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# Biological activity of Thyme oil and Thymol against *Tetranychus urticae* Koch

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With 3 tables

## Abstract

**Thyme oil was obtained by hydrodistillation and Thymol the major constituents was purchased from Prolabo Co. and they were tested against *Tetranychus urticae* Koch. Thymol was more potent than Thyme oil as a deterrent factor for reducing egg laying by the mite. Mortality percentage reached 100% with both materials used, however, with low concentration the effect was pronounced with Thymol than Thyme oil.**

## 1 Introduction

Reports are available that essential oils exhibit antifeedant activity against agriculturally important pests (TARE & SHARMA, 1990). The families Lamiaceae, Laraceae, Apiaceae and Rutaceae are rich sources in volatile oils, from which certain class of plant constituents i.e. mono or sesquiterpenoid have been identified as a potential insect antifeedants (ASAKAWA et al., 1980).

Camphor oil has been used as moth, mosquito and screw worm repellent (WINDHOLZ et al., 1976). Oil of (Tansy) *Tanacetum vulgare* mixed with oils of fleabane and pennyroyal and diluted with alcohol has been used as a mosquito repellent (CROCKETT, 1977). Also vapour of *Mentha arvensis* oil was used as fumigant to control insect infestation of pigeon pea seeds during storage (SRIVASTAVA et al., 1989).

This investigation deals with Thyme oil *Thymus vulgaris, L.* Lamiaceae, that grow will in mediteranean region and in Sinai. The leaves are employed to treat different human ailments, (PICCAGLIA & MOROTTI, 1990). The old farmers in Egypt cultivate thyme and ruta plants between their important crops to protect them by repelling the insects.

So, the aim of this investigation is to study the effect of thyme volatile oil and its main active principle thymol (40% of the oil) on the two spotted spider mite, *Tetranychus urticae* Koch.

## 2 Material and Methods

Thyme leaves were obtained from the Pharmaceutical Sciences Dept. Farm in Giza, the volatile oil was obtained by hydrodistillation using Clevenger apparatus. After 3 h of distillation the oil was collected, dried over anhydrous sodium sulphate. Different dilutions were made from the oil and thymol to test its activity against the insect.

### *2.1 Chromatographic investigation of the volatile oil*

The oil was chromatographically fractionated by GLC using the condition reported by MOHAMED (1993). Peak identification was performed by comparing the relative retention time of each peak with those of standard compounds. Thymol the major compound present in the oil was obtained from Prolabo company, Italy.

### *2.2 Biological effect*

Mites were obtained from a laboratory culture of the two spotted spider mite, *Tetranychus urticae* Koch on Lima bean, *Phaseolus vulgaris* L., under 25 ± 5 °C and 60 ± 5% R.H.

To study the deterrent effect of thyme oil and thymol against the female adults, raspberry leaf discs were placed with the lower surface upward in a petri-dish lined with moist cotton wool. One half of each disc was treated with selected concentrations, while the other half served as control. Ten adult females of the mite were then introduced into the middle of the petri-dish. Orientation of the females *T. urticae* on treated and control discs was recorded after 1, 24, 48, 72 and 96 h from the beginning of the experiment. Also, the number of eggs laid on both sides and the percentage mortality of adults were recorded after 96 h.

The oviposition deterrent indices (ODI) as defined by LUNDGREN (1975) was calculated as follow:

$$\text{ODI} = \frac{B - A}{A + B} \times 100$$

where A and B are the number of eggs laid on the treated and control leaf discs, respectively.

To study the toxicity as well as the biological effects of the materials tested, newly emerged females of the mites *T. urticae* were transferred singly to the lower surfaces of raspberry leaf discs treated with the different concs. (1, 0.5, 0.25, 0.125 and 0.0625%) of thyme oil and thymol. The total number of eggs laid was recorded after 10 days from beginning of the experiment. The mortality of the females as well as the percentage of hatchability of the resulting eggs were calculated. Another group of mites were placed on untreated discs which served as control.

## 3 Results and Discussion

### *3.1 Chemical constituents of Thyme oil*

The percentage of volatile oil obtained was 2.7%, GLC analysis revealed the presence of thymol and p-cymene as major components. Their levels were 52.9 and 16.66%, respectively. Phellandrene, thujone, terpeniol, linalyl acetate, borneol and terpinyl acetate were present as minor compounds, while α-pinene, β-pinene, limonene and α-terpenene occurred as traces compounds, and some unidentified compounds acounted to 5.57%.

### *3.2 Choice tests*

Table 1 shows that thymol at all concentrations used strongly deterred *T. urticae* adult females. The higher the conc. (1%) of thyme oil used the greater was the deterrency effect obtained. Decreasing the concs. enhanced the females to lay eggs on the treated part.

