

FOLIA
HORTICULTURAE
Ann. 16/1, 2004, 183-187

**Effectiveness of natural essential oils
in the monitoring of greenhouse whitefly
(*Trialeurodes vaporariorum* Westwood)**

Romuald Górski

Department of Plant Protection Methods
Faculty of Horticulture, Agricultural University of Poznań
Zgorzelecka 4, 60-198 Poznań, Poland
e-mail: rgorski@au.poznan.pl

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

ABSTRACT

The studies present the usefulness of sandalwood oil, basil oil, and grapefruit oil in the monitoring of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood). Addition of the mentioned aromatic substances on yellow sticky traps significantly increased the number of trapped insects by 487.64%, 483.20%, and 333.09%, respectively.

INTRODUCTION

The observed increased response of insects to definite colours inspired entomologists to apply coloured sticky traps in plant protection. These traps, thanks to their effect, signal precisely the appearance of harmful insects on cultivations

(Gillespie and Quiring 1987, Yano et al. 1987, Górski 1999). The attractiveness of traps for pests can be increased by using attractive 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 were 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-phenylpropionaldehyde with a cinnamon aroma (Górski 2001) caused a statistically significant increase in adult thrips caught on blue sticky traps. Researchers also tried to increase trap attractiveness for insects by using natural essential oils and their compounds. Several odours have been reported to be behaviourally attractive to greenhouse pests. Eugenol and geraniol, compounds of natural essential oils occurring in flower scent were attractive to western flower thrips (*Frankliniella occidentalis* Pergande). The addition of those compounds significantly increased the attractiveness of blue traps to adult thrips in laboratory experiments (Frey et al. 1994). In earlier studies carried out by the present author (Górski 2001) increased response of western flower thrips to coloured sticky traps with cinnamon oil, cypress oil, and rosemary oil was found. For example, sciarid fly (*Sciaridae*) responded positively to a great number of natural essential oils, i.e. bergamot oil, rose-tree oil, geranium oil, lavender oil, lemon oil, melissa oil and patchouli oil. At the same time, it was found that the colour of sticky traps and aromatic attractants cooperate in the stimulation of the insects' responses. This fact has been confirmed by a definite absence of western flower thrips and sciarid flies reaction to essential oils applied on colourless (transparent) sticky traps, in contrast to an increased reaction to coloured sticky traps (Górski 2001).

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

MATERIAL AND METHODS

Studies on the effectiveness of natural essential oils in the monitoring of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood) were carried out in the years 2002 and 2003 in greenhouses of the Experimental Station "Marcelin" of the Horticultural Faculty Agricultural University in Poznań. The studied aromatic substances were added to yellow sticky traps. The traps were made of plastics and their size was 4 x 6 cm. Before the application of natural essential oils, the lower part of the traps (1 cm stripe at the lower shorter edge) was protected with a paper tape, after which the traps were sprayed with insect glue (Soveurode®) in aerosol.

Subsequently, the protecting paper tape was removed and the uncovered area was covered with aromatic substance using a paintbrush. All natural 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, three different aromatic substances were tested. Each substance was tested individually in a separate chamber of 40 m² surface. In the chambers fuchsia plants (*Fuchsia hybrida* Voss.) were cultivated. The plants were strongly attacked by greenhouse whitefly. In the first experimental series, the following natural essential oils were tested: basil oil, spruce oil, tea-tree oil. In the second experiment, the test included grapefruit oil, sandalwood oil and ylang-ylang oil. All aromatic substances used in the studies were produced by 'Pollena Aroma' Co. in Warsaw. In the control combination, yellow sticky traps were used with no addition of aromatic substances. All tested sticky traps were suspended in the cultivation of fuchsia in vertical position (the shorter edge upwards) so that their lower edge (covered with aromatic substance) was at the height of plant tops. In each combination, five sticky traps were used. The localization of traps was changed in each chamber twice a week in order to eliminate the effect of the suspension place on the number of caught insects. After seven days from the moment of suspension, the traps were removed and the number of trapped imagines was counted. The experiment was replicated five times. The obtained results were statistically analysed using the Duncan's test at the significance level $p = 0.05$.

RESULTS

In the first experimental series all tested aromatic substances increased the effectiveness of sticky traps (Table 1). Greenhouse whitefly (*Trialeurodes vaporariorum* Westwood) reacted most intensively to basil oil. The addition of this oil on yellow sticky traps caused a statistically significant increase in the caught insects in comparison with the control combination with no aromatic substance. The effectiveness increased by 483.20%. In the remaining combinations, no significant differences were found in comparison with the control.

