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ORIGINAL ARTICLES

Investigated Repellency Effect of Some Essential Oils of 17 Native Medicinal Plants on Adults *Plodia Interpunctella*

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Zahra Rafiei Karahroodi, Saied Moharramipour, Alireza Rahbarpour, Investigated Repellency Effect of Some Essential Oils of 17 Native Medicinal Plants on Adults *Plodia Interpunctella, Am.-Eurasian J. Sustain. Agric., 3(2): 181-184, 2009*

ABSTRACT

Volatile oils are some secondary metabolites of plants for defending against insects and other herbivores. Some of them are very repellent for insects. Behavioral responses of adults *Plodia interpunctella* was investigated to 17 native medicinal plants of Iran with a Y tube olfactometer (RZR model). Plants were collected from Markazi province of Iran. Volatile oils extracted by hydrodistillation from 17 plant species growing in Iran, included as: *Achillea wilhelmsii, Achillea millefolium, Artemisia dracunculus, Salvia multicaulis, Thymus vulgaris, Ziziphora clinopodioides, Rosmarinus officinalis, Lavandula angustifolia, Mentha piperata, Hyossopus officinalis, Salvia officinalis, Anethum graveolens, Foeniculum vulgare, Carum carvi, Petroselinum sativum, Artemisia absinthum and Melissa officinalis.* Adults of *P. interpunctella* were less than one-day old. In each experiment 50 adults individually were placed in olfactometer. In one arm was placed two grams food without essential oil and in another arm food plus 2 micro liters essential oil and week air flowed from end of each arm that was filtered with active charcoal. If insect entered 5 centimeters to tube it was selected choice for insect. For determining significance of data, we used χ^2 test. The results showed all essential oils had significance repellency effect and moths had different responses for each essential oil. The Strongest repellency showed in *Anethum graveolens* (100%), *Thymus vulgaris* (100%) and *Rosmarinus officinalis* (93.33%) and the weakest repellency in *Hyossopus officinalis* (7.69%) and *Petroselinum sativum* (9.48%). These results showed that medicinal plants could use as a repellent against *P. interpunctella*.

Key words:

Introduction

The Indian meal moth, *Plodia interpunctella* (Hu¨bner), is a major economic insect pest of stored products (Rees, 2004). The moth prefers to feed on broken grains and more especially on milled cereal products such as flour, breakfast foods, stored cereal products, dried vegetables, dried fruits and almonds, pistachios and walnuts, groundnuts, raisins and prunes, processed foods and meals. It is cosmopolitan and is found in warehouses and storage bins throughout the world (Veena *et al* 2005). The continuing loss of chemical insecticides through regulatory action, new laws and interpretations of those laws, economic costs of pesticide regulations, and consumer preferences and expectations, have important consequences for the management of *P. interpunctella* and other stored-product insects (Arthur, 1996). The impending loss of the fumigant methyl bromide through compliance with the Montreal Protocol (Anonymous, 2004) will undoubtedly further affect management programs for *P. interpunctella*, accelerating the demand for new control strategies (Phillips *et al*., 2000). Many of the commonly used synthetic chemical fumigants are associated with health and environmental risks, and many insects have developed resistance to them (Zettler, 1982). There is therefore the need to develop safer alternatives to conventional fumigants.

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Several natural products, including principals from many species of spices, herbs and medicinal plants, are known to have a range of useful biological properties against insects (Tripathi *et al*., 1999). Their essential oils appear to be the most toxic (Shaaya *et al.*, 1991). The essential oils are considered a powerful source of natural derivatives useful as an insecticide and repellent against stored product pests (Lee *et al.,* 2001) .

Few reports describe the contact and fumigant toxicity of essential oils or their major components against eggs of stored product insects (Obeng-Ofori and Reichmuth, 1997 and Huang *et al*., 1997; Tripathi *et al*., 2000). Essential oils have a low toxicity to warm-blooded animals, high volatility, and toxicity to stored-grain insect pests (Keita, *et al.,* 2000, 2001, Tripathi *et al*., 2002).

Plant essential oils are obtained through steam distillation of herbs and medicinal plants. These oils have been used traditionally as medicines in many countries, and ancient peoples were also aware of their pesticidal properties; however, only in recent years have these oils been commercialized as pest control products (Isman 2000).

In recent years, essential oils have received much attention as potentially useful bioactive compounds against insects essential oils from plants like *Myrtus comunis, Origanum syriacum, Laventula stoechos* and pure compounds like thymol, carvacrol and α- pinene have been documented for larvicidal activities towards *Culex pipens molestus* (Traboulsi *et al.,* 2002).

