



## Toxic Effect of Some Plant Extracts on the Productivity of Wheat Granary Weevil, *Sitophilus granarius* (L.) (Coleoptera: Curculionidae)

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### Abstract

In this study, leaf extracts of parsley, *Petroselinum crispum*; mint, *Mentha piperita* and thyme, *Thymus vulgaris* were used in the experiment to evaluate for their effect on productivity against granary weevil, *Sitophilus granarius*. All the extracts of test plants had effects on productivity to the granary weevil. The reduction of adults was highest in mint for granary weevil. Effects on productivity of leaf extracts are more or less same. Effect on productivity increased proportionally with the concentration of the plant extracts.

Keywords: Granary weevil, *Sitophilus granarius*, productivity, plant extract.

## Buğday Biti, *Sitophilus granarius* (L.) (Coleoptera: Curculionidae)'un Verimliliği Üzerine Bazı Bitki Özütlerinin Toksik Etkisi

### Özet

Bu çalışmada, maydanoz, *Petroselinum crispum*; nane, *Mentha piperita* ve kekik, *Thymus vulgaris* yaprak özütlerinin buğday biti, *Sitophilus granarius*'un verimliliği üzerine olan etkileri deneysel olarak değerlendirilmiştir. Deneme bitkilerinin bütün özütleri, buğday bitinin verimliliği üzerinde etkili olmuştur. Ergin birey azalması üzerinde nane, buğday biti üzerinde en yüksek etkiyi göstermiştir. Yaprak özütlerinin verimlilik üzerine etkisi çok ya da az benzerlik göstermiştir. Verimlilik üzerine olan etki, bitki özütlerinin konsantrasyonu ile orantısız olarak artmıştır.

Anahtar Kelimeler: Buğday biti, *Sitophilus granarius*, verimlilik, bitki özütü.

## 1. INTRODUCTION

The wheat weevil, *Sitophilus granarius* (L.) 1758 (also known as the grain weevil or granary weevil), occurs all over the world and is a common pest in many places. It can cause significant damage to harvested grains that are being stored and may drastically decrease yields. The females lay many eggs and the larvae eat the inside of the grain kernels [1, 2].

Grain weevils will also attack other hard cereal products such as macaroni, spaghetti and biscuit. Fine cereal products are unsuitable for breeding purposes unless they become caked [3].

*Sitophilus granarius* is highly destructive and cosmopolitan. Granary weevil attacks all types of grain such as wheat, oat, rice, sorghum, barley, maize and perhaps the most destructive pest insect in the world. On the other hand especially wheat plays a vital role in the diet of common people of developing countries [4, 5].

Application of different pesticides contribute to a stable supply of agricultural production, but their continuous use causes serious environmental pollution such as soil, air and water, health hazards to all living organisms and pesticides resistance [5, 6, 7, 8].

This paper investigates the potential of some plant extracts applied at different doses to control of granary weevil, *S. granarius* in wheat.

## 2. MATERIALS AND METHODS

### *Insect Cultures*

The granary weevil adults were obtained from the stock culture of the laboratory of the Plant Protection Department, Faculty of Agriculture, Ankara. In this research, *S. granarius* was reared in a 1 L wide-mouthed glass jars containing wheat grains. Mouth of the jars was covered with a fine mesh cloth for ventilation and to prevent escape of the weevil's populations (figure 1). Cultures were maintained in an incubator at  $27 \pm 1$  °C and  $70 \pm 5$  % relative humidity[5]. (figure 2). Insects used in all experiments were 1 to 7 day old adults (figure 3). All experimental procedures were carried out under the same environmental conditions as the cultures.

### *Plant Materials*

Parsley, *Petroselinum crispum* (Mill) Nym. was obtained from a local market of Ankara while mint, *Mentha piperita* L. and thyme, *Thymus vulgaris* L. were collected from Central Anatolian Region. In laboratory, contact toxicity of methanol extracts from parsley, mint and thyme were tested against *S. granarius*.