In the second experimental series similarly as in the first series, it was found that all aromatic substances had an effect on increased effectiveness of the sticky traps. Greenhouse whitefly reacted most intensively to sticky traps with the addition of sandalwood oil. The effectiveness was increased by 487.64%. Also grape fruit oil exerted a strongly attracting effect. Its application caused a 333.09% increase in caught imagines as compared with the control combination. Comparison of results obtained in the combinations with sandalwood oil and grape fruit oil did not showed significant differences by the Duncan's test. 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 ylang-ylang oil and the control traps.

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

Series of experiment	Type of essential oil	Number of caught insects (per trap)	Percentage increase in relation to control
A	Basil oil	145.80 b*	483.20
	Tea-tree oil	45.30 a	81.20
	Spruce oil	40.50 a	62.00
	Control – yellow sticky trap with no addition of essential oil	25.00 a	–
B	Sandalwood oil	161.60 b	487.64
	Grape fruit oil	119.10 b	333.09
	Ylang-Ylang oil	42.80 a	55.64
	Control – yellow sticky trap with no addition of essential oil	27.50 a	–

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

DISCUSSION

In the presented studies, natural essential oils showed a high attractiveness for greenhouse whitefly (*Trialeurodes vaporariorum* Westwood). Greenhouse whitefly reacted particularly intensively to sandalwood oil, basil oil, and grapefruit oil. After the application of aromatic substances on yellow sticky traps, the number of insects caught increased significantly amounting to 487.64%, 483.20%, and 333.09%, 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 present author, a significant increase in the pest reaction to lemon oil was demonstrated (Górski 2001). The addition of lemon oil increased the number of imagines trapped on yellow sticky traps by 94.51% in comparison with the control combination without aromatic substances. greenhouse whitefly. A significant reaction of greenhouse whitefly to 4-methoxybenzaldehyde with an anise aroma was also found. The application of this compound increased the number of insects caught on yellow sticky traps by 25.32% in comparison with the control.

CONCLUSIONS

Natural essential oils such as: basil oil, grapefruit oil, and sandalwood oil can be useful in the monitoring of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood).

The addition of the above mentioned oils significantly increased the number of insects caught on yellow sticky traps.

REFERENCES

- BRODSGAARD J. F., 1990. The effect of anisaldehyde as a scent attractant for *Frankliniella occidentalis* (Thysanoptera: Thripidae) and the response mechanism involved. Bull. SROP/WPRS 13(5): 36-38.
- FREY J.E., CORTADA R.V., HELBING H., 1994. The potential of flower odours for use in population monitoring of western flower thrips *Frankliniella occidentalis* Perg. (Thysanoptera: Thripidae). Biocontrol Sci. Technol. 4(2): 177-186.
- GILLESPIE D.R., QUIRING D.J.M., 1987. Yellow sticky traps for detecting and monitoring greenhouse whitefly (*Homoptera: Aleurodidae*) adults on greenhouse tomato crops. J. Econ. Entomol. 80(3): 675-679.
- GÓRSKI R., 1999. Monitorowanie szkodników roślin szklarniowych. Post. Ochr. Rośl. 39(1): 5-9.
- GÓRSKI R., 2001. Barwne pułapki chwytne w monitorowaniu szkodników roślin szklarniowych. Roczn. AR Poznań. Rozp. Nauk. 310: 3-108.
- HOWLETT F.M., 1914. A trap for thrips. J. Econ. Biol. IX: 21-23.
- TEULON D.A.J., RAMAKERS P.M.J., 1990. A review of attractants for trapping thrips with particular reference to glasshouses. Bull. SROP/WPRS 13(5): 212-214.
- TEULON D.A.J., PENMAN D.R., RAMAKERS P.M.J., 1993. Volatile chemicals for thrips (*Thysanoptera: Thripidae*) host finding and applications for thrips pest management. J. Econ. Entomol. 86(5): 1405-1415.
- YANO E., GERRARD D.J., CHIANG H.C., 1987. Quantitative monitoring techniques for the greenhouse whitefly. Bull. OILB/SROP 10(2): 198-202.

SKUTECZNOŚĆ NATURALNYCH OLEJKÓW ETERYCZNYCH
W MONITOROWANIU MĄCZLIKA SZKLARNIOWEGO
(*TRIALEUREDES VAPORARIORUM* WESTWOOD)

Streszczenie: W badaniach przeprowadzonych w latach 2002 i 2003, w szklarniach Stacji Doświadczalnej „Marcelin” Akademii Rolniczej w Poznaniu wykazano przydatność olejku sandałowego, bazyliowego i grejpfrutowego w monitorowaniu mączlika szklarniowego (*Trialeurodes vaporariorum* Westwood). Po naniesieniu na żółtych tablicach chwytnych wymienionych substancji zapachowych zanotowano istotny wzrost liczby odłowionych owadów. Wzrost ten wynosił odpowiednio w stosunku do kontroli (tablice chwytne bez dodatku olejku eterycznego) 487,64%, 483,20 i 333,09%.

Received September 15, 2003; accepted March 30, 2004