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Field Evaluation of the Efficacy of *Moringa oleifera* in Controlling Two Main Pests, *Aphis gossypii* and *Bemisia tabaci* Infesting Tomato Plants

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Abstract: The sweet-potato whitefly *Bemisia tabaci* (Genn.) is one of the insect vectors of plant diseases, which cause great damage to plants. Furthermore, cotton aphid is the most important insect challenging field tomato production. Although, there are some insecticides coast and environmental hazard necessitates the development of management options. With this intent extracts of *Moringa oleifera* target plant were evaluated for their insecticidal property. The maximum of eggs and nymphs/plant for whitefly, were recorded from untreated chick while the minimum was from seeds extract. The grand mean total of mortality percentage for cotton aphid was calculated in plots treated with seeds and leaves extract (12.59% and 12.43%, respectively). *B. tabaci* has resistance to synthetic insecticides now. The preliminary evaluation under field conditions for evaluating the effects of moringa extracts was evaluate against the count of eggs and nymphs of whitefly. Data recorded show that seeds and leaves extracts was significantly effective in preventing oviposition by adult whitefly on tomato foliage, while the flowers and stem extracts represent lowest effect. The relationship between concentrations and mortality percentage is important in this study, because the increasing of concentrations increase their efficacy. This study indicated that all botanical tested except that of stem extract had shown sufficient aphicidal and white fly effect which was significantly different from control population.

Key words: *Moringa oleifera* · Phyto-Insecticides · Ovipositional Or Repellent Effects · Tomato Plant · *Bemisia tabaci* · *Aphis gossypii*

INTRODUCTION

Sweet potato whitefly, (Hemiptera: Aleyrodidae) and cotton aphid, cotton aphid, (Homoptera: Aphididae) are a harmful and the most problematic insects in the world. Whitefly was first described in 1889 as a pest of tobaco as *Aleyrodes tabaci* [1]. The potential damage to the tomato crops and the coast of management has been exceptionally high avoiding whiteflies infestation help to reduce viral damage to the crops. Further, many authors studied the efficacy of phytopesticides within the recommended programme for controlling the target two pests [2-5]. Damage of whitefly feeding to tomato yield is both directly through phloem-feeding and indirectly by the transmission of plant viruses such as tomato yellow leaf curl viruses [6]. *Aphis gossypii* Glover causes sever damage and reducing plant vigour beside the secretion of honeydew and transmission of several viruses.

Studies screened 20 plant materials for their insecticidal properties in the form of aqueous extracts against some insect pests [7-13]. Over the decades chemical pesticides are the safe application methods as a standard practice to control many insects in the field [14, 15]. Among the diverse environmental -friendly and safe strategies for pest management, bio-pesticides had the priority methods alternative to chemical pesticides [16]. The effectiveness of bio- pesticides is known for their use for many years worldwide in all the agricultural zones [17]. Botanical extracts are less harmful to the environment and their use avoids the development of insect resistance.

Medicinal extracts are used worldwide since ancient times [18]. Moringa plants have been biological; lesser side effects and coast activities. More than two decades, entomologists have started to look for other tools to combat these pests, especially after the increase

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of environmental pollution and human diseases caused by the indiscriminate use for chemical pesticides on crops, which caused a lot of harmful diseases such as cancer, renal failure, diseases of liver and respiratory system [19, 20].

Medicinal plants such as moringa tree *M. oleifera* Lamk. Fam. Moringaceae) used by as a source of medicines since a long time [18]. It is used as medicinal herbs, due to their natural cost; effectiveness and lesser side effects.

Moringa oleifera is commonly known as drumstick-tree or horse radish-tree. It is used as human food and in the same time used as repellent against plan pests. *M. oleifera* is a small graceful tree with sparse foliage often planted in fencing in Egypt.

However, apart from its traditional medicinal and nutritional uses, there are several reports on the physiological activities of the target plant.

