fruit fly, *B. zonata*was generally decreased in treatment with Biosad, Elsan, Lufox, Mani, and Match compared to untreated. Similarly **Farag et al (2017**) illustrated that activity of acetylcholine esterase decrease in treated individuals with Biomectin and Tracer compared to untreated ones.

3. Laboratory evaluation of *Moringa oleifera* oil, lemon peel oil and *M. oleifera* leaf extract as singly tested against pupal stage of peach fly, *B. zonata*

The tested plant extracts namely *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract were evaluated in the laboratory against peach fly pupae, *B. zonata*, by mixing the three types of soils at the required concentration and the results of these experiments are as below:

3.1 Effect of *Moringa oleifera* oil, lemon peel oil and *M. oleifera* leaf extract on some biological measurements

3.1.1 Effect of pupal mortality

Effect of *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract on percentage of pupal mortality at different concentrations 1.5, 3 and 6ml/L are shown in **Tables (4, 5 & 6).** Generally, data indicated that percentage of pupal mortality were increased gradually with increase concentration and the percent mortality showed noticeable higher values were 6, 5 & 4.66 in treated yellow soil and values were 6.33, 5 & 5 in treated sandy whereas, in clay soils the values were 7, 6.33 & 6 at concentration of 6ml/L respectively.

Table 4. Effect of lemon peel oil, *Moringa oleifera* oil and *M. oleifera* leaf extract on *B. zonata* pupae* when mixed with yellow soil

Treatment	Concentration ml/L	Pupal mortality	Pupal duration /day	% Adult emergence	%Emerged deformed adult	Malformation score
Lemon peel oil	1.50	2.00	7.00	80.00	20.83	1.33
	3.00	3.66	10.00	63.33	37.27	2.33
	6.00	5.00	12.00	50.00	41.10	2.17
***Moringaoleifera* oil**	1.50	4.00	8.00	60.00	21.70	1.63
	3.00	5.66	9.33	43.33	23.33	2.33
	6.00	6.00	14.66	40.00	26.10	2.30
***Moringaoleifera*leaf extract**	1.50	1.66	6.00	83.33	15.73	0.33
	3.00	2.33	8.00	76.66	25.57	1.00
	6.00	4.66	9.66	53.33	35.93	1.47
Control	-	0.66	7.00	93.33	0.00	0.23
F. test		**	**	**	**	**
L.S.D		1.002	0.695	10.020	3.258	0.222

* (3 replicates each 10 pupae)

Table 5. Effect oflemon peel oil, *Moringa oleifera* oil and *M. oleifera* leaf extract on *B. zonata* pupae when mixed with sandy soil

Treatment	Concentration	Pupal mortality	Pupal duration /day	% Adult emergence	% Emerged deformed adult	Malformation score
Lemon peel oil	1.50	2.33	8.33	76.66	13.10	0.70
	3.00	4.00	12.66	60.00	21.70	1.67
	6.00	5.00	14.66	50.00	26.10	2.13
***Moringa oleifera* oil**	1.50	4.33	7.00	56.66	18.10	1.03
	3.00	4.66	11.00	53.33	18.87	1.67
	6.00	6.33	12.66	36.66	27.77	2.90
***Moringa oleifera* leaf extract**	1.50	4.00	6.66	60.00	22.20	0.33
	3.00	4.66	10.00	53.33	24.50	0.67
	6.00	5.00	11.66	50.00	53.33	1.27
Control		1.00	7.66	90.00	0.73	0.50
F. test		**	*	**	**	**
L.S.D		0.775	1.413	7.752	6.208	0.418

Statistical analysis assures that there were highly significant differences between the three tested plant extracts and control in three tested types of soils. These results are in agreement with those of **Negm (2014)** who cleared that the tested concentrations of Novaluron significantly reduced pupal mortality of *B. zonzta*.

3.1.2 Effect of pupal duration

Results obtained in **Tables (4, 5 & 6)** revealed that percentages of pupation were increased gradually which showed higher value recording 12.00, 14.66 & 9.66 day in treated yellow soil and 14.66, 12.66 & 11.66 day in treated sandy soil and 15.00, 16.33 & 14.00 day in treated clay soil at the highest concentration when treated with lemon peel oil, *M. oleifera* oil and *M. oleifera* leaf extract respectively. In general, lemon peel oil, *M. oleifera* oil and *M. oleifera* leaf extract caused elongated the pupal duration when the concentrations were increased. Statistical analysis of the data revealed that this increase in pupal duration was significant for the three tested plant extracts compared with untreated in treated sandy soil while was highly significant differences in treated yellow and clay soils.

