FORESTRY IDEAS, 2022, vol. 28, No 2 (64): 298–300

Influence of essential oil of *Thymus pulegioides* L. harvested in forest area on *Myzus persicae* S. in tobacco and *Apis mellifera* L.

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Received: 02 July 2022 / Accepted: 05 August 2022 / Available online: 26 September 2022

Abstract

In laboratory conditions, the effect of Essential oil (EO) vapours from *Thymus pulegioides* L. against *Myzus persicae* S. on tobacco and *Apis mellifera* L. bees were tested. Aphids' mortality increased when concentration increased. A low mortality of *M. persicae* of 9.7 % was reported at 0.5 μL·L^{-1} air, at 1 μL·L^{-1} air mortality was 31.6 %, and at 2 and 3 μL·L^{-1} air mortality was 100 %. Concentration of 2 μL·L^{-1} air was found to be the minimum which has maximum efficacy of 100 %. Differences between efficacy of various concentrations were found to be statistically significant. EO vapours tested at concentration of 2 μL·L^{-1} air applied under the same conditions to *A. mellifera* showed 100 % toxicity to the bees as well. No mortality was reported in the control.

Key words: green peach aphid, honey bees, mountain thyme.

Introduction

The control of economically important agricultural pests with biological substances is gaining popularity. Green peach aphid *Myzus persicae* S. is such an economic pest, rapidly multiplying and attacking huge variety of plants (Blackman and Eastop 2000). Green peach aphid has been found to exhibit resistance to neonicotinoid insecticides (Devine et al. 1996), moreover the application of some is highly restricted in Europe (Cressey 2017). Insecticides contain substances dangerous to human health (Meena et al. 2018). EO as biopesticides are one of the alternatives of chemical insecticides (Pavela et al. 2010) and can be applied against *M. persicae* as shown by previous research (Radev 2022). EO are extracted from a number of plants including mountain thyme *Thymus pulegioides* L. The species is distributed in forest clearings and pastures. Thyme EO is characterised by antimicrobial (Elfellah et al. 1984) and antioxidant (Youdim et al. 2002) activity.

The object of present study is to test the insecticidal effect of *T. pulegioides* essential oil on *Myzus persicae* S. and *Apis mellifera* L. (non-target organism).

Materials and Methods

To extract EO from *T. pulegioides*, stems and flowers were collected from forest pastures in the Rhodopes mountain during flowering phase, June 2021. The amount of 1.5 kg was distilled for 3 h in a micro-distiller. The EO was stored in a glass container.

Insecticidal efficacy of *T. pulegioides* EO vapours were tested in laboratory conditions against *M. persicae* on tobacco using a similar to Digilio et al. (2008) method. Tobacco planted plants in pots were infested with aphids. After 5 days, plants with a known number of aphids were placed in 10 L air-tight cylinders. Concentrations of 0.5, 1, 2 and 3 $\mu L \cdot L^{-1}$ air and one control were tested in three replicates for each concentration. The oil was pipetted on filter paper and placed at the bottom of the cylinder. After 24 h, the efficiency was calculated according to Abbott (1925). Aphids that did not react when touched were considered as dead.

The minimum concentration that had highest efficacy was tested on 3 days old *A. mellifera* bees. Bees were newly emerged, caged and fed on 50 % sugar syrup. Three replicates and a control were used for the experiment; bees were treated with EO for 24 h under the same conditions described for aphids. Each replicate contained twenty bees.

The results were statistically processed by using one-way Anova in Excel.

Results and Discussion

The test results showed that *T. pulegioides* EO vapours have insecticidal effect against *M. persicae*. Aphids' mortality increased when concentration increased. A low mortality of aphids of 9.7 % found at 0.5 $\mu L \cdot L^{-1}$ air, at 1 $\mu L \cdot L^{-1}$ air mortality was 31.6 %, and at 2 and 3 $\mu L \cdot L^{-1}$ air it was 100 %. Concentration of 2 $\mu L \cdot L^{-1}$ air was found to be the minimum concentration which has maximum efficacy. A significant statistical differences were found between the efficacy of the various concentrations ($F > F_{crit}$, Anova: Single factor, p = 0.000) (Fig. 1). Mortality results for

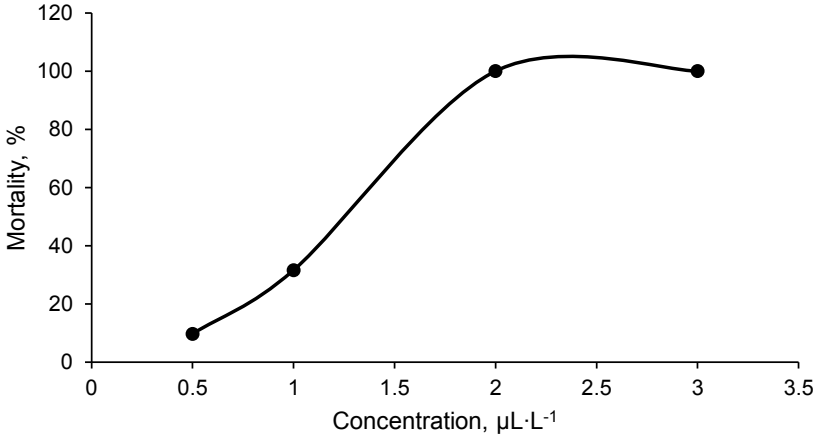

Fig. 1. Insecticidal efficiency of *T. pulegioides* EO against *M. persicae* at different applied doses.

the concentrations 0.5 μL·L^{-1} air and 1 μL·L^{-1} air show higher efficacy compared to those of Digilio et al. (2008). Khaled et al. (2017) showed toxic effect of *Thymus capitatus* L. EO by fumigation as well as by spraying against *M. persicae*.

The concentration of 2 μL·L^{-1} air was tested for toxicity on *A. mellifera.* The data shows very high toxicity of 100 % (means ±SD 100 ±0.0) of *T. pulegioides* EO vapours on treated bees while no mortality was recorded in the control. High statistical difference was found between the tested and control groups ($F > F_{crit}$, Anova: Single factor, $p = 0.000$).

Conclusions

EO vapours of *T. pulegioides* showed an insecticidal effect against *M. persicae* on tobacco and *A. mellifera*. The study information can be used in the production of tobacco seedlings, and in bees for pest control. More in-depth studies are needed in this field of study.

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