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Effects of Crude Plant Extracts from Five Parts of *Melia azedarach* on *Tribolium confusum*

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Abstract—***Tribolium confusum*** **is one of the most common pests of many commodities, especially cereals and their products. These pests are known for being the most destructive insect pests attacking and infesting stored flour and grain in soil, warehouses, grocery stores, and homes. Therefore, this study aims to control these pests with an environmentally friendly, healthier, and cost-effective pesticide instead of the common artificial chemicals to practice the current management of cereal storage pest control in the Kurdistan Region of Iraq. For this to be achieved, the toxicity effect of crude plant extracts from five different parts of** ***Melia azedarach*** **in tap water with concentrations of 50%, 60%, 70%, 80%, and 90% at different times (2, 4, 6, 8, and 10 h) against stored-product insect was tested. The toxicity effect of these extracts varied based on the crude plant part extracts, concentrations, and exposure period according to the SAS system investigation on the mortality rate of** ***T. confusum*** **adults (Duncan test). The extracts' compatibility with treated adults of** ***T. confusum*** **in the clear petri dish was noted. Besides, the number of dead adults was measured by loss of motion.**

***Index Terms*—Crude plant extract, *Melia azedarach*, *Tribolium confusum*, *Mortality*.**

I. Introduction

The quantitative and qualitative agricultural saved yields are important sources of world food. They are getting lost by the attack of more than 600 species of beetle pests (Rajendran, 2002; Kostyukovsky and Trostanetsky, 2006; Meena, Suhag and Prates, 2006; Stejskal, et al., 2015). Confused flour beetle Species (*Tribolium confusum*), Family: Tenebrionidae, and Order: Coleoptera is one of the most common beetles that have a crucial impact on different types of stored cereal (Soomro and Sultana, 2018; and Gharsan, et al., 2018). Since different types of control for insect contamination are a major problem in food commodities of food industries (Isman, 2006), many different materials are tested on protecting cereal yields against insect pests in storage (Adler, Ojimelukwe and Tapondjou, 2000; Weaver and Subramanyam, 2000; Isman, 2006).

Chemical materials are commonly used as pesticides in crop protection, which cause environmental pollutants and have undesirable effects on animals and human beings. Thus, bioinsecticides have been used as various strategies for controlling insect pests in recent years (Khambay, et al., 2002; Hashim and Devi, 2003; and Nathan, et al., 2005).

The method of insect control with plant extracts has a great impact on insects, including ovicidal, repellent, antifeedant, sterilization, and toxic effects in insects, for instance, the toxicity may happen through contact, and ingestion, or through fumigant action (Isman, 2006). The extract compounds from some chemotypes of the common Name: Bead Tree, Kurdish Name: Zhehre Masi, Species: *Melia azedarach*, Family: Meliaceae, and Order: Sapindales have been reported to be toxic to insects (Kanver, Rao and Batra, A., 2014).

The present study aimed to test the natural plant extract of *M. azedarach* in different concentrations and times against the severe crop-product pest (*T. confusum*).

II. Materials and Methods

A. Plant Extract

First, fresh plant parts of *M. azedarach*, such as a premature leaf, mature leaf, flower, pre-mature fruit, and mature fruit were collected from Koya town. Then, plant parts are washed with water, dark-shade dried, and grind to powder using an electric blender. Followed by, about 20 g of each plant part's powder being soaked in 100ml of tap water in different glass bottles. After 1 day, the solutions were filtered using filter paper and stored in a glass container in a refrigerator (4°C) (Negahban, Moharramipour and Sefidkon, 2007). Finally, plant part extracts were tested to determine the mortality percentage of *T. confusum* adults.

B. Insect Collection

Two to three weeks old adults of confused flour beetle (*T. confusum*) were collected and separated from the contaminated flour and rice (Mohamed, Zaitoun and Singer, 2013). The insect was reared in a hot place approximately at 30°C before the test.