3.1.3 Effect of% adult emergence

In case of treated soils with *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract it was found in Tables (4, 5 & 6) that adult emergence was concentration-related. It decreases with increase of concentrations until reach to very low emergence (40.00%, 50.00% & 53.33%) in treated yellow soil respectively at the highest concentration (6ml/L) compared with untreated counterparts (control) which was 93.33%. While in treated sandy soil adult emergence decrease in treatment with *M. oleifera* oil which reach to very low emergence (36.66%) compared with lemon peel oil (50.00%) and *M. oleifera* leaf extract (50.00%) at the highest concentrations and control was 90.00%. In case of treated clay soil, adult emergence was very low decreased compared with treated yellow and sandy soils which reached to 30.00% , 36.66% and 40.00% at the highest concentrations when treated with *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract respectively. This decrease was highly significant concerning the three tested plant extracts and control in three tested types of soils. The obtained results are in agreement with those of **Abo El-mahasen et al (2010)** who found that a reduction in adult emergence of house fly which was completely inhibited at 1000 and 2000 ppm of Pyriproxyfen (insect growth regulutors)**. Negm (2014)** who showed that the tested concentrations of Novaluron significantly reduced adult emergence of *B. zonzta*.

3.1.4. Effect of %Emerged deformed adult

According to the concentrations of lemon peel oil, *M. oleifera* oil and *M. oleifera* leaf extract which mixed the yellow, sandy and clay soils, the percentage of emerged deformed adult was concentration dependent where it reached the maximum values as 41.10%, 26.10% and 35.93% respectively in yellow soil while in treated sandy soil as 26.10%, 27.77% & 53.33% and in treated clay soil were 44.43%, 55.50% & 55.50 % respectively at a concentration of 6ml/L. Pupae and emerged adult flies showed different scores of deformities in all parts of the body; plates(a, 1-2-3-4 -5) cleared pupal-adult intermediate individuals. It is likely that all these deformities could attributed to the interference of the three plant extracts with the hormonal system of pupae and adults. Statistical analysis of the data revealed that there were highly significant differences between the three tested plant extracts and control in three tested types of soils **(Tables 4, 5 & 6)**. The results are also in agreement with those reported by **Kelany *et al.* (1991)** who found a different grades (scores) of deformities in emerged flies of *M. domestica* when treated with aqueous neem seed kernel extract. **Hussein (1995)** mentioned that the vetiah oil and clove oil caused 28.0% and 20.5% malformation in pupae of *Parasarcophaga aegyptiaca* respectively. These results are in harmony with those obtained by **Selem (2005)** who found that treatment of 3rd larval instar of *M. domestica* with NeemAzal-T and galangal extract caused abnormalities in larvae, pupae and adults. **Khalil et al (2010)** who stated that Pyriproxyfen induced high malformations percentage in the adult fly of *M. domestica*.

3.1.5. Malformation score

Results in **Tables (4, 5 & 6)** showed that mean of malformation score of deformed adults produced after treatment with *M. oleifera* oil were increased gradually which showed higher value recording 2.90, 2.73 & 2.30 at the highest concentration in sandy, clay and yellow soils respectively. The same trend, in treatments with lemon peel oil and *M. oleifera* leaf extract which cleared at the highest concentration, the highest values were 3.07, 2.17 & 2.13 and 1.93, 1.47 &1.27 in clay, yellow and sandy soils, respectively. Statistical analysis showed that there were highly significant differences between the three tested plant extracts and untreated in three tested types of soils. The present results are in conformity with those reported by **Fahmy et al (2013)** who recorded the morphogenetic activity as larval-adult and pupal-adult intermediates of *B. zonata* resulting from IGRs treatment where the EC_{50} values for 1-day pupae were 2.80, 1450 and 5000 ppm, for Pyriproxyfen, Methoxyfenozoide and Novaluron, respectively.

Table 6. Effect of lemon peel oil, *Moringa oleifera* oil and *M. oleifera* leaf extract on *B. zonata* pupae when mixed with clay soil

Treatment	Concentration	Pupal mortality	Pupal duration /day	% Adult emergence	%Emerged deformed adult	Malformation score
Lemon peel oil	1.50	2.00	10.00	80.00	28.93	1.63
	3.00	4.66	13.66	53.33	37.60	2.60
	6.00	6.33	15.00	36.66	44.43	3.07
***Moringa oleifera* oil**	1.50	3.66	9.00	63.33	31.70	2.43
	3.00	6.00	12.33	40.00	41.67	2.40
	6.00	7.00	16.33	30.00	55.50	2.73
***Moringa oleifera* leaf extract**	1.50	3.66	8.66	63.33	31.70	1.20
	3.00	4.00	12.66	60.00	44.27	1.67
	6.00	6.00	14.00	40.00	55.50	1.93
Control	-	1.33	8.66	86.66	1.46	0.27
F. test		**	**	**	**	**
L.S.D		1.069	1.016	10.685	10.144	0.399

Deformed pupae and adults produced after treatment of the three types of soils with *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract and then offered to pupae of *B. zonata* could be explained as follow:

