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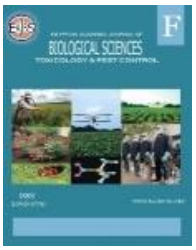

Comparison Between the Effect of Neem Oil and Neem Aqueous Extract on *Tetranychus urticae* Koch (Acari: Tetranychidae)

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ABSTRACT

The two-spotted spider mite, *Tetranychus urticae* Koch is one of the most important pests responsible for yielding losses for many crops. For several years, chemical control of mites has been extensively practiced; a major problem in the control of *T. urticae* is the response to develop resistance to many acaricides, and so, scientists make efforts to replace the chemical acaricides with natural acaricides, as a mean to reduce negative impacts to human health and the environment. In the search for control alternatives, this study aimed to evaluate the effect of neem essential oil and the aqueous neem extract against adult females of *Tetranychus urticae* under laboratory conditions. Also, LC_{50} of each treatment was established and the obtained results revealed that the active essential oil of neem was more effective than the aqueous neem extract. LC_{50}: 33.99 ppm and 260.30 ppm for neem oil and aqueous extract respectively. However, LC_{90} value was 238.83 ppm and 1813.70 ppm for neem oil and aqueous extract, respectively.

INTRODUCTION

The Acarid family (Tetranychidae), contains more than 1,200 polyphagous mite pest species and *Tetranychus urticae* Koch might be considered the most important one (Alzoubi and Cobanoglu, 2008), causing serious damage to vegetables (e.g., beans, eggplant, peppers, tomatoes, and potatoes), flowers, and fruit crops (e.g., strawberries, raspberries, currants, and pear). Many crops must be protected with synthetic acaricides during hot and dry seasons that favor severe outbreaks of *T. urticae*. It is able to transmit many of viruses to the plant (Thomas, 1969). The use of chemically synthesized acaricides brings a number of disadvantages, such as the development of resistance by the pest, hormolygosis, incompatibility with natural predators, phytotoxicity, environmental pollution, and risks to human health. Plants have the richest source of renewable natural pesticides. Specifically, plant extracts provide a safe and viable alternative to synthetic pesticides and are compatible with the use of beneficial organisms, pest-resistant plants, and to preserving a healthy environment in an effort to decrease reliance on synthetic pesticides Miranova and Khorkhordin (1996). There are many benefits of using botanical pesticides such as reduced environmental degradation, increased safety for those who works at farm, increased food safety, reduction in pesticide resistance, and improved profitability of production. The essential oils derived from plants are attracting interests of the scientists, as these are environmentally safe and non-toxic to humans (Isman and

Machial, 2006). As a result, many plant compounds, the majority of which are alkaloids and terpenoids, have now been known to affect insects' behavior, growth, and development, reproduction, and survival (Nakanishi, 1975; Jacobson, 1982; Arnason *et al.*, 1989; and Warthen *et al.*, 1990). Many investigations have recently been performed in relation to the influnce of plants such as neem tree, *Azadirachta indica* A. Juss (Meliaceae), and *Melia azaderach* L. (Meliaceae) (Metcalf and Flint,1951; Schmutterer 1990; Martin and Woodcock, 1993 and Erdogan and Toros (2007). Our research goals were to evaluate the comparison between the toxic effect of neem oil and aqueous neem extract against the two-spotted spider mite *T. urticae* under laboratory conditions.

MATERIALS AND METHODS

Rearing Mites:

Tetranychus urticae was collected from unsprayed castor bean plants and reared on it at 25± 2° C and 60± 5%RH.

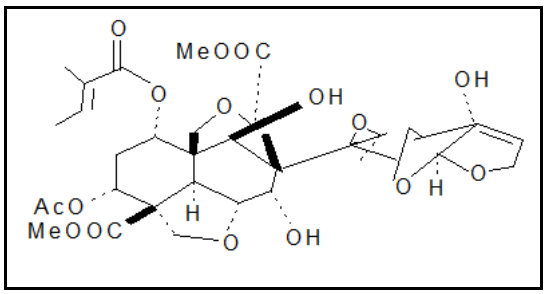
Neem Essential Oil Extraction:

Neem oil was extracted by steam distillation apparatus in Plant Protection Research Institute, Mansoura, Egypt, using seeds collected from the farm of Agriculture Faculty farm, Mansoura University. The oil was separated dried over anhydrous sodium sulfate and stored in dark glass bottles at 4° C at freezing until used.

Neem Aqueous Extract:

Neem aqueous extract was extracted as leaves of neem tree were collected from the farm of Agriculture Faculty farm, Mansoura University and soaked in water and the concentration was detected on the base of the weight of dried leaves powder/ the volume of water.

- Neem oil and aqueous extract contain azadirachtin, $C_{35}H_{44}O_{16}$:



(Kausik *et al.* 2002)

Preparing the Stock Solution Of The Tested Materials:

Convenient stock concentrations of each material were prepared on basis of the tested material, (neem oil or neem leaves powder), weight, and the volume of the distilled water (w/v) and add emulsifier (tween 80 (0.1%)). The stock concentrations were kept in glass stoppered bottles and stored under refrigeration. Such stock solutions were prepared periodically. Four diluted concentrations for each plant extract were used to draw the LC-P lines. Three replicates were used for each concentration.