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C. Mortality Test

The extracted parts of the plant were used to test the adult mortality rate of *T. confusum*. The extracts were mixed with tap water to make different concentrations (50%, 60%, 70%, 80%, and 90%). The filter paper was placed inside the petri dish (6 cm diameter) and then 10 adults of the insect were released into each petri dish. After that, they were sprayed with each concentration from each part of the plant until the insect body was rushed. The same number of insects was treated with tap water and used as a control in the test. Four replications were done for each concentration and control in each part of the plant (Sahaf, Moharramipour and Meshkatalsadat, 2008). The adult confused flour beetle mortality was recorded at 2, 4, 6, 8, and 10 h after the treatment. The number of insect mortality was measured using direct observation with naked eyes, and when the insect has no motion, the insect was considered dead (Muhammad, 2008).

III. Results and Discussion

This study was conducted to determine the insecticidal activity of chemical materials in the crude plant part extracts of *M. azedarach*, they were used on the adult of *T. confusum*. The different rates of insect mortality were caused by the impact of different crude plant part extracts of *M. azedarach* regarding different concentrations and times.

The relation between five crud plant extracts (A) of *M. azedarach*, which was prepared into five different concentrations with control (B) at five different periods of exposure (C) on the adult of Confused Flour Beetle (*T. confusum*) is presented in Table I. The efficiency of crude plant extract of the pre-mature leaf was tested against concentrations of 50% and 60%. The concentration of 50% for mature leaf crude plant extracts showed the lowest effect on the mortality rate of *T. confusum* adult after 2 h, which was about 0.00%. However, the highest mortality rate at the same period of exposure was raised to 40% for mature fruit crude plant extract at 90% concentration. After 4 h treatments, the value of minimum mortality rate was recorded, which was 2.50% against 50%, 60%, and 70% concentration for the immature leaf crude plant extract determined for confused flour beetle adult and the loftiest mortality rate was 77.50% at a concentration of 90% was found for crude plant extract of the mature fruit. The minimum toxicity effects of mortality rate for the crude plant part extracts against *T. confusum* were about 2.50% after 6 h at concentrations of 50% and 60%. However, the maximum mortality rate was escalated to 92.00% after 6 h treatments

TABLE I
Illustrate the Interactions between Crude Plant Part Extracts (A), Crude Plant Part Extract Concentrate (B) and Mean Mortality % of Adult Tribolium Confusum at Different Exposure Periods (h) (C)

Crude plant part extract (A)	The concentration of plant part extract (B)	Mean mortality % of adult *Tribolium confusum* at different exposure periods (h) (C)					
		(2) h	(4) h	(6) h	(8) h	(10) h	p value
Pre-mature leaf	C	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	non
	50	0.00±0.00	0.00±0.00	2.50±2.50	2.50±2.50	2.50±2.50	0.7362
	60	0.00±0.00	2.50±2.50	5.00±2.88	5.00±2.88	7.50±2.50	0.2837
	70	5.00±2.88	5.00±2.88	5.00±2.88	10.00±2.88	20.00±4.08	0.0092
	80	12.50±2.50	15.00±2.88	20.00±4.08	25.00±2.88	35.00±2.88	0.0009
	90	15.00±2.88	17.50±4.78	30.00±4.08	37.50±4.78	52.50±4.78	0.0001
Mature leaf	C	0.00±0.00	0.00±0.00	2.50±2.50	2.50±2.50	5.00±2.88	0.4146
	50	0.00±0.00	5.00±2.88	5.00±2.88	10.00±4.08	10.00±4.08	0.1916
	60	5.00±2.88	7.50±2.50	15.00±2.88	15.00±2.88	17.50±2.50	0.0226
	70	7.50±2.50	12.50±2.50	15.00±2.88	17.50±2.50	27.50±2.50	0.001
	80	17.50±2.50	27.50±2.50	32.50±2.50	37.50±2.50	47.50±6.29	0.0014
	90	20.00±4.08	35.00±6.45	42.50±4.78	52.50±2.50	62.50±4.78	0.0001
Flower	C	2.50±2.50	2.50±2.50	2.50±2.50	5.00±2.88	5.00±2.88	0.8961
	50	15.00±5.00	17.50±2.50	22.50±4.78	22.50±4.78	22.50±4.78	0.6519
	60	15.00±5.00	17.50±2.50	22.50±4.78	22.50±4.78	22.50±4.78	0.6519
	70	22.50±2.50	37.50±4.78	45.00±5.00	47.50±6.29	52.50±4.78	0.0084
	80	40.00±4.08	57.50±4.78	65.00±5.00	72.50±4.78	72,50±4.78	0.001
	90	45.00±2.88	67.50±2.50	77.50±6.29	77.50±6.29	77.50±6.29	0.0016
Pre-mature fruit	C	0.00±0.00	2.50±2.50	2.50±2.50	2.50±2.50	2.50±2.50	0.9052
	50	10.00±4.08	20.007.07	27.50±10.30	37.50±8.53	42.50±6.29	0.0522
	60	15.00±2.88	20.00±4.08	27.50±4.78	35.00±6.29	37.50±6.29	0.0313
	70	12.50±4.78	30.00±7.07	32.50±8.53	45.00±6.45	45.00±6.45	0.0227
	80	27.50±2.50	35.00±2.88	47.50±4.78	50.00±7.07	55.00±6.45	0.0091
	90	35.00±6.45	47.50±2.50	55.00±2.88	65.00±2.88	75.00±6.45	0.0002
Mature fruit	C	2.50±2.50	2.50±2.50	2.50±2.50	2.50±2.50	5.00±2.88	0.9413
	50	10.00±4.08	22.50±4.78	32.50±4.78	37.50±2.50	40.00±4.08	0.0007
	60	12.50±4.78	27.50±2.50	40.00±4.08	50.00±4.08	55.00±6.45	0.0001
	70	32.50±7.50	47.50±7.50	50.00±5.77	60.00±5.77	62.50±4.78	0.0326
	80	42.50±4.78	57.50±2.50	70.00±8.16	77.50±6.29	82.50±4.78	0.001
	90	60.00±4.08	77.50±4.78	97.50±2.50	100	100	0.00

