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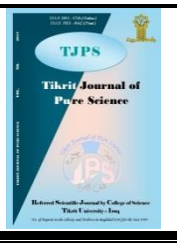

Plant essential oils as Grain Protectants against *Rhizopertha dominica* (Coleoptera:Bostrichidae) During Storage

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Abstract

This study aimed to control lesser grain borer *Rhizopertha dominica* via using of *Zingier officinale* (ginger) and *Helianthus annuus* (sunflower) oils as protectant of *Tritium* spp. The inhibition rates were 38.00, 28.98, 22.67 and 4.60% respectively when the wheat treated by 0.5, 1, 1.5and 2% of sunflower oil while the inhibition rates were 35.50, 28.00, 7.25 and 3.25% respectively when the wheat treated by the same concentrations of *Z. officinale* oil. The damage assessments were decreased while increasing the concentration of the oils, the *H. annuus* oil is more protectant than *Z. officinale* oil in 2%. Approximately the two plant oils caused same damage percentage when the wheat treated by 1% during storage. To sum up, the results strengthen the possibility of using the plant oils for the management this insect.

Introduction

Wheat is the leading source of protein in human foods, having higher protein content than maize or rice, the other major cereal grains. In terms of total production tonnages used for food, it is currently second to rice as the main [1] human food crop and ahead of maize.

Wheat is attacked by various insect pests between harvest and storage.

Stored grains are subject to insect infestation, knowing major sources of grain deterioration in stores are important [2].The most important insect is *Rhizopertha dominica* since it infests all types of cereal grains, but prefer wheat, corn, and brown rice [3]. Many insecticides were utilized to control stored product infestation, and these compounds have causes mammalian toxicity and insect persistence, environment pollution [4, 5]. A number of the source plants have been traditionally used for protection of stored commodities, especially in the Mediterranean region and in Asia, but interest in the oils was renewed with emerging demonstration of their fumigant and contact insecticidal activities to a wide range of pest in the 1990s [6]. Plant essential oils for pest, there has been a growing interest in research concerning the possible use of plant extracts as alternatives to synthetic insecticides. Botanical insecticide composed of essential oils may be a sound alternative to the more persistent synthetic pesticides for managing the major pests of stored product insects. They usually have a broad spectrum of bioactivity and therefore may be used for several pest species.

In addition, a natural products uses as insecticides, like essential oils are secondary metabolism products of plants, and may be a sound alternative to the more persistent synthetic pesticides for managing the major pests of stored product insects. Essential oils are among the best known substances tested against insects. Most of these substances were tested against insect attacking stored products in order to establish new control practices with lower mammalian toxicity, Many plant parts of Ginger (*Zingiber officinale* like rhizomes have oil and many chemical compounds, which have insecticidal activity [7,8]. The most important fatty acids which found in sunflower oil (*Helianthus annuus*) are oleic and linoleic acid the kernel contains 45–55% oil [9]. The main objective of this research is to obtain the useful advice to manage stored product insects via using plant oils as grain protectants.

Materials and Methods

Laboratory Insects rearing:

The insects were collected from the culture in Plant Protection Department in College of Agriculture and reared under laboratory temperature at 29 ∓ 2˚C, relative humidity 70 ∓ 5. Ten pairs of adults of *R. dominica* were taken in plastic bottles [10].

Essential oils isolation

The rhizomes of *Z. officinale* and *H. annuus* seeds were crashed and extracted by according to [11] method. Finally the oils kept in a small tube in refrigerator.

Bioassays

To assess the effect of both *Z. officinale* and *H. annuus* against, *R. dominica*. Complete randomized design (CRD) was used, the wheat were put in plastic containers, and treated by the four concentrations from each plant oils in three replications, added the 2 pairs of insect for each replicate. The containers were covered with muslin cloth and tight by a rubber band to prevent the entry of any insect in it, the results recorded daily. Control insects were kept under the same conditions without any essential oil.

Damage assessment

The grain must be carefully examined and the damaged grains was counted and weighed. Percent weight loss was calculated using the formula given by [12] as follows:

UNd – Dnu) X100/U (Nd+Nu)

Where U = weight of non-broken grain

D = weight of broken grain

Nd = the number of broken grains

(Nu) = the number of non-broken grain.

Inhibition rate %

The formula adjusted by [13] had been used to calculate the inhibition rate (IR).

IR = [(Cn-Tn) / Cn] × 100

Where Cn = the Numbers of insects in control and Tn = the Number of insects in treated grains)

Where Cn is the numbers of adults control.

Results

The inhibition rate of number of insects fed on grain treated by *H. annuus* oil were 38.00, 28.98, 22.67 and 4.65% respectively while the inhibition rate of number of insects fed on grain treated by *Z. officinale* oil were 35.50, 28.00, 7.25 and 3.25% respectively.

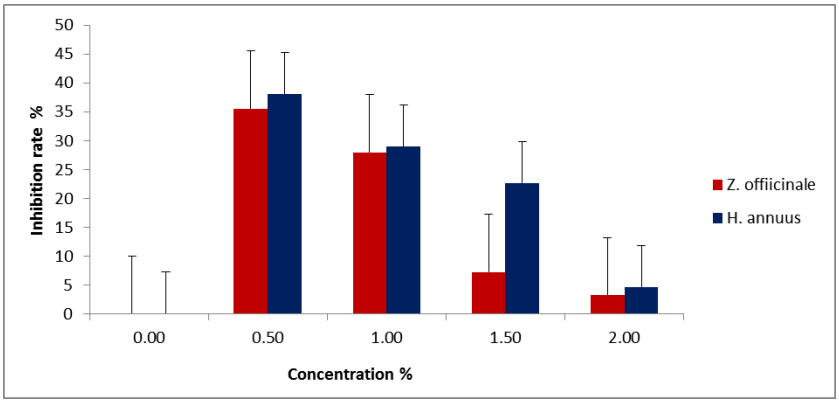

Figure (1): Inhibition rate % of *R. dominica* F1 adults.