Despite the popular use of moringa leaves and seeds for medicinal treatment there is limited data available regarding to agricultural treatments. The leaves are also rich source of essential amino acids such as methionine, cystine, trytophan and lysine with a high content of protein, with the exception of the work of Butain and Verma [21] who found that some different pests attacking drumsticks tree and it is also used for pest control [22]. The objective of the present study is directed towards evaluating repellence and biological effects of moringa leaf and stem bark extracts for the control of aphids and white fly insects).

MATERIALS AND METHODS

The fresh leaves; seeds; stem and flowers of *Moringa oleifera* were collected from special farm in Menofia Governorate. The leaves were destalked, washed and shade dried at ambient temperature with constant turning adverts fungal growth. The stem bark was prepared by the same methods for preparing leaves. The leaves, the stem barks, seeds and flowers were crushed separate using an electric blender and all were stored in 4.0°C temperature in refrigerator in well labelled air -tight containers for analysis.

Preparation of Extracts: About one kg of stem bark; leaves; seeds and flower from moringa plant had been powdered was extracted with one litter of 70% methanol and incubated for three weeks at room condition. Ten gram of dried powdered (leaves, stembarks, seeds and flowers) of the target plant were extracted successively with 200 ml of EtOH in an orbital shaker for 24 h at room temperature. The extracts were filtered using Whatman No.1 filter paper to remove extractable substances at every 3 h interval. The combined extracts were then evaporated with rotary evaporator and the dried extracts were then evaporated with rotary evaporator and the dried extracts were stored at 3°C in two different sterile containers. Ten g of leaf extract was re-suspended in 1000 ml 70% EtOH and decolorized with charcoal. After filtration and lyophilization, the decolorized extract was suspended again in 100% dd H_2O (500 ml) and stirred for 10 min. The centrifuged and the supernatants collected. Subsequently, the supernatant was completely dried under reduced pressure to give two fractions: (1) a water dissoluble fraction, (2) a water indissoluble fraction of which precipitate was collected and dried.

Location of Confining Study: Experimental work was carried on the special farm at El-Sadat region, from March to June 2019, a time of pests activity. During these months the temperature ranged from 25 to 28°C. The land of the experimental plot was ploughed two times. The weeds and stubbles were removed from the field. Several holes were made every 50 cm interval and line to line 1 meter. About 25-30 days old tomato seedling were purchased from lCal El-Sadat city. Four weeks old healthy seedling of *Lycopersicon esculentum* were transplanted in the plot size 5x3 m with a spacing of 60x60 cm. The experimental area is about 400 m^2. White fly infestation started after one month of planting. Small netted nylon bags of si10x20 cm were used to cover the infested leaves. Five infested leaves from the plant were selected and covered with nylon bags. The numbers of the adult flies on the trapped leaves were recorded. The extracts of the tested parts were prepared from leaves, stem bark, seeds and flowers and made into concentrations of 1, 3 and 5%. Phosphorus insecticide Dimethoate (0.03%) was used as a standard check and water spray was used as a control. The prepared extracts concentrations sprayed on covered leaves through nylon net with help of small spray pump and labelled properly. Then the number of dead adults were recorded at the determined times. The mean number of dead adults on 5 leaves /plant were recorded and tabulated.

Among, *A. gossypii,* the experiment was laid out in RCB Design with five replications consisting of five treatments. The plot size was 3.0m x 2.0m with spacing of 0.5 m, 1.5m and 2.5 m between row, plot and replications,

respectively. Four botanicals extract, chemical insecticide as standardcheck and untreated control were evaluated using lCal field tomato. The treatments were applied when the aphid population was reached economic threshold (15% plants infested) [23]. The data collected were subjected for analysis using SAS statistical package [24].

