

EFFECTIVENESS OF NATURAL ESSENTIAL OILS IN MONITORING OF THE OCCURRENCE OF PEA LEAFMINER (*LIRIOMYZA HUIDOBRENSIS* BLANCHARD) IN GERBERA CROP

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Abstract: The presented studies revealed the usefulness of spruce oil, basil oil, juniper oil and clove oil in monitoring of the occurrence of pea leafminer (*Liriomyza huidobrensis* Blanchard). While using above mentioned oils on yellow sticky traps, it was found that the number of trapped insects increased significantly. In relation to the control (traps without any addition of aromatic substance), the increase amounted to: 561.33%, 287.95%, 159.74% and 130.77%, respectively.

Key words: monitoring, yellow sticky traps, aromatic attractants, pea leafminer

INTRODUCTION

Coloured sticky traps are suitable and efficacious tools for monitoring of greenhouse pests. The action of these traps consists in the fact that their colour lures the flying forms of insects which get stuck to them because catching surfaces are covered with entomological glue (Baranowski and Górski 1991; Górski 1999, 2001). 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 anise aroma (Brodsgaard 1990; Teulon and Ramakers 1990; Frey et al. 1994), benzaldehyde with almond aroma (Teulon et al. 1993), and 3-phenylpropionaldehyde with cinnamon aroma (Górski 2001) caused a statistically significant increase in adult thrips trapped 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 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, lavandin oil, lemon oil, melissa oil, and patchouli oil. Greenhouse whitefly (*Trialeurodes vaporariorum* Westwood) reacted most intensively to lemon oil. At the same time, it was found that the colour of sticky traps and aromatic attractants cooperate in the stimulation of insects' responses. This fact has been confirmed by a definite absence of western flower thrips, sciarid flies and greenhouse whitefly reaction to essential oils applied on colourless (transparent) sticky traps, in contrast to an increased reaction of these pests to coloured sticky traps (Górski 2001).

The objective of the present studies was the evaluation of effectiveness of natural essential oils added to yellow sticky traps for monitoring the occurrence of pea leafminer (*Liriomyza huidobrensis* Blanchard).

MATERIAL AND METHODS

Studies on the effectiveness of natural essential oils in monitoring of pea leafminer (*Liriomyza huidobrensis* Blanchard) were carried out in the years 2003 and 2004 in commercial greenhouse in Przeźmierowo. The studied aromatic substances were added to yellow sticky traps. The traps were made of plastics and their size was 4 × 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 that 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, four different aromatic substances were tested. Each substance was tested individually in a separate chamber of 120 m² in the cultivation of gerbera (*Gerbera jamesonii* Bolus) strongly attacked by *L. huidobrensis*. In the first experimental series, the following natural essential oils were tested: ginger oil, sage oil, spruce oil, sweet flat oil. In the second experiment, the test included basil oil, clove oil, juniper oil, and tea-tree oil. All aromatic substances used in the studies were produced by "Pollena Aroma" Co. in Warsaw. In the control variant, yellow sticky traps were used with no addition of aromatic substances. All tested sticky traps were hung in the cultivation of gerbera 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 experimental variant, five sticky traps were used. The localization of traps was changed in each chamber twice a week in order to eliminate the effect of suspension place on the number of insects caught. After seven days from the moment of suspension, the traps were removed and the number of trapped imagines was counted. The experiment was replicated four times. The ob-

tained 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). The pea leafminer (*Liriomyza huidobrensis* Blanchard) reacted most intensively to spruce oil. The addition of this oil on yellow sticky traps caused a statistically significant increase of trapped adult insects in comparison with the control with no aromatic substance. The effectiveness increased by 561.33%. In the remaining treatments, no significant differences were found in comparison with the control traps.

In the second experimental series, similarly as in the first series, it was found that all aromatic substances had the effect on increased effectiveness of the sticky traps (Table 1). The pea leafminer reacted intensively to basil oil, juniper oil and clove oil. The application of these oils on yellow sticky traps caused a significant increase of insects caught in comparison with traps without any addition of essential oils. The effectiveness increased by 287.95%, 159.74% and 130.77% respectively. In the remaining treatments with the use tea-tree oil, no significant difference was found in comparison to the control traps.

