

THE EFFECT OF OIL EXTRACTS OF SELECTED PLANT SPECIES ON FEEDING OF LARGE PINE WEEVIL *HYLOBIUS ABIETIS* (L.) BEETLES ON SCOTS PINE SHOOTS*

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Abstract. The aim of the study was to verify whether oil extracts prepared from plants of 22 selected species contained substances reducing feeding of *Hylobius abietis* beetles in shoots of *Pinus sylvestris*. Experiments were conducted under laboratory conditions. A statistically significant reduction was shown for the size of damage on pine twigs treated with oil extracts of *Lycopersicon esculentum* leaves. In contrast, extracts of *Papaver rhoeas* and *Junlans regia* leaves increased feeding of large pine weevil beetles.

Key words: *Hylobius abietis*, oil extracts, antifeedants, deterrents

INTRODUCTION

In order to reduce the harmfulness of certain insect species different preparations, also those of plant origin, have been used for several centuries. These include rotenoids obtained from roots of tropical papilionaceous plants (*Fabaceae*) from genera *Derris*, *Lonchocarpus*, *Tephrosia* and *Milletia* [Goszczyński 1993]. These plants contain many glycosides, such as e.g. rotenone (C₂₃H₂₂O₆), which is effective against numerous insect species; however, it exhibits high toxicity also in relation to endotherms. Natural pyrethrines may be obtained from flowers of different *Chrysanthemum* spp., which at a considerable insecticide activity exhibit low toxicity towards mammals [Goszczyński 1993].

At present, in relation with increased requirements of environmental protection, interest in natural origin plant protection agent is also increasing. Preparations produced

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from margosa tree *Azadirachta indica* (A. Juss.) exhibit high effectiveness as deterrents and insecticides [Malinowski 1997].

It seems that this type of agents may be also used against certain species of forest insects [Korczyński 1992]. Investigations on the response of large pine weevil *Hylobius abietis* (L.) to preparations of plant origin have been conducted for a long time [Korczyński and Ejchorst 2000 a, b, Korczyński and Owczarek 2001, Korczyński and Kowańdy 2001, Kuźmiński 2002 a, b, 2003 a, b, 2004]. This study was the successive stage of the investigations. Its aim was to verify whether oil extracts prepared from selected plant species affect feeding of *Hylobius abietis* beetles on shoots of *Pinus sylvestris*.

MATERIAL AND METHODS

In the experiments dried and powdered leaves of 22 plant species were used. Oil extracts were prepared by adding 6 g powder from a selected plant species to 100 g rapeseed oil. Containers with oil and powder were kept in a water bath maintaining the temperature of approx. 100°C for 3 h. Next the extract was filtered. Preparation for the experiment was obtained by diluting oil extract in water at a concentration of 25%. The control preparation was produced by diluting rapeseed oil in water at the same ratio.

Beetles of large pine weevil *Hylobius abietis* required for the experiments were caught in central western Poland, in the Oborniki Forest District (the Regional Directorate of State Forests in Poznań). The ratio of male to female specimens was on average 1:1.

The effect of oil extracts on the volume of feeding by large pine weevils was assessed by giving Scots pine twigs, treated with the preparation produced from the extract and twigs treated with the control preparation, for beetles to feed on. Weevils together with twigs were placed in Petri dishes. A total of 8-10 Petri dishes with a diameter of 20 cm and height of 2.5 cm were used in one experiment. Five sections of pine twigs treated with the preparation, five sections of control twigs and 20 large pine weevil beetles were placed in each dish.

Weevils were pre-starved for 24 h in order to increase their interest in food during the experiment. Weevils could feed on bark of test twigs for 4 h, after which the size of damage to bark caused by beetles was determined.

The significance of differences between the mean size of eating on sections of twigs treated with the preparation and the mean size of eating on control sections was analyzed using the Student t test for pairs of observations [Ruszczyc 1978].

RESULTS

It was shown that only three out of the 22 preparations affected statistically significantly the size of eating by large pine weevil beetles (Table 1). Oil extract of *Lycopersicon esculentum* leaves considerably reduced the size of eating, while oil extracts of *Papaver rhoeas* and *Juglans regia* leaves increased the size of eating.

Table 1. Damage of bark on pine twigs treated with oil extract and control pine twigs, mm²
 Tabela 1. Uszkodzenia kory gałązek sosnowych traktowanych wyciągiem olejowym i gałązek kontrolnych sosnowych, mm²

