



**Toxic effect of cinnamon, castor plant oils and their combination on *Tetranychus urticae* (Acari: Tetranychidae)**

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**Abstract:**

The biological effects of cinnamon oil, castor oil and their combination were studied under laboratory conditions against adult female of the two spotted spider mite, *Tetranychus urticae* Koch. (Acari: Tetranychidae). Also, LC<sub>50</sub> of each treatment was established and the obtained results revealed that the mixture of the two oils and cinnamon oil were more effective than the castor oil. LC<sub>50</sub> was 1100.92, 2928.97 and 7856.59 ppm for the mixture of the two oils, cinnamon oil and castor oil, respectively, for *T. urticae*. The study indicated that, the mixture of cinnamon oil and castor oil was more effective than each one alone on *T. urticae*.

**Introduction**

Red spider mites, *Tetranychus urticae* Koch. (Acari: Tetranychidae) is a notorious pest of economically important agricultural crops as well as ornamental plants (Navajas, 1998). It has been reported to attack about 1200 species of plants (Zhang, 2003), of which more than 150 are economically important (Jeppson *et al.*, 1975 and Xie *et al.*, 2006). It causes damage to sweet corn, beans, peas, hops, grapes, deciduous fruit trees, strawberries and many other fruit, vegetables, flowers and ornamental plants (Johnson and Lyon, 1991).

Commercially available synthetic acaricides are usually expensive and may be needed to be imported for use by farmers. They also tend to have detrimental effects on the environment and can be hazardous to humans. These negative effects have resulted in an increasing interest for natural plant-based

pesticides which are assumed to be safer than the synthetic pesticides (Yanar *et al.*, 2011). Natural plant extracts play an increasingly prominent role as alternatives to synthetic pesticides due to the increasing concern on health hazards, environmental pollution and negative effects on non target organisms (Sharma *et al.*, 2006 and Mariam *et al.*, 2015).

Cinnamon oil (*Cinnamomum verum*), the bark oil consists of cinnamaldehyde (80– 90%), eugenol, eugenol acetate, cinnamyl acetate, cinnamyl alcohol, methyl eugenol, benzaldehyde, benzyl benzoate, linalool, monoterpene, hydrocarbon, caryophyllene, safrole and others, such as pinene, phyllandrene, cymene and cineol (Health, 1978). Castor oil (*Ricinus communis*) is producing non-edible plant oil provide a better economical alternative (Deligiannis *et al.*, 2009) and

using pressing and extraction may offer vegetal oils. This can also be used as bio-oil (fuel without transesterification) which can then be completely biodegradable (Boza and Saucedo, 2011). Castor bean is a naturally occurring plant, inexpensive and an environmental-friendly resource (Jumat *et al.*, 2010).

The present work was aimed to evaluate the biological aspects of cinnamon oil, castor oil and their mixture against the two spotted spider mite *T. urticae*.

## Materials and methods

### 1. Rearing mites:

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

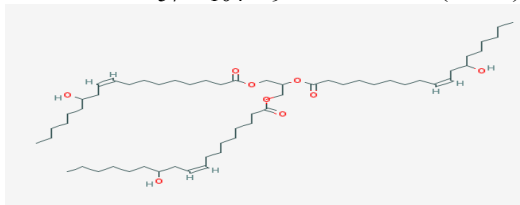
### 2. Plant oils:

Cinnamon oil and castor oil was bought from Essential Oil Extracts Center, National Research Center.

-Cinnamon oil contains cinnamic acid, C<sub>9</sub>H<sub>8</sub>O<sub>2</sub>.  
cinnamic acid formula (Vogt, 2010)



-Castor oil contains ricinoleic acid C<sub>18</sub>H<sub>34</sub>O<sub>2</sub> Osol *et al.* (1975)



-Mixture of the two plant oils made by mixing cinnamon oil and castor oil 1:1 proportion.

### 3. Preparing the stock solution the tested plant oils:

Convenient stock concentrations of each oils were prepared on basis of the tested plant oil weight and the volume of the distilled water (w/v) in the presence of tween 80 (0.1 %) as emulsifier. The stock concentrations were kept in glass

stopped bottles and stored under refrigeration. Such stock solutions were prepared periodically. Four diluted concentrations for each plant oil were used to draw the LC-P lines. Three replicates were used for each concentration.

### 4. Toxicity test:

The toxicity of cinnamon oil, castor oil and their mixture 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. Each acaricide had four concentrations which were sprayed on the individuals. Mortality was recorded for 7 days after treatment. The mortality percentage was estimated and corrected according to the **Abbott's formula (1925)**. LC<sub>50</sub> values were determined using probit analysis statistical method of **Finney (1971)**.