RESULTS AND DISCUSSION

The repellent effects produced by the extracts on white fly immature are recorded in Tables 1 & 2. From data in tables, we infer that the two bio-pesticides tested (seeds and leaves) produced a repellent effect, changing significantly the behavioural ovipositiona mong *B. Tabaci* Genn. adults significantly. However, the stem extract showed better action, compared to flower extract. The phyto-pesticides can be act in different intensity bio-pesticide way over target pest how a function of active principles concentration [25-29].

Variations in active component concentration could causes different control pest action [30-33]. The results recorded in Table (3) shows that the data were subjected to ANOVA to compare means for significance to differences. The treatment with seeds and leaves extract were significantly superior over all other treatments, which recorded a high total mean percentage 4.96% and 4.43% mortality a 12 hours against adults of whitefly. The results suggest that these plant extracts have insecticidal activity and can be used for controlling whiteflies. Table (2), support the data recorded in Table (3), because the mean nymphs /plant reduced from 11.43 to 4.13 nymphs for flowers and seeds extracts respectively.

Among the effect of the target materials on cotton aphid, mean daily mortality after five days of treatment applications show that both levels of seeds and leaves has induced aphids mortality (Table 4). Seeds extract had caused 12.59% (grand total mean mortality percentage)

Table 1: Repellence effects of three moringa extracts on *Bemisia tabaci* measured by eggs counting over tomato foliage plants under field conditions

Treatment	Conc. (%)	Eggs counting (Mean eggs/ plant)	Total mean	F.	P.
Seeds	5.0	3.2±0.1	4.03	5.2	Sig.
	3.0	4.1±0.2			
	1.0	4.8±0.4			
Leaves	5.0	3.0±0.2	5.07		Sig.
	3.0	4.0±0.3			
	1.0	5.2±0.2			
Flowers	5.0	9.0±0.1	10.5		Non
	3.0	10.7±0.2			
	1.0	11.8±0.2			
Stem	5.0	17.5±0.2	18.9		Sig.
	3.0	18.3±0.1			
	1.0	20.9±0.2			
Cont.	0.0	24.5±0.1	------		-----

Table 2: Repellence effects of three moringa extracts on *Bemisia tabaci* measured by live nymphs counting over tomato foliage plants under field conditions

Treatment	Conc. (%)	Nymphs counting (Mean Nymphs / plant)	Total mean	F.
Seeds	5.0	3.1±0.01	4.13	3.8
	3.0	4.0±0.02		
	1.0	5.3±0.03		
Leaves	5.0	3.9±0.02	4.96	
	3.0	4.8±0.01		
	1.0	6.2±0.04		
Flowers	5.0	10.6±0.02	11.43	
	3.0	11.2±0.03		
	1.0	12.5±0.01		
Stem	5.0	14.7±0.03	15.7	
	3.0	15.1±0.01		
	1.0	17.3±0.02		
Cont.	0.0	19.9±0.03	----	

Table 3: Effect of moringa plant extracts on adults of *Bemisia tabaci* Genn

Treatment	Conc. (%)	Count live adults / plant) (Zero time)	Time of observations (% mortality) 4.0 h.	8.0 h.	12.0 h.	Total mean mortality %	F
Seeds	5.0	6.3	4.2±0.02	4.6±0.03	6.9±0.01	3.58	4.8
	3.0		1.9±0.03	3.0±0.04	4.9±0.03		
	1.0		1.0±0.03	2.7±0.01	3.1±0.02		
Leaves	5.0	5.7	3.7±0.01	4.1±0.02	6.0±0.01	3.63	
	3.0		3.0±0.01	3.7±0.01	5.3±0.03		
	1.0		2.1±0.03	2.8±0.01	2.0±0.02		
Flowers	5.0	5.8	5.0±0.02	5.3±0.03	6.1±0.01	3.33	
	3.0		2.2±0.01	2.9±0.02	3.6±0.01		
	1.0		1.0±0.03	1.7±0.00	2.2±0.03		
Stem	5.0	6.2	4.5±0.01	4.7±0.01	4.7±0.0	2.92	
	3.0		3.0±0.01	3.1±0.01	3.2±0.03		
	1.0		1.0±0.03	0.9±0.0	1.2±0.04		
Dimethoat (0.03%)		6.9	7.8±0.03	9.2±0.0	12.8±0.01	9.93	
Cont.	0.0	5.4	5.5	6.3	6.6	6.13	