Family Rodzina	Species Gatunek	Size of damage Wielkość uszkodzeń			
		control kontrola		extract wyciąg	
		x	± SE	x	± SE
<i>Papaveraceae</i>	<i>Papaver rhoeas</i> L.	11.00	± 4.256 a	20.63	± 2.784 b
	<i>Chelidonium majus</i> L.	34.25	± 5.092 a	45.50	± 6.240 a
<i>Fabaceae</i>	<i>Trifolium repens</i> L.	35.00	± 4.001 a	18.00	± 3.742 a
	<i>Lupinus polyphyllus</i> Lindl.	15.75	± 2.890 a	11.63	± 3.279 a
	<i>Robinia pseudoacacia</i> L.	26.13	± 3.735 a	28.13	± 4.224 a
<i>Compositae</i>	<i>Tanacetum vulgare</i> L.	17.13	± 6.224 a	31.25	± 3.986 a
	<i>Arctium lappa</i> L.	33.88	± 5.858 a	25.75	± 3.217 a
	<i>Achillea millefolium</i> L.	25.00	± 3.808 a	29.50	± 3.615 a
<i>Solanaceae</i>	<i>Lycopersicon esculentum</i> Mill.	11.20	± 2.620 a	2.50	± 0.792 b
	<i>Solanum tuberosum</i> L.	37.29	± 5.167 a	36.43	± 6.961 a
	<i>Nicotiana tabacum</i> L.	22.75	± 5.628 a	37.63	± 6.825 a
<i>Balsaminaceae</i>	<i>Impatiens noli-tangere</i> L.	32.00	± 5.121 a	39.56	± 4.448 a
<i>Urticaceae</i>	<i>Urtica dioica</i> L.	15.38	± 2.970 a	16.50	± 3.808 a
<i>Caprifoliaceae</i>	<i>Sambucus nigra</i> L.	19.00	± 7.101 a	18.63	± 5.117 a
<i>Liliaceae</i>	<i>Convallaria majalis</i> L.	27.63	± 5.022 a	34.88	± 4.974 a
<i>Dryopteridaceae</i>	<i>Dryopteris filix-mas</i> (L.) Schot.	37.88	± 7.744 a	41.88	± 5.437 a
<i>Buxaceae</i>	<i>Buxus sempervirens</i> L.	29.56	± 4.318 a	15.78	± 2.707 a
<i>Cruciferae</i>	<i>Brassica oleracea</i> L.	14.40	± 2.482 a	8.70	± 2.785 a
<i>Apiaceae</i>	<i>Apium graveolens</i> L.	22.11	± 4.820 a	30.33	± 4.664 a
<i>Ericaceae</i>	<i>Ledum palustre</i> L.	30.44	± 3.496 a	23.11	± 3.683 a
<i>Juglandaceae</i>	<i>Juglans regia</i> L.	14.38	± 3.257 a	27.63	± 2.797 b
<i>Tiliaceae</i>	<i>Tilia cordata</i> Mill.	18.75	± 5.372 a	20.75	± 2.796 a

x – mean.

± SE – standard error of mean.

If numerical values in a given line are denoted with different letters (a, b), their means differ statistically significantly.

x – średnia.

± SE – błąd standardowy średniej.

Jeżeli wartości liczbowe w danym wierszu są oznaczone odmiennymi literami (a, b), to średnie różnią się statystycznie istotnie.

It was not possible to show a significant effect of e.g. oil extracts of *Tilia cordata*, *Arctium lappa* and *Dryopteris filix-mas* on feeding activity of weevils. At the same time it was shown in earlier studies that powder prepared from *Tilia cordata* leaves attracted weevil beetles [Korczyński and Kuświk 2001], whereas powder preparations prepared from *Arctium lappa* and *Dryopteris filix-mas* leaves reduced the size of damage to pine shoots caused by weevils [Korczyński and Ejchorst 2000 b]. This means that at least in some cases powder preparations may exhibit higher activity than oil extracts.

It should be added that in this study no effect on feeding of weevils was shown for oil extract prepared from *Sambucus nigra*, similarly as a lack of such effect shown for the powder preparation prepared from plants of this species [Korczyński and Ejchorst 2000 b].

CONCLUSIONS

1. Oil extract of tomato *Lycopersicon esculentum* leaves contains substances reducing feeding of large pine weevil beetles on shoots of Scots pine.

2. Oil extracts of field poppy *Papaver rhoeas* leaves and common walnut *Juglans regia* leaves contain substances increasing feeding of large pine weevils.

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WPLYW WYCIĄGÓW OLEJOWYCH Z ROŚLIN WYBRANYCH GATUNKÓW NA ŻEROWANIE CHRZĄSZCZY SZELINIAKA SOSNOWCA *HYLOBIUS ABIETIS* (L.) NA PĘDACH SOSNY ZWYCZAJNEJ

Streszczenie. Celem badań było stwierdzenie czy wyciągi olejowe uzyskane z roślin należących do 22 wybranych gatunków zawierają substancje ograniczające żerowanie chrząszczy *Hylobius abietis* na pędach *Pinus sylvestris*. Badania wykonano w warunkach laboratoryjnych. Wykazano statystycznie istotne zmniejszenie wielkości uszkodzeń na gałązkach sosnowych traktowanych wyciągiem olejowym z liści *Lycopersicon esculentum*. Natomiast wyciągi z liści *Papaver rhoeas* i *Junlans regia* zwiększały żerowanie chrząszczy szeliniaka sosnowca.

Słowa kluczowe: *Hylobius abietis*, wyciągi olejowe, antyfidanty, deterenty

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