

## EVALUATION OF THE EFFECTIVENESS OF NATURAL ESSENTIAL OILS IN THE MONITORING OF THE OCCURRENCE OF GREENHOUSE WHITEFLY (*TRIALEURODES VAPORARIORUM* WESTWOOD)

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**Abstract:** The presented studies revealed the usefulness of marjoram oil, thyme oil, juniper oil and sweet flag oil in the monitoring of the occurrence of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood). While using the examined natural essential oils on yellow sticky traps, it was found that the number of caught insects increased significantly. In relation to the control (traps without any addition of aromatic substance), the increase amounted to: 423.13%, 422.28%, 209.91% and 139.43% respectively.

**Key words:** monitoring, yellow sticky traps, aromatic attractants, greenhouse whitefly

### INTRODUCTION

The observed increased reaction of insects to definite colours inspired to apply coloured sticky traps in plant protection. These traps, thanks to their effect, signal precisely the appearance of harmful insects on cultivations and thereby permit to control them effectively still before any damages occur on the plants (Yano et al. 1987; Gillespie and Quiring 1987; Shipp and Zariffa 1991; Górski 1999). The mechanism of these traps is that their colour lures the flying forms of insects, which get stuck on the traps whose catching surfaces are covered with entomological glue (Baranowski and Górski 1991; Górski 1999; 2001).

In the Department of Plant Protection Methods Agricultural University in Poznań, studies have been carried out for many years on the increase of the effectiveness of sticky traps in the monitoring of greenhouse plant pests. Among others, it refers to the application of aromatic attractants to coloured sticky traps.

The objective of the present studies was the evaluation of the effectiveness of natural essential oils added to yellow sticky traps for the monitoring of the occurrence of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood).

## MATERIAL AND METHODS

Studies of the effectiveness of natural essential oils in the monitoring of greenhouse whitefly (*T. vaporariorum* Westwood) were carried out in the years 2002 and 2003, in a greenhouse at the Experimental Station "Marcelin" of the Horticultural Department August Cieszkowski Agricultural University in Poznań. The studied aromatic substances were added to yellow sticky traps. Each trap was made of plastic and its size was: 4 × 6 cm. Before the application of essential oils, the lower part of the trap (1 cm belt at the lower shorter edge) was protected with a paper tape. Next the traps were sprayed with entomological glue in aerosol. Subsequently, the protecting paper tape was removed and the uncovered area was painted with aromatic substance using a paintbrush. All essential oils were applied in the amount of 0.1 ml per one sticky trap. The experiment was carried out in two series. In each series, 3 different aromatic substances were tested; each substance was tested individually in a separate chamber of 40 m<sup>2</sup> surface. In the first experimental series, the following essential oils were tested: ginger oil, marjoram oil, thyme oil. In the second experiment, the test included juniper oil, sage oil and sweet flag oil. All aromatic substances used in the studies were produced by "Pollena Aroma" Co. in Warsaw. In the control combination yellow sticky traps did not have any addition of natural essential oils. The observations were carried out in the cultivation of fuchsia (*Fuchsia hybrida* Voss.) intensively attacked by greenhouse whitefly. All tested sticky traps were suspended in vertical position (the shorter edge upwards) so that their lower edge (covered with aromatic substance) was at the height of the plant tops. In each combination, 5 sticky traps were installed. Twice a week, the localization of traps in each chamber was changed in order to eliminate the influence of the suspension place on the number of the caught insects. After 7 days from the date of the installation of traps, the traps were removed and the number of the caught imagines was counted in the laboratory. Both experimental series were replicated 5 times. The obtained results were statistically analysed at the significance level of  $\alpha = 0.05$  using the Duncan's test.

## RESULTS

The results from the first experimental series that tested the allurements of the ginger oil, marjoram oil and thyme oil for greenhouse whitefly (*T. vaporariorum* Westwood) are presented in table 1.

The results indicate that all investigated aromatic substances increased the effectiveness of sticky traps. Greenhouse whitefly reacted intensively to marjoram oil and thyme oil. The application of these oils on yellow sticky traps caused a statistically significant increase of the caught insects in comparison with the control combination without any aromatic substance. The effectiveness increased by 423.13% and 422.28% respectively. Comparison of results obtained in the combinations with marjoram oil and thyme oil did not show any significant differences by the Duncan's test.

Table 1. Attractiveness of natural essential oils added to yellow sticky traps for greenhouse whitefly (*Trialeurodes vaporariorum* Westwood)

Type of essential oil	Mean number of caught insects (individuals/trap)	Increase percentage in relation to control
Marjoram oil	307.60 b	423.13
Thyme oil	307.10 b	422.28
Ginger oil	81.00 a	37.76
Control	58.80 a	–
LSD (0.05)	82.55	–
Juniper oil	281.40 b	209.91
Sweet flag oil	217.40 b	139.43
Sage oil	98.80 a	8.81
Control	90.80 a	–
LSD (0.05)	82.96	–

Mean values marked with the same letter do not differ at the significance level  $\alpha = 0.05$  according to the Duncan's test

In the remaining combination with the use of ginger oil, no significant differences were found in comparison to the control.