Toxicity Test:

The toxicity of neem oil and neem leaves powder was evaluated against adult females of *T. urticae*. Thirty newly emerged adult females were transferred to the lower surface of castor leave discs (2.5 cm diameter) placed separately on moist cotton wool in Petri dishes. Each petri dish contains three replicates, ten individuals in each replicate. Neem oil acaricide had four concentrations 50, 100, 200, and 300 ppm, and neem leaves powder acaricide had four concentrations, also, 100, 500, 1000, and 2500 ppm, which

were sprayed on the individuals. Mortality was recorded for 7 days after treatment. The mortality percentage was estimated and corrected according to Abbott's formula, 1925. LC_{50} values were determined using appropriate analysis statistical method of Finney, 1971.

Equation: Sun, 1950 (to determine LC_{50} index**)**

$$\text{Toxicity index for } LC_{50} = \frac{LC_{50} \text{ of the most effective compound}}{LC_{50} \text{ of the least effective compound}} \times 100$$

RESULTS AND DISCUSSION

Effect of Neem Oil and Neem Leaves Aqueous Extract on The Female of The Two Spotted Spider Mite *Tetranychus urticae* Koch:

Data represented in Table (1) indicated that the neem oil caused high mortality proportion on the two spotted spider mite, *Tetranychus urticae* Koch., the aqueous extract. This result may be due to neem oil contains a huge amount of azadirachtin. High rates of mortality have been found on mites fed on *Tetranychus urticae* the leaves treated with *A. indica* essential oil. In addition, the same essential oil significantly reduced the reproductive capacity of mites, and the survival of the progeny of treated females greatly diminished in comparison to the control. Irena *et al.* (2015) evaluated that the botanical pesticide Neem Azal-T/S, an emulsion concentrate containing 10 g/l of azadirachtin-A, toxic and behavioral effects of on the two-spotted spider mite, *Tetranychus urticae* Koch, in order to obtain data that could be used in further research aimed to improve the management of this important pest. However, Table (2) and Fig. (1) Described that the neem oil was more effective than the aqueous extract, with LC_{50}: 33.99 ppm and 260.30 ppm, respectively. LC_{90} value was 238.83 ppm and 1813.70 ppm for neem oil and aqueous extract. The toxicity index was 100% for neem oil while it was 13.06% for aqueous extract. The slope values were 1.51 and 1.52 for neem oil and aqueous extract, respectively.

Although the effectiveness of neem oil and the aqueous neem extract on *T. urticae* but the neem oil have high effect with low concentrations. When Babu *et al,* 2008 used the neem kernel aqueous extract for the management of red spider mite, *T. urticae,* and the results proved the low effectiveness of the aqueous extract on *T. urticae*.

Table 1: Corrected mortality % of two spotted spider mite,*Tetranychus urticae Koch*, treated with neem oil and neem aqueous extract under laboratory conditions 25±2 ˚C and 60±5% RH.

No.	Treatments	Conc. (ppm)	Mortality after treatments %				Total Mortality %
			One day	Three days	Five days	Seven days	
1	Neem oil	50	6.67	16.67	16.67	20	60
		100	13.33	16.67	23.33	23.33	76.67
		200	20	20	23.33	23.33	86.67
		300	26.67	26.67	26.67	16.67	96.67
2	Neem leaves Aqueus extract	100	6.67	3.33	10	10	30
		500	10	16.67	16.67	16.67	60
		1000	16.67	23.33	23.33	16.67	80
		2500	20	36.67	30	10	96.67

Table 2: Efficiency of neem oil and neem aqueous extract against *Tetranychus urticae* Koch

Treatments	Conc.	Corrected mortality %	LC_{50}	LC_{90}	Slope± S.D.	Toxicity index LC_{50}	R	P
Neem oil	50	60	33.99	238.83	1.51 ± 0.261	100	0.969	0.882
	100	76.67						
	200	86.67						
	300	96.67						
Neem leaves Aqueous extract	100	30	260.30	1813.70	1.52 ± 0.150	13.06	0.977	0.096
	500	60						
	1000	80						
	2500	96.67						

R: Regression **P: Probability**

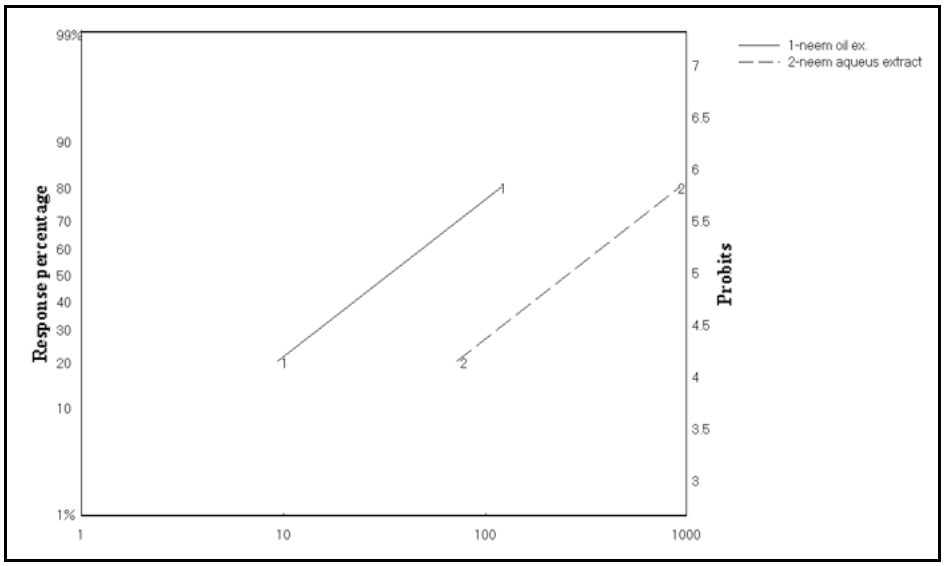


Fig. 1: LC-P lines for neem plant derivatives against adult female of *T. urticae*

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