Department of Entomology
Faculty of Science
Ain Shams University

Effectiveness of some plant essential oil formulations on the two-spotted spider mite *Tetranychus urticae* Koch (Acari: Tetranychidae) and its predacious mites of the family Phytoseiidae

A thesis
Presented to the Department of Entomology, Faculty of Science,
Ain Shams University, For the
Award of the Ph.D.
Degree of Science
(Entomology)

BY

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ABSTRACT

The present study aims to assess the effectiveness of five essential oils and their prepared formulations against the two-spotted spider mite, *Tetranychus urticae* Koch and its associated predatory mites of the family Phytoseiidae. The relative percentages of the main components of the tested essential oils (*Artemisia maritima* L., *Melissa officinalis* L., *Mentha longifolia* (L.) Huds., *Thymus vulgaris* L. and *Zingiber officinale* Roscoe oils) were identified by GC/MS.

The studied essential oils were tested for their acaricidal activity against the serious agricultural pest, *T. urticae*, using different application methods. All the tested essential oils proved that they have acaricidal, repellent and oviposition deterrence activity against *T. urticae* with variable degrees. In most cases, the direct spray application was the most effective application against eggs, nymphs and females of *T. urticae* while the systemic application was the least one against the nymphs and females. However, the fumigant application was the most effective application on *T. urticae* in case of *M. longifolia* oil.

The obtained data showed that the LC_{50} values of *M. officinalis, T. vulgaris, Z. officinale, A. maritima* and *M. longifolia* oils on *T. urticae* females were 0.36, 0.40, 0.60, 0.77 and 1.43%, respectively using the direct spray application. In addition, the acaricidal activity of the prepared oil formulations (the prepared formulations labeled: Misicide, Melissacide, Mento, Thymo and Gingcide) were tested against *T. urticae* stages. Melissacide and Thymo were the most potent formulations against *T. urticae* nymphs and females while Mento being the least one.

The efficiency of the studied essential oils and their formulations on eggs and females of the tested predatory phytoseiid mites (*Neoseiulus barkeri* (Hughes), *Neoseiulus californicus* (McGregor) and *Typhlodromips swirskii* (Athias-Henriot)) were evaluated in the

present study. Based on the LC_{50} values, Thymo and Mento (LC_{50}= 0.44 and 0.72%) showed the least adulticidal activity against *N. barkeri* and *N. californicus*, while Melissacide and Misicide (LC_{50}= 0.016 and 0.174 %) showed the highest one, respectively. In addition, Mento (LC_{50}= 0.34%) was the least effective tested formulation against *T. swirskii* females, while Melissacide (LC_{50}= 0.002 %) was the most effective one.

The obtained data showed that females of *N. barkeri* and *T. swirskii* showed a significant reduction in food consumption and fecundity when sprayed with two sublethal concentrations (LC_{25} recorded on each predator and LC_{25} recorded on *T. urticae*) of the most tested formulations. On the other hand, spraying *N. californicus* females with the two sublethal concentrations of Misicide resulted in a significant reduction in both food consumption and fecundity. However, in most cases, spraying *N. californicus* females with the two sublethal concentrations of Melissacide, Mento, Thymo and Gingcide did not show any significant reduction in food consumption but resulted in a significant reduction in egg deposition. Evaluation of the persistence and phytotoxicity of the tested formulations was also included in the present study.

Key words: *Tetranychus urticae,* Tetranychidae, *Neoseiulus barkeri, Neoseiulus californicus, Typhlodromips swirskii,* Phytoseiidae, *Artemisia maritima, Melissa officinalis, Mentha longifolia, Thymus vulgaris, Zingiber officinale,* essential oils, oil formulations, acaricidal activity.

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