

**RESPONSE OF LARGE PINE WEEVIL  
*HYLOBIUS ABIETIS* (L.) (COLEOPTERA, CURCULIONIDAE)  
BEETLES TO THE SMELL OF ALCOHOLIC EXTRACT  
FROM PLANTS OF SELECTED SPECIES\***

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**Abstract.** The aim of the study was to determine the motor response of large pine weevil beetles to the smell of methanol extracts prepared from leaves of plants belonging to 23 selected species. Responses were analysed under laboratory conditions using olfactometers. Large pine weevil beetles were shown to respond to the aroma of two extracts. Methanol extracts of *Mentha piperita* L. and *Trifolium repens* L. leaves statistically significantly attracted large pine weevils.

**Key words:** *Hylobius abietis*, plant aroma, alcoholic extracts

**INTRODUCTION**

Smell stimuli play a great role in the life of insects. For instance they control reproduction processes, as well as participate in the process of selection and acceptance of individual plants or their parts as the alimentary base. For this reason substances preventing the identification of the host plant or repelling insects are being used with increasing frequency in plant protection. Due to the degree of their effect on animals they are called sensory significant substances. Plants may be sources of such substances. It is estimated that there are approx. 1000 chemical compounds in plants, exhibiting proven activity in relation to insects [Nawrot 1984, Wyrostkiewicz 1989]. In turn, on the basis of a list compiled by McIndoo in 1945 it may be assumed that at least 1180 plant species contain compounds toxic towards insects [Harborne 1997]. Most plants containing the above mentioned substances are found in the tropical climate. However, further studies showed that also in the moderate climate zone there are many plant species exhibiting antifidant properties towards insects [Wasina 1987]. Such plants include such

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common species as e.g. calamus *A. calamus* [Tewari and Krishna Moorthy 1985, Wyrostkiewicz 1992, Korczyński and Ejchorst 2000 b], common garlic *Allium sativum* L. [Oprychałowa 1994], or mugwort *Artemisia absinthium* L. [Korczyński 1992, Wyrostkiewicz 1992, Oprychałowa 1994].

It was also attempted to use plants, or rather substances of plant origin, in the protection of deciduous tree cultures against damage caused by beetles of the large pine weevil *Hylobius abietis* (L.). Such studies have been conducted for more than a decade at the Department of Forest Entomology, the Agricultural University of Poznań [Korczyński 1992, Korczyński and Ejchorst 2000 a, b, Korczyński and Owczarek 2001, Korczyński and Kowańdy 2001, Kuźmiński 2002 a, b, 2003 a, b, 2004].

This study is the next stage in the series of detailed investigations on the effect of substances of plant origin on *Hylobius abietis* beetles.

The aim of this study is to assess the effect of aroma of alcoholic extracts obtained from leaves of selected plant species on the behaviour of *Hylobius abietis* beetles.

## MATERIAL AND METHODS

Dried and powdered leaves of 23 plant species were used in the experiments. Plants were collected at anthesis of individual species. Extracts were prepared by placing 6 g plant powder in 100 g methanol for 24 h. Next the extract was filtered. Pure methanol was the control. Pieces of white paper with G.S.M. of 200 g/m<sup>2</sup> and dimensions of 1 × 2 cm were immersed in the extract and in methanol for 1 h. Next paper pieces were dried at approx. 24°C for 2 h, after which they were placed in olfactometers with large pine weevil beetles.

Olfactometers described by Korczyński [1992] were used in the experiments. Weevils were placed in the central container, from which they could enter eight test tubes attached to the sides of the central container. Paper pieces, previously immersed in the extract, were placed at the bottom of four test tubes selected at random. Pieces of paper immersed in the control preparation were placed in the other four test tubes. The source of aroma was separated from the rest of the test tube using an untight seal. Large pine weevil beetles with a random sex structure were placed in olfactometers. Two hours since the onset of the experiment the numbers of weevils were determined in individual test tubes and in the central container.

Statistical analysis of results was conducted using the one-way analysis of variance and Duncan's multiple range test, included in the STATISTICA 5.1\* software package.

Large pine weevil beetles required for the experiment were caught in the central-Western Poland, in the Oborniki forest district. On the average the ratio of the number of males to females was 1:1.

## RESULTS

It was shown that only two of the 23 tested preparations produced from leaves of selected plant species had a statistically significant effect on responses of large pine weevils.

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\* StatSoft (1997). STATISTICA for Windows [Computer program manual]. Tulsa, OK: StatSoft, Inc., 2300 East 14th Street, Tulsa, OK 74104, phone: (918) 749-1119, fax: (918) 749-2217, e-mail: info@statsoftinc.com, WEB: <http://www.statsoft.com>

vil beetles (Table 1). They were extracts of *Mentha piperita* and *Trifolium repens*. In both cases their action attracting insects was observed. None of the tested preparations had a repelling effect on insects.

Earlier studies [Korczyński 1992, Korczyński and Owczarek 2001, Kuźmiński 2002 b] tested responses of large pine weevil beetles to the aroma of powders produced from selected plant species used in this study. At that time it was found that the aroma of powders produced from *Dryopteris filix-mas* and *Convallaria majalis*, similarly as that of methanol extracts applied in this study, did not affect responses of large pine weevils.