A- Pupal-adult intermediate (Pupal- adult intermediate (incomplete adult exclusion)

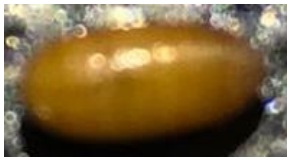
This type of deformed individual posses the external character of pupae (covered with pupal exoskeleton), but has a distinct adult head or distinct adult head and thorax. This intermediate individuals may be elongated, pigmented twisted or twisted as shown in plates (a. 1-2-3-4 -5). These deformations of resulted Pupal-adult intermediate appeared in the following cases:

a- Head only emerged from the pupalexuviae, plate (a. 1)

b- Deformed head and part of thorax emerged, plate (a. 2-3)

c- Partially eclosed adult with deformed thorax and poorly developed wings. The abdomen failed to exuviate, plate (a. 4).

Adult completely free from pupal exuvia except one of wing, plate (a. 5).



A

Normal pupa

A.1

a.1- part of head enclosed from the puparium.

a.2

a. 2- Deformed head and part of thorax enclosed.

a.3

a. 3- Deformed head and longer part of thorax enclosed.

a.4

a. 4- Deformed head, thorax and part of abdomen enclosed.

a.5

a. 5- Adult completely free from pupal exuvia except one of wing.

B- Deformed adults

Morphological abnormalities in adult stage were revealed after treated pupae of *B. zonata* with *M. oleifera* oil, lemon peel oil and *M. oleifera* leaf extract. These deformations of resulted adult flies appeared in the following cases:

Adults succeed to get loose from the pupal exuvia. These adults possessing different forms of deformation indicating abnormal eclosion as shown in the following cases:

1- Abnormal adult fly with severely curled wings, plate (b.1).

2- Deformed adult fly with obvious enlarged thorax and crumpled wing, one wing had broken, plate (b.2).

1-

♂ ♀

A (Normal adult)

b.1 **b.2**

b.1- Deformed adult with severely curled wings.
b.2- Deformed fly with obvious enlarged thorax and crumpled wing, one wing had broken.

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تأثير بعض المستخلصات النباتية على السمية، والتأثيرات البيوكيميائية وبعض القياسات البيولوجية لذبابة الخوخ *Bactrocera zonata* (Saunders)

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الموجـــــز

تعتبر ذبابة الخوخ من الآفات الحشرية الخطيرة التى تصيب الفاكهة والخضروات والمكسرات فى جميع أنحاء العالم. توفر هذه الدراسة معلومات عن السمية، التأثيرات البيوكيميائية وبعض القياسات البيولوجية لذبابة الخوخ بإستخدام بعض المستخلصات النباتية التى يمكن إستخدامها فى برنامج المكافحة المتكاملة لهذه الحشرة. تم دراسة تأثير تركيزات مختلفة من زيت المورينجا، زيت قشر الليمون ومستخلص ورق المورينجا على التأثيرات البيوكيميائية (البروتين الكلى، الكربوهيدرات الكلية و أنزيم الأستيل كولين استريز) وبعض النواحى البيولوجية (الموت العذرى، مدة طور العذراء، خروج الحشرات الكاملة، الحشرات الكاملة المشوهة ودرجة التشوة) لذبابة الخوخ. أوضحت النتائج أن زيت المورينجاكان أكثر المستخلصات النباتية سمية لعذارى ذبابة الخوخ حيث سجل التركيز الذى يؤدى لموت 50% من العذارى 2.569 و 2.773 و 2.370 مل/لتر، بينما كان التركيز الذى يؤدى لموت 90% من العذارى كان 85.459 و 92.171 و 18.314 مل/لتر عند خلطها بالتربة الصفراء والرملية والطينية على التوالى. بينما احتل زيت قشر الليمون المركز الثانى فى السمية وأخيراً مستخلص ورق المورينجا. أظهرت النتائج أن تركيزات البروتين الكلى، الكربوهيدرات الكلية ونشاط أنزيم الأستيل كولين استريز تأثرت بشكل ملحوظ فى عذارى ذبابة الخوخ بعد التعرض لتلك المستخلصات النباتية حيث كان التأثير عالى المعنوية مقارنة بمعاملة العينة الضابطة. كما أظهرت النتائج أن هناك تأثير مثبط لتلك المستخلصات المستخدمة عند كل التركيزات عند خلطها مع ثلاثة أنواع من التربة (الصفراء والرملية والطينية) مقارنة بالعينة الضابطة. تشير هذه النتائج إلى احتمالية إستخدام تلك المستخلصات النباتية المختبرة والتى تستخدم كمنتجات نباتية طبيعية لمكافحة ذبابة الخوخ.

الكلمات المفتاحية: المستخلصات النباتية، تأثيرات حيوية، ذبابة ثمار الخوخ

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