Most of these oils are environmentally non-persistent and non-toxic to humans (with some exceptions), while being effective against several pest species. In the present study, we investigated repellency effect of essential oils of 17 medicinal plants against adults of *P. interpunctella.*

Material and methods

Plant material and exraction of essential oils

Plant materials were collected from Markazi province of Iran, from Agricultural Research Center. The collected plants were included of: *Achillea wilhelmsii* (leaf), *Achillea millefolium* (leaf), *Artemisia dracunculus* (leaf), *Salvia multicaulis* (leaf), *Thymus vulgaris* (leaf), *Ziziphora clinopodioides* (leaf), *Rosmarinus officinalis* (leaf), *Lavandula angustifolia* (leaf), *Mentha piperata* (leaf), *Hyossopus officinalis* (leaf), *Salvia officinalis* (leaf), *Anethum graveolens* (seed), *Foeniculum vulgare* (seed), *Carum carvi* (seed), *Petroselinum sativum* (seed), *Artemisia absinthum and Melissa officinalis* (leaf). Plant materials were dried in dark and then cut in pieces and hydrodistilled. This extraction of essential oils was carried out by a Clevenger type apparatus for 4 h hydrodistilation.

Insect rearing

Plodia interpunctella was reared at 28±1 ºC with photoperiod 13h dark and 11h light and 60±5% relative humidity. Larvae were reared in an artificial diet containing of: wheat bran (800 g), brewers yeast (160 g), pure honey (200 ml), glycerin (200 ml), methyl parabon (1 g) and choloramphenicol 1 g. Adults entered to plastic funnel that covered with a net cloth for gathering eggs.

Repellency assay

In this study, a Y tube glass olfactometer model RZR (Rafiei *et al* 2008) was used to test repellency of medicinal plant essential oils (figure 1). For studying repellency effect, we introduced one new emergence female of *P. interpunctella* to main brunch of olfactometer. In one arm was settled 2 µl essential oil plus 2 g of food, in another arm only 2 g of food. The repellency was assessed 30 min after introduction of adult insect to olfactometer. For each essential oil have been tested 50 individual of moth. For preventing pseudoreplication insects were settled in olfactometer individually. All data analyzed as nonparametric data via X^2 test. Before that all data has been weight cases. Data analyzed by SPSS 15. Percentage of repellency achieved from this formula (%R) = 2 (X − 50), X is percentage of insects in control tube.

Results and discussion

The results showed all essential oils had significance repellency effect and moths had different responses for each essential oil. The Strongest repellency was exhibited in *Anethum graveolens* (100%), *Rosmarinus officinalis* (100%) and *Thymus vulgaris* (93.33%) and the weakest repellency effect has been shown in *Hyossopus officinalis* (7.69%) and *Petroselinum sativum* (9.48%) repellency, respectively (Table 1). The others had repellency effect between 32% to 88%.

Fig. 1: olfactometer RZR for studying

Table 1: χ^2 test of repellency effect of essential oils on adults of *P. interpunctella*

	No. of insects			
plant	*control*	*treatment*	*% Repellency*	χ^2
Achillea millefolium	33	17	32	5.12*
Artemisia dracunculus	35	15	40	8**
Thymus vulgaris	48	2	93.33	42.33**
Lavandula angustifolia	40	10	62	18**
Hyossopus officinalis	27	23	7.69	32^{ns}
Salvia officinalis	33	17	32	5.12*
Achillea wilhelmsii	40	10	60	18**
Ziziphora clinopodioides	42	8	68	23.12**
Salvia multicaulis	45	5	80	32**
Mentha piperata	39	11	56	15.68**
Melissa officinalis	35	15	40	8**
Petroselinum sativum	27	23	9.48	0.32^{ns}
Foeniculum vulgare	33	17	32	5.12^{*}
Carum carvi	47	3	88	38.72**
Artemisia absinthum	41	9	64	20.48^{**}
Anethum graveolens	100	0	100	
Rosmarinus officinalis	100	0	100	

*** There is significant difference at 1%*
** There is significant difference at 5%*
ns there is no significant difference at 1%

The results of goodness of fit test (χ^2) showed that there is significant differences at 1% level between essential oils of *Achillea wilhelmsii*, *Ziziphora clinopodioides*, *Artemisia dracunculus, Thymus vulgaris*, *Salvia multicaulis*, *Mentha piperata*, *Lavandula angustifolia*, *Melissa officinalis, Artemisia absinthum and Carum carvi* with control. For *Achillea millefolium*, *Salvia officinalis* and *Foeniculum vulgare* significant difference observed at 5%. There is no significant repellency for *Hyossopus officinalis*, *Petroselinum sativum* had no significant difference. We could not calculate χ^2 for *Rosmarinus officinalis* and *Anethum graveolens* because of 100% repellency.

These results showed that medicinal plants could use as repellent of *P. interpunctella*, especially *Anethum graveolens, Thymus vulgaris* and *Rosmarinus officinalis*. These essential oils can use for protecting stored products from injury of Indian meal moth. They have good potential to replace with chemical repellents for this pest and they are safe for human and had no residue on stored products.

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