with 90% concentrations for mature fruit crude plant extract against the adult of *T. confusum*. The mortality of adult insects that were affected by *M. azedarach* crude plant extract of pre-mature leaf was recorded at the lowest rate of about 5.00% after 8 h at concentrations of 50% and 60%. On the other hand, at the same time, the highest mortality rate was elevated to 100% at 90% concentration for mature fruit crude plant extracts. Finally, after 10 h of treatment, the lowest mortality rate was 5.00% with 50% concentration against the adult of *T. confusum* which was fixed for pre-mature leaf crude plant extract, while the highest mortality rate of 100% after 10 h was found at 90% concentrations of mature fruit crude plant extract of *M. azedarach*. This study investigated the activity of the crude plant extract of the fruit of the Argentinian *M. azedarach* L. (Meliaceae). The use of these plant extracts as a pesticide has an effective potential impact on pest control programs (Mariäa, et al., 2003). The obtained data from the Crude plant extract of *M. azedarach* fruit contributes to a better understanding of the toxicity action as a bio-insecticide (Al-Mehmadi and Al-Khalaf, 2010).

Overall, the results from this investigation indicate that the mature fruit crude plant extract was able to induce more than three-fourths mortality at 4 h, and reached its maximum value of 100 at 8 h of treatment. The results for the other crude plant part extracts against the adult of *T. confusum* show encouraging results that agree with the study that was done by Ali and Mohammed in 2013, who showed that the effect of the extracts as a pesticide was raised with the exposure time with increasing concentration. Besides, it was established that there were mortality rates in all concentrations and times for extracts of five crude plant part extracts of *M. azedarach* on the adult of *T. confusum* compare to the controls. Sensitive species of Coleoptera seem to be affected particularly by this crude plant extract to a point that in many cases toxicity defunct values are as high as 90–100% (Mariäa, et al., 2003).

IV. Conclusion

Using this natural fast-acting insecticide, we may have a sustainable strategy for improving the insecticide's ability to control *T. confusum* adults as it is cost-effective, and environmentally friendly to human beings and the rest of the ecosystem. Notably, the most active part of the *M. azedarach* plant was the mature fruit crude plant part extracted from the procured mortality data; hence, *T. confusum* can be controlled using this method.

From the results, the effectiveness of crude plant extracts from the five plant parts of *M. azedarach* as an insecticide, the following can be concluded:

1. The crude plant extracts can be used to control the adults of *T. confusum*, especially the mature fruit of the plant.
2. Reducing the environmental impact which otherwise could be caused by dangerous artificial pesticides.
3. This fast-acting insecticide is cost-effective.

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