**Equation: Sun, 1950** (to determine LC<sub>50</sub> index)

**Toxicity index for LC<sub>50</sub>=**

$$\frac{\text{LC}_{50} \text{ of the most effective compound}}{\text{LC}_{50} \text{ of the least effective compound}} \times 100$$

## Results and discussion

### 1. Effect of the cinnamon oil, castor oil and their mixture on adult female of two-spotted spider mite, *Tetranychus urticae* (Koch):

Data given in **Table (1)** showed that the mixture of cinnamon and castor oils caused high mortality proportion on the two spotted spider mite *Tetranychus urticae* then cinnamon oil, while the castor oil caused mortality less than the mixture and cinnamon oil. These findings were in agreement with Health, (1978); Abd El- Wahab (2003) and Ghada and Amal (2015).

**Table (1): Corrected mortality % of two spotted spider mite *Tetranychus urticae* treated with cinnamon oil, castor oil and their mixture under laboratory conditions 25±2 °C and 65±5% RH.**

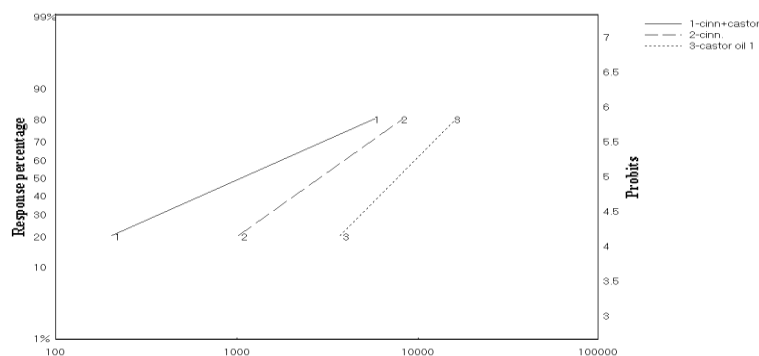
Treatments	Conc. (ppm)	Mortality after treatments %				Total Mortality %
		One day	Three days	Five days	Seven days	
Castor oil	5000	-----	6.67	20	6.67	33.34
	10000	-----	13.33	26.67	13.33	53.33
	15000	13.33	20	33.33	13.33	80
	20000	20	20	33.33	13.33	86.66
Cinnamon oil	1000	-----	6.67	-----	13.33	20
	5000	20	6.67	20	20	66.67
	10000	26.67	-----	40	13.33	80
	15000	13.33	26.67	40	13.33	93.33
Castor oil+ Cinnamon oil	500	-----	-----	20	13.33	33.33
	1000	26.67	-----	26.67	-----	53.34
	5000	6.67	13.33	40	6.67	66.67
	10000	26.67	6.67	26.67	33.33	93.33

Data in Table (2) and Figure (1) revealed that cinnamon oil and castor oil mixture were more effective than castor oil with LC<sub>50</sub>, 2928.97 ppm, 1100.92 ppm and 7856.59 ppm, respectively. However, the toxicity index was 100% for the mixture, 37.59% for cinnamon oil while was 14.01 for castor oil. The slope values indicated that the oil mixtures had

the lowest value which was 1.15, followed by 1.8 and 2.6 for cinnamon oil and castor oil, respectively. Also, LC<sub>90</sub>/LC<sub>50</sub> values were 3.08, 4.96 and 12.88 for castor oil, cinnamon oil and the mixture, respectively. These results were in agreement with Mwandila *et al.* (2013) and Mariam *et al.* (2015).

**Table (2): Efficiency of cinnamon oil, castor oil and their mixture against two spotted spider mite *Tetranychus urticae*.**

Treatment	Conc. (ppm)	Corrected mortality%	LC <sub>50</sub>	LC <sub>90</sub>	Slope± S.D.	Toxicity index (LC <sub>50</sub> )	LC <sub>90</sub> /LC <sub>50</sub>
Castor oil	5000	33.34	7856.59	24230.82	2.6± 0.3	14.01	3.08
	10000	53.33					
	15000	80					
	20000	86.66					
Cinnamon oil	1000	20	2928.97	14524.98	1.8± 0.17	37.59	4.96
	5000	66.67					
	10000	80					
	15000	93.33					
Castor oil + Cinnamon oil Mixture	500	33.33	1100.92	14182.7	1.15± 0.13	100	12.88
	1000	53.34					
	5000	66.67					
	10000	93.33					



**Figure (1): LC-P lines for cinnamon oil, castor oil and their mixture against adult female of two spotted spider mite *Tetranychus urticae*.**

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