*Table 1.* The distribution of *T. urticae* on treated plant discs with Thymol and Thyme oil

| Concentrations % | % Distribution of mites on treated leaf part after 1 h | 24 h | 48 h | 72 h | 96 h | % Mortality after 96 h | No. of eggs// after 96 h. T. | C. | ODI |
|---|---|---|---|---|---|---|---|---|---|
| Thymol: | | | | | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0.3 | 100 |
| 0.5 | 0 | 0 | 0 | 5.26 | 5.26 | 10 | 0 | 0.5 | 100 |
| 0.25 | 0 | 0 | 0 | 5.26 | 10.53 | 10 | 0 | 0.8 | 100 |
| 0.125 | 0 | 0 | 0 | 5.26 | 15.79 | 5 | 0 | 0.9 | 100 |
| 0.0625 | 0 | 0 | 0 | 5.26 | 16.67 | 0 | 0 | 1.6 | 100 |
| Thyme oil: | | | | | | | | | |
| 1 | 0 | 0 | 0 | 5.26 | 5.41 | 30.0 | 0 | 5.15 | 100 |
| 0.5 | 0 | 5.0 | 7.69 | 17.95 | 23.68 | 25.0 | 0.15 | 10.8 | 97.26 |
| 0.25 | 0 | 5.0 | 10.0 | 20.0 | 31.25 | 17.5 | 0.65 | 13.18 | 90.60 |
| 0.125 | 0 | 7.5 | 32.5 | 45.0 | 52.50 | 7.5 | 0.85 | 13.63 | 88.26 |
| 0.0625 | 0 | 17.5 | 40.0 | 50.0 | 57.89 | 5.0 | 1.75 | 15.85 | 80.1 |

T = Treated, C = Control

*Table 2.* Effect of Thymol on reproduction and mortality of *T. urticae*

| Concentration % | No. eggs///10 days | % Reduction in No. of eggs///10 days | % Mortality / | % Unhatched eggs |
|---|---|---|---|---|
| 1 | 0 ** | 100 | 100 | – |
| 0.5 | 0.8 ** | 97.32 | 80 | 16.67 |
| 0.25 | 1.4 ** | 95.36 | 73.33 | 14.29 |
| 0.125 | 2.0 ** | 93.44 | 66.67 | 10.00 |
| 0.0625 | 4.2 ** | 86.69 | 40 | 1.92 |
| Control | 58.93 | – | 0 | 0 |
| **L.S.D. at:** | | | | |
| 0.05% | 1.843 | | | |
| 0.01% | 2.443 | | | |

** High significant

*Table 3.* Effect of Thyme oil on reproduction and mortality of *T. urticae*

| Concentration % | No.eggs///10 days | % Reduction in No. of eggs///10 days | % Mortality / | % Unhatched eggs |
|---|---|---|---|---|
| 1 | 0 ** | 100 | 100 | – |
| 0.5 | 3.4 ** | 89.09 | 86.67 | 25.50 |
| 0.25 | 8.8 ** | 74.01 | 53.33 | 18.94 |
| 0.125 | 21 ** | 47.45 | 40.00 | 10.48 |
| 0.0625 | 26.33** | 38.24 | 26.67 | 9.62 |
| Control | 58.93 | – | 0 | 0 |
| **L.S.D. at:** | | | | |
| 0.05 | 6.063 | | | |
| 0.01 | 8.037 | | | |

** High significant

The ODI of thymol was 100% at all the concs., while the ODI of thyme oil were 100 and 80.11% by using concentrations 1 and 0.0625%, respectively. The results obtained show clearly that ODI in treatment with thyme oil was smaller than that with thymol.

### *3.3 Biological effect of thyme oil and thymol on adult females*

Tables 2 and 3 show the fecundity of the females of *T. urticae* as influenced by the oil and its major constituent. The effect was highly significant for all the concentrations tested either with thymol or with thyme oil. Thymol proved to be more effective than thyme oil as the percentage of reduction in the total number of eggs laid per female during ten days was 100% in comparison with control. At very low concentration 0.0625%, the percentage of reduction in the total eggs laid by mites due to the treatment with thymol and thyme oil were 86.69 and 38.24%, respectively.

Mortality percentage reached 100% with both materials used, however, with low concentration the effect was pronounced with thymol than thyme oil.

In conclusion it was clearly noticed that thymol was potent than thyme oil as a deterrent agent and a factor for reducing egg laying by the mite. Thymol concentrations used were similar to that of the oil. So, the expected effect will be to thymol. In this respect FARAG et al. (1994) reported significant reduction in egg production following treatment of cotton leaf worm with thyme oil and thymol, however the effect of thyme essential oil was more pronounced than thymol, they attributed this result to the fact that the whole components found in the oil potentiated the effect. The other constituents might cause

synergistic action as deterrency agent. EL-GENGAIHI et al. (1992) confirmed the role of volatile oil as antifeedant and growth inhibiting effect in their study of the effect of *Vitex agnus costus* volatile oil on *Spodoptera littoralis* larvae.

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