Table 4: Daily mean mortality of cotton aphids, *Aphids gossypii* as affected by different levels botanical extracts of moringa part powders (100 individuals)

Treatment	Conc. (%)	Time of observations (% mortality) 1 day	2 days	3 days	4 days	5 days	Total Avg.	Grand total Avg.
Seeds	5.0	15.8±0.04	15.0±0.02	13.1±0.04	11.1±0.01	10.6±0.01	13.12	12.59
	3.0	14.4±0.02	13.9±0.03	13.9±0.02	11.0 ±0.01	10.3±0.02	12.7	
	1.0	13.1±0.01	13.0±0.03	12.7±0.02	11.0±.0.01	10.0±0.02	11.96	
Leaves	5.0	15.0±0.03	14.5±0.01	14.0±0.03	11.0±0.02	10.6±0.02	13.02	12.43
	3.0	14.0±0.02	14.0±0.01	13.6±0.01	10.7 ±0.02	10.2±0.01	12.5	
	1.0	13.3±0.03	13.1±0.02	12.0±0.01	10.4±0.02	10.0±0.02	11.76	
Flowers	5.0	14.6±0.03	13.7±0.01	13.0±0.02	11.5±0.03	10.5±0.03	12.66	12.07
	3.0	14.2±0.03	13.5±0.02	12.5±0.01	11.0 ±0.02	10.1±0.02	12.26	
	1.0	12.0±0.02	12.1±0.02	12.0±0.02	10.4±0.03	10.0±0.04	11.3	
Stem	5.0	4.6±0.01	2.9±0.03	1.7±0.01	1.0±0.02	0.3±0.02	2.1	1.82
	3.0	1.0±0.02	3.8±0.02	2.0±0.02	2.7±0.03	0.1±0.03	1.92	
	1.0	3.0±0.03	1.5±0.01	1.0±0.01	1.8±0.01	0.0±0.02	1.46	
Dimethoat (0.03%)	2.2	25.3±0.01	47.1±0.01	61.8±o2	78.7 ±0.03	81.3±0.01		58.84
Cont. (Water spray)	0.0	0.05±0.01						

mortality followed by flower 12.04% then the stem extract had a poor efficacy to protect the tomato leaves from the target pest attack which represent the lowest one (1.74%). The mortalitypercentage after 5 days from the beginning of experiments shows mild effects for all tested materials. Highest mortality in the fifth day of application was recorded in seeds extract compared with control (water spray), while the chemical insecticide used (Dimethoate 0.03%) gave a high rate of mortality (58.8%). Cotton aphid nymphs showed decrease in the number of molts as the seed extracts used. Stem extracts are represent the lowest effects (Table 4). The results showed that the efficacy of phyto-insecticides tested decreased with the increase of time. These results observed are agreement with the finding data by Stark & Rangus, Abdel-Raheem and Lamya Ahmed Al-Keridis [34], Sabry *et al.* [35], Mohamed Abdel-Raheem *et al.* [36] and Mohamed Abdel-Raheem [37] for *Acyrthosiponpisum* Harrisnymphs exposed to bean plants treated with Margosan -O.Out of four phyto-pesticides extracts showed excellent performance against pest attack in leaves of tomato plants.

The results of this study indicated that all botanical tested except that of stem extract had shown sufficient aphicidal and white fly effect which was significantly different from control population. As a conclusive remark, all botanicals tested had been proved to have capacity of killing field cotton aphids and white fly under field conditions. The phyto-extracts are the natural source of bio-insecticides and do not create any environmental problem. Therefore, moringa plant extracts was identified as a potent bio-pesticide for tomato cultivation.

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