The damage assessments were decreased while increasing the concentration of the oils, the *H. annuus* oil is more protectant than *Z. officinale* oil in 2%. Approximately the two plant oils caused same damage percentage when the wheat treated by 1% during storage.

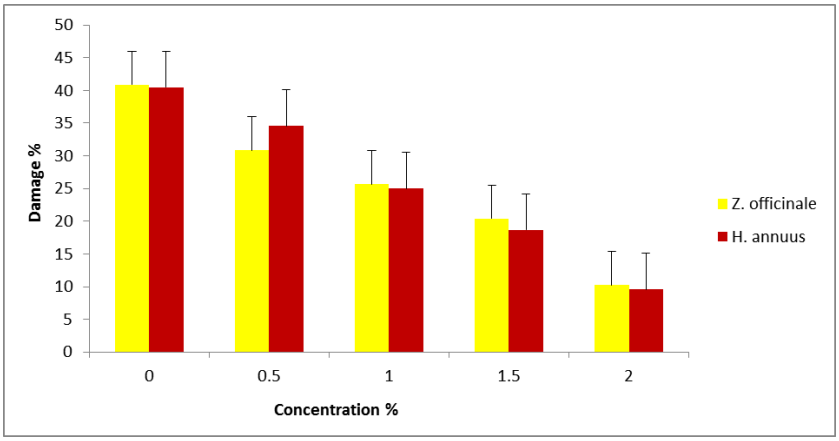

Figure (2): Damage assessment (%) of *R.dominica*on grain after treatment of two plant oil

Discussion

To protect cereal grains from infestation, different aforesaid chemicals are being used and the residues of these Chemicals may cause harm to humans. So it is necessary to look for a safer way of protecting the grains. Use of Vegetable oil for grain protection is

one of the options. Many researchers have worked in this direction. [14] Used vegetable oils (groundnut, rape seed and sunflower) at 10 ml/kg and tested alone and in combination with pirimiphosmethyl at, or of the recommended dosage against *Sitophilus granarius* (L.) in wheat grain (Triticum aestivum).

The results of our study are in agreement with [15] the toxic activity of *Mentha pulegium* essential oil was more toxic than *Lippiaci trodora* Kunth (Verbenaceae), *R. officinalis* and *Juniper ussabina* (Pinaceae) against the adults of *Callosobruchus maculatus*. In similar study conducted by *Zingiber zerumbet* and *Curcuma zedoaria* essential oils had insecticides activity when examined on the two products insects *T. castaneum* and *Sitophilus. oryzae* adults.

The respond of the lesser grain borer *R. domenica* vary towards the toxic impact of the essential probably in accordance to chemical composition of the plants as well as insect susceptibility[4].The toxicity of *Z. officinale* essential oil belongs to the found of natural products called monoterpenoids and the effect increased with an increase of concentrations [16]. Similar studies carried out by [17] noticed that the reduction in pest population 96-100% when the insects treated by concentration 0.2% of garlic oil. In other study the wood ash was found highly effective in prohibiting the adult emergence (F_1) with higher inhibition rate and showed reduction in seed damage and weight loss (%) [18]. Biological activities of essential oils depends on its chemical composition which, in turn, varies with plant parts used for extraction, extraction method, plant phenological stage, harvesting season, plant age, soil nature and environmental conditions [19]. Similar results have been observed in case of Schinus molle, *Alpinia conchigera, Zingiber zerumbet* and *Curcuma zedoaria* essential oils both in *Tribolium castaneum* and *Sitophilus oryzae* adults [20].

Conclusions

The use of plant essential oils had powerful toxic impact on examined insects, the use of botanical compounds like essential oils in broader ranges as a cheap, practical available that can be use whenever necessary in big quantities such as for commercial agent to manage other insects of stored products. Sunflower oil more effective than ginger oil in both studied factors. The use of essential oil instead of chemical insecticides against stored products insects because not only it is feasible and cheap but also would not leave any unfavorable chemical residues on treated insects.

Use of essential oils in broader ranges as a cheap, practical available that can be use whenever necessary in big quantities to manage other insects of stored products.

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إستخدام الزيوت النباتية كحاميات الحبوب ضد الإصابة *Rhizopertha dominica* (Coleoptera: Bostrichidae) بحشرة خلال الخزن

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الملخص

تم تقييم فعالية زيوت كل من بذور عباد الشمس *Helianthus annuus* ورايزوم نبات الزنجبيل *Zingier officinale* بعد استخلاصها بجهاز السوكسوليت باستخدام المذيب الاسيتوني ضد حشرة ثاقبة الحبوب الصغرى *Rhizopertha dominica* ، حيث أظهرت النتائج لمعدل التثبيط 4.60, 22.67, 28.98, 38.00% على التوالي عند استخدام التراكيز 0.5 ,1, 1.5و 2%.كما إن نسبة الضرر قلت مع زيادة التركيز للزيوت وأظهرت النتائج بان زيت عباد الشمس وفر حماية للحنطة عند المعاملة بالتركيز 2% وبذلك يمكن اعتبار المنتجات النباتية حاميات غذائية ضد الآفات الحشرية أثناء الخزن.

الكلمات المفتاحية: زيت عباد الشمس والزنجبيل، ثاقبة الحبوب الصغرى، حاميات الحبوب.