Table 1. Attractiveness of natural essential oils added to yellow sticky traps for pea leafminer (*Liriomyza huidobrensis* Blanchard)

Series of experiment	Type of essential oil	Mean number of trapped insects (per one trap)	Percentage increase of number of trapped insects in relation to control
A	Spruce oil	24.80 b	561.33
	Ginger oil	11.70 a	212.00
	Sage oil	11.00 a	193.34
	Sweet flat oil	7.80 a	108.00
	Control – yellow sticky trap with no addition of essential oil	3.75 a	–
B	Basil oil	30.26 c	287.95
	Juniper oil	20.26 b	159.74
	Clove oil	18.00 b	130.77
	Tea-tree oil	15.80 ab	102.56
	Control – yellow sticky trap with no addition of essential oil	7.80 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

Chemical control of pea leafminer is very difficult. This species shows a high tolerance to plant protection agents (Dankowska and Baranowski 2000). In the protection of greenhouse cultivations against *L. huidobrensis*, early monitoring of that pest has an essential importance. In monitoring of harmful insects occurring on greenhouse plants, coloured sticky traps have proven to be useful (Gillespie and

Quiring 1987; Yano et al. 1987; Shipp and Zariffa 1991). In the Department of Plant Protection Methods, Agricultural University in Poznań, studies have been carried out for many years on the increase of effectiveness of sticky traps in monitoring of greenhouse pests. Among others, it refers to the application of aromatic attractants to coloured sticky traps (Górski 2001).

In the presented studies it has been shown that the addition of aromatic substances to yellow traps increases their attractiveness for *L. huidobrensis*. The pea leafminer reacted particularly intensively to spruce oil, basil oil, juniper oil and clove oil. After the application of these aromatic attractants on sticky traps, the number of trapped insects increased significantly.

In home and foreign literature, no data referring to the response of leafminers to natural essential oils have been found.

In studies carried out by Dankowska and Baranowski (2000) the attractiveness of aromatic chemical compounds for *L. huidobrensis* was investigated. The addition of 3-phenylpropionaldehyde with cinnamon aroma and benzyl acetate with jasmine aroma to yellow sticky traps increased the number of trapped imagines by 62.40% and 34.60%, respectively, in comparison with the control variant without aromatic substances. At the same time, the effect of colour of sticky traps on the number of caught adult *L. huidobrensis* was found. The yellow traps were more attractive for pea leafminer than the blue ones.

CONCLUSION

Natural essential oils such as: basil oil, clove oil, juniper oil and spruce oil can be useful in monitoring of pea leafminer (*Liriomyza huidobrensis* Blanchard). The addition of the above mentioned oils significantly increased the number of insects trapped on yellow sticky traps.

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POLISH SUMMARY

SKUTECZNOŚĆ DZIAŁANIA NATURALNYCH OLEJKÓW ETERYCZNYCH W MONITOROWANIU WYSTĘPOWANIA MINIARKI SZKLARNIÓWKI (*LIRIOMYZA HUIDOBRENSIS* BLANCHARD) W UPRAWIE GERBERY

Badania nad skutecznością działania naturalnych olejków eterycznych w monitorowaniu miniarki szklarniówki (*L. huidobrensis* Blanchard) przeprowadzono w latach 2003 i 2004, w szklarni produkcyjnej w Przeźmierowie, w uprawie gerbery. Testowane substancje zapachowe nanoszono na żółte tablice chwytne o wymiarach 4 × 6 cm, w ilości 0,1 ml na 1 pułapkę. Ocenie poddano następujące naturalne olejki eteryczne: bazyliowy, drzewa herbacianego, goździkowy, imbirowy, jałowcowy, szałwiowy, świerkowy, tatarakowy. W kombinacji kontrolnej stosowano żółte tablice chwytne bez dodatku substancji zapachowych. Określono liczbę imagines odłowionych na powierzchniach chwytnych pułapek.

W przedstawionych badaniach stwierdzono, że dodatkowe zastosowanie substancji zapachowych na żółtych tablicach chwytnych zwiększa efektywność przywabiania miniarki szklarniówki. Miniarka ta szczególnie silnie reagowała na olejki, takie jak: świerkowy, bazyliowy, jałowcowy, szałwiowy. Po zastosowaniu wymienionych atraktantów zapachowych zanotowano istotny wzrost liczby odłowionych owadów. Wzrost skuteczności działania pułapek chwytnych wyniósł odpowiednio w stosunku do kontroli 561,33%; 287,95%; 159,74%; 130,77%.