In the second experimental series, juniper oil, sage oil and sweet flag oil were tested (Tab. 1).

Similarly as in the first series of experiments, it was found that all aromatic substances positively affected effectiveness of the yellow sticky traps. The highest increase of the effectiveness of the traps by 209.91% in relation to control combination was recorded on yellow sticky traps with the addition of juniper oil.

Also sweet flag oil exerted a strongly alluring effect on greenhouse whitefly. Its application caused 139.43% increase of caught imagines as compared to the control combination.

The analysis of variance based on the Duncan's test did not show any significant differences between the results obtained in the combinations with juniper oil and sweet flag oil. However, the differences were significant when compared with the control.

No significant differences were found between the number of insects caught on sticky traps with the addition of sage oil and the control traps.

## DISCUSSION

Monitoring of pest population is one of the important factors determining the success of plant protection. Coloured sticky traps are suitable and effective tools for the monitoring of greenhouse pests. The attractiveness of traps for pests can be increased by using alluring flower odours in combination with the coloured sticky traps (Frey et al. 1994). Aldehydes found in flower oils were first described as thrips attractants (Howlett 1914). Catches of thrips by means of different aromatic aldehydes was investigated by several researchers (Brodsgaard 1990; Teulon and Ramakers 1990; Teulon et al. 1993; Frey et al. 1994; Górski 2001). Application of 4-methoxybenzaldehyde with an anise aroma (Brodsgaard 1990; Teulon and Ramakers 1990; Frey et al. 1994), benzaldehyde with an almond aroma (Teulon et

al. 1993) and 3-phenylpropinaldehyde with a cinnamon aroma (Górski 2001) caused a statistically significant increase of adult thrips caught on blue sticky traps.

In the presented studies, the author investigated the attractiveness of natural essential oils for greenhouse whitefly (*T. vaporariorum* Westwood).

All investigated aromatic substances increased the effectiveness of yellow sticky traps. Greenhouse whitefly reacted particularly intensively to marjoram oil, thyme oil, juniper oil and sweet flag oil. After the application of aromatic substances on sticky traps, the number of caught insects increased significantly amounting to 423.13%, 422.28%, 209.91% and 139.43% respectively.

In foreign literature, no data referring to the reaction of greenhouse whitefly to aromatic substances have been found.

In earlier studies carried out by the author, a significant increase of the pest reaction to lemon oil was demonstrated (Górski 2001). The application of lemon oil increased the number of imagines caught on yellow sticky traps by 94.51% in comparison to the control combination without aromatic substances.

In another studies, this author investigated the attractiveness of chemical aromatic substances for greenhouse whitefly. A significant reaction of this pest to 4-methoxybenzaldehyde with an anise aroma has been found. The application of this compound increased by 25.32% the number of insects caught on yellow sticky traps in comparison to the control.

## CONCLUSION

Natural essential oils such as: juniper oil, marjoram oil, thyme oil and sweet flag oil can be useful in the monitoring of the occurrence of greenhouse whitefly (*T. vaporariorum* Westwood). The application of the above mentioned oils increased significantly the number of insects caught on yellow sticky traps.

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## POLISH SUMMARY

### OCENA SKUTECZNOŚCI DZIAŁANIA NATURALNYCH OLEJKÓW ETERYCZNYCH W MONITOROWANIU WYSTĘPOWANIA MĄCZLIKA SZKLARNIOWEGO (*TRIALEUREDES VAPORARIORUM* WESTWOOD)

Badania nad skutecznością działania naturalnych olejków eterycznych w monitorowaniu występowania mączlika szklarniowego (*Trialeurodes vaporariorum* Westwood) przeprowadzono w latach 2002 i 2003, w szklarni znajdującej się na terenie Stacji Doświadczalnej „Marcelin” Akademii Rolniczej im. Augusta Cieszkowskiego w Poznaniu. Badane substancje zapachowe stosowano na żółtych tablicach chwytnych o wymiarach 4 × 6 cm, które wykonano z tworzywa sztucznego. Wszystkie testowane substancje zapachowe nanoszono na pułapki za pomocą pędzla, w ilości 0,1 ml na 1 tablicę chwytnej. Określono liczbę imagines odłowionych na powierzchniach chwytnych pułapek.

W przeprowadzonych badaniach wykazano przydatność w monitorowaniu mączlika szklarniowego naturalnych olejków eterycznych takich jak: majerankowy, tymiankowy, jałowcowy i tatarakowy. Po zastosowaniu na żółtych tablicach chwytnych wymienionych substancji zapachowych zanotowano istotny wzrost liczby odłowionych owadów. Wzrost ten wyniósł odpowiednio w stosunku do kontroli 423,13%, 422,28%, 209,91% i 139,43%.