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Bioinsecticidal activity of essential oil of *Mentha arvensis* L. grown in forest area on *Helicoverpa armigera* Hub. in tobacco and *Apis mellifera* L.

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Abstract

In laboratory conditions bioinsecticidal effect of *Mentha arvensis* L. essential oil (EO) on *Helicoverpa armigera* Hub. 3rd instar larva on tobacco and *Apis mellifera* L. was found. There were differences between the efficacy of the divers concentrations. Good bioinsecticidal effect of 48 % was detected at concentration of 1.25 % v/v, high effect of 92 % at concentration of 2.5 % v/v and 100 % efficacy at 5 % v/v. Phytotoxicity on tobacco plants was found only at 5 % v/v EO concentration. The concentrations of 2.5 % v/v and even the less than 1.25 % v/v could be used to control the pest *H. armigera*. Concentrations of 1.25 % v/v and 2.5 % v/v applied under the same conditions to *A. mellifera* showed 100 % toxicity to the bees as well.

Key words: cotton bollworm, honey bees, wild mint.

Introduction

The cotton bollworm *Helicoverpa armigera* Hub. is a polyphagous pest and one of the most dangerous worldwide. It attacks a huge variety of plant species (Gopalakrishnan et al. 2016). The use of pesticides had led to insect resistance (Sharpe 1999), some of them are restricted in Europe (Cressey 2017), and contain agents dangerous to human health (Yu et al. 2013). Essential oils (EOs) have a strong effect on insects (Boulamtat et al. 2021), and can be used (Radev 2022a). They show repellent and lethal effects (Ibrahim 2019). The plant extracts have physiological effects on insects (Rahimi et al. 2018), and their elaboration is a long process (Shcherbakova 2011). EO could be extracted from various plants such as *Mentha arvensis* L. distributed also in forestry areas.

The present work aims at study the bioinsecticidal activity of *M. arvensis* EO on *H. armigera* 3rd instar larvae and *Apis mellifera* L. under laboratory conditions.

Materials and Methods

EO from *M. arvensis* was produced from stems and flowers picked from forest area in the Central Rhodopes mountain in blooming season, July 2021. The amount of 1.5 kg was hydro-distilled in a micro-distiller. The EO was stored in a glass container at room temperature.

The larvae collection of *H. armigera* was done by methodology of Papulwar et al. (2018) from tobacco plants at the Tobacco and tobacco products institute, Markovo. Larvae 3rd instar were determined according to DPI&F (2005) and placed in Petri dishes 90×20 mm with filter paper at the bottom. The test treatment was provided according to Boulamtat et al. (2021) methodology, and 0.01 % Tween 80 was used as emulsifier. The efficiency was calculated according to Abbott (1925).

The minimum concentration with highest efficacy was tested on 3 days old *A. mellifera* bees according to Radev (2022b), bees were treated with EO for 48 h under the same conditions as *H. armigera* larvae.

The results were statistically processed by using one-way Anova in Excel, at $p \leq 0.05$.

Results and Discussion

The results demonstrated bioinsecticidal effect of *M. arvensis* EO on *H. armigera* 3rd instar larvae. Good bioinsecticidal effect of 48 % was detected at concentration of 1.25 % v/v, high effect of 92 % at concentration of 2.5 % v/v and 100 % efficacy at 5 % v/v. There were differences between the efficacy of the divers concentrations ($F > F_{crit}$, $p = 0.00$) (Fig. 1). Effectiveness results for the concentrations of 1.25 % v/v and 2.5 % v/v were higher, while for 5 % v/v was the same compared to those of Boulamtat et al. (2021) for *M. spicata* EO. All the EO concentrations in laboratory study were applied over tobacco plants for phytotoxicity. Phytotoxicity (dried spots on tobacco plants) was reported only at 5 % v/v EO concentration.

The concentrations of 1.25 % v/v and 2.5 % v/v *M. arvensis* EO were tested for

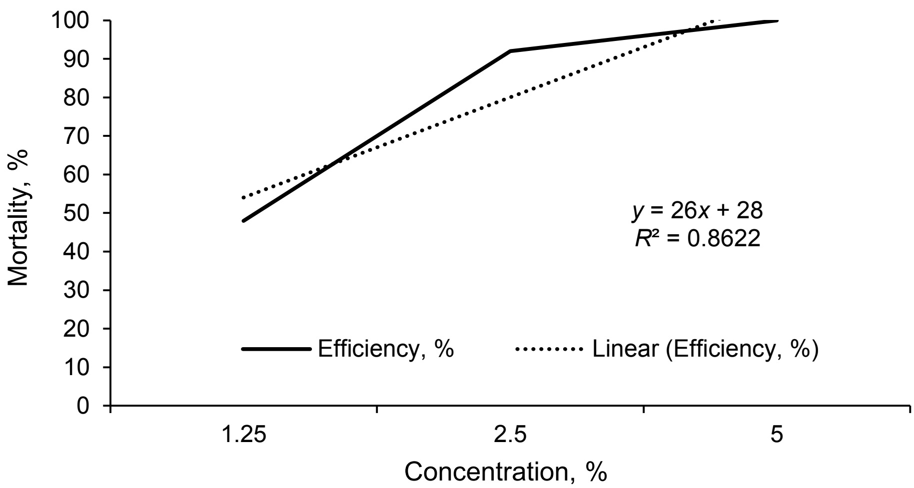

Fig. 1. Insecticidal efficacy of *M. arvensis* EO on *H. armigera* in varied concentrations applied.

toxicity on *A. mellifera*. Results indicated 100 % mortality (means ±SD 100 ±0.0). There is difference between the tested and control groups ($F > F_{crit}$, $p = 0.00$).

Conclusions

The results can be used as possible mean for the tobacco' pest control, and in bees' protection when performing treatments. More deep researches in this direction should be done.

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