Table 1. The effect of aroma of alcoholic extracts produced from leaves of selected plant species on large pine weevil beetles. The number of beetles is given in the number of specimens per olfactometer

Tabela 1. Wpływ zapachu wyciągów alkoholowych z liści wybranych gatunków roślin na chrząszcze szeliniaka sosnowca. Liczbę chrząszczy podano w osobnikach na olfaktometr

Plant species Gatunek rośliny	Mean number of beetles Średnia liczba chrząszczy			Value F Wartość F	Dun- can's Test Dun- cana	Signifi- cance level Poziom istotności p	Action shown Wyka- zane działa- nie
	central container pojemnik centralny (A)	prepara- tion preparat (B)	control kontrola (C)				
<i>Achillea millefolium</i> L.	6.62	7.62	5.74	0.7982	–	0.46331	0
<i>Apium graveolens</i> L.	10.25	4.37	5.37	8.7708	<u>A C B</u>	0.00170	0
<i>Arctium lappa</i> L.	7.00	7.12	5.87	0.2075	–	0.81427	0
<i>Brassica oleracea</i> L. var. <i>capitata</i>	6.50	13.25	10.25	4.7918	<u>B C A</u>	0.01931	0
<i>Buxus sempervirens</i> L.	7.50	7.00	5.50	0.7054	–	0.50523	0
<i>Caragana arborescens</i> Lam.	8.37	6.12	5.50	2.0351	–	0.15565	0
<i>Convallaria majalis</i> L.	6.50	8.12	5.37	0.7455	–	0.48664	0
<i>Datura stramonium</i> L.	9.62	8.12	12.25	2.2587	–	0.12928	0
<i>Dryopteris filix-mas</i> (L.) Schott	6.62	6.37	7.00	0.0412	–	0.95974	0
<i>Hypericum perforatum</i> L.	6.75	6.37	6.87	0.0541	–	0.94747	0
<i>Impatiens noli-tangere</i> L.	10.50	10.12	9.37	0.2098	–	0.81242	0
<i>Laburnum anagyroides</i> Med.	6.37	10.75	12.87	6.7288	<u>C B A</u>	0.00552	0
<i>Ledum palustre</i> L.	6.62	7.75	5.62	1.2230	–	0.31446	0
<i>Lupinus polyphyllus</i> Lindl.	7.12	8.00	4.87	1.1873	–	0.32471	0
<i>Lycopersicon esculentum</i> Mill.	8.75	9.50	11.75	0.7000	–	0.50781	0
<i>Mentha piperita</i> L.	7.12	16.00	6.87	12.2748	<u>B A C</u>	0.00029	+
<i>Nicotiana tabacum</i> L.	6.12	6.62	7.25	0.1778	–	0.83838	0
<i>Papaver rhoeas</i> L.	8.25	7.37	4.37	1.7555	–	0.19724	0
<i>Robinia pseudacacia</i> L.	5.50	7.62	6.87	0.5235	–	0.59999	0
<i>Sambucus nigra</i> L.	3.87	8.62	7.50	5.2082	<u>B C A</u>	0.01456	0
<i>Solanum tuberosum</i> L.	11.50	9.12	9.35	0.7212	–	0.49784	0
<i>Trifolium repens</i> L.	5.87	14.50	9.62	9.5578	<u>B C A</u>	0.00112	+
<i>Urtica dioica</i> L.	11.00	8.12	10.87	2.3136	–	0.12358	0

0 – no effect was shown, + – attracting action.

0 – nie wykazano wpływu, + – działanie wabiące.

However, it was also found in those studies that powders of *Urtica dioica*, *Buxus sempervirens*, *Papaver rhoeas*, *Brassica oleracea* var. *capitata*, *Trifolium repens*, *Lupinus polyphyllus*, *Impatiens noli-tangere*, *Apium graveolens*, *Achillea millefolium*, and *Mentha piperata* had a repelling action on weevils. In contrast, the aroma of methanol extracts of these plants did not affect responses of large pine weevils. This means that plant powders much more effectively retain substances exhibiting the repelling activity than volatile methanol extracts.

In studies by Kuźmiński [2002 c, 2004] on average approx. 30% water extracts of plants had an effect on responses in wood weevils.

## CONCLUSIONS

1. Methanol extracts produced from leaves of *Mentha piperita* and *Trifolium repens* attract large pine weevil beetles.

2. The aroma of methanol extracts much less frequently than that of powders or water extracts has an effect on the behaviour of wood weevils.

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**REAKCJE CHRZĄSZCZY SZELINIAKA SOSNOWCA  
– *HYLOBIUS ABIETIS* (L.) (*COLEOPTERA*, *CURCULIONIDAE*)  
NA ZAPACH WYCIĄGÓW ALKOHOLOWYCH  
Z ROŚLIN NALEŻĄCYCH DO WYBRANYCH GATUNKÓW**

**Streszczenie.** Celem badań było określenie reakcji ruchowych chrząszczy szeliniaka sosnowca na zapach wyciągów metanolowych sporządzonych z liści roślin należących do 23 wybranych gatunków. Reakcje badano w warunkach laboratoryjnych z wykorzystaniem olfaktometrów. Wykazano reakcję szeliniaków na zapach dwóch wyciągów. Wyciągi metanolowe z liści *Mentha piperita* L. i *Trifolium repens* L. wabiły szeliniaki w stopniu statystycznie istotnym.

**Słowa kluczowe:** *Hylobius abietis*, zapach roślin, wyciągi alkoholowe

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