### *Preparation of Plant Extracts*

The extraction was done according to the method originally described by [15] with a few modifications. Fresh leaves of parsley, mint and thyme were washed in tap water after collection and then air-dried under the shade. The air-dried leaves were then oven-dried at 60 °C. The dried material were ground manually and passed through a 25 mesh sieve to obtain fine dust. Fifteen gram of fine dust of each plant extracts were separately mixed with 200 ml of methanol solvent. The mixture was then stirred for 40 minutes in a magnetic stirrer and left to stand for next 24 hours. The mixture was then filtered through a fine cloth and again through a filter paper (Whatman No.1). The filtrate was then boiled for solvent evaporation in a water bath at 70 °C to a constant volume. After the evaporation the condensed extracts were preserved in tightly corked labelled bottles and stored in a refrigerator for further use. Before using in experiment each solution was diluted with distilled water to prepare different concentration of plant extract [5].

### *Productivity Test*

Five gram of wheat grain was treated with different plant leaf extracts at the concentration of 10, 20, 40 and 80 mg/ml along with a control treatment and kept in the Petri dishes (9 cm diameter). After 24 hours 10 pairs of 5-7 day-old adult granary weevil were released at the centre of Petri dishes containing wheat grains and covered with lid for next 8 days to allow them to oviposit. The adults were then sieved out and removed from the Petri dishes. In this experiment the numbers of progeny of granary weevils (from day 28 to day 45) were recorded. The observed data were statistically analysed and adjusted by Duncan's multiple range test.

## 3. RESULTS AND DISCUSSION

Observations made on the effects of methanol solvent extracts of leaves of parsley, mint and thyme on the progeny adult emerge of *S. granarius* presented in table 1. It was found that all the treated plants significantly reduced the progeny ( $P < 1$  %) adult emergence of *S. granarius* in comparison to control and the effects, in general, was concentration dependent. The reduction was highest in mint followed by parsley and thyme. The

present study revealed that the reduction of F<sub>1</sub> adult emergence of granary weevil by using the leaf extract of parsley, mint and thyme agreed with the previous findings of Prakash and Rao [9], and Subramanya et al. [10].

Previous studies demonstrated that essential oils and extracts isolated from *Satureja hortensis* and *Foeniculum vulgare* have pesticides effects [11].

Essential oils from various plants have shown promise as sources for insecticides. Earlier attempts to explore the toxicity of plant derivatives against *S. granarius* and *Stephanolix oryzae* have been made by essential oils. Aslan et al. [12] evaluated essential oil from the plant species *Micromeria fruticosa*, *Nepata racemosa* and *Origanum vulgare* for their toxicities against the adults of *Lasioderma serricorne* and *S. granarius* and larvae of *Ephestia kuehniella*. In that study, although insecticidal activities against these pests were achieved with essential oils from all three plant species, the oil of *O. vulgare* was found to be the most effective against *S. granarius*. Kordalı et al. [13] studied the toxicity of essential oils isolated from three *Artemisia* species to *S. granarius*. All of the essential oils tested were found to be toxic to adults of *S. granarius*. The oils showed about 80-90 % mortality of granary weevil. Kordalı et al. [14] tested insecticidal properties of essential oil isolated from Turkish *Origanum acutidens* on *S. granarius* and *Tribolium confusum*. *Origanum acutidens* oil caused 68.3 % and 36.7 % mortality of *S. granarius* and *T.confusum* adults. Results showed that the oil was more toxic against *S. granarius*.

#### 4. CONCLUSION

Efficacy of different plant extracts was evaluated for their growth inhibiting and grain protecting action against granary weevil, *S. granarius*. The reduction of first adult emergence of granary weevil by using the extract of leaf of parsley, mint and thyme can control the weevil. The plant extract will be very economic and non-toxic for human and environment will remain safer. Considering cost effectiveness, easy preparation, easy usage technology and environment-friendly advantages plant extracts can be the most important component of integrated pest management in controlling granary weevil of storage. On the other hand, wheat is an important agricultural crop, especially, for solving the world hunger problem.



**Figure 1.** *S. granarius* was reared in a 1 L wide-mouthed glass jars containing wheat.



**Figure 2.** Cultures were maintained in an incubator at  $27 \pm 1$  °C and  $60 \pm 5$  % relative humidity.



**Figure 3.** One to seven day old adults of *S. granarius*.

**Table 1.** Productivity rate of *Sitophilus granarius* treated with extracts of different plants at different concentrations

Plant material (leaf)	Number of adult (F <sub>1</sub> )				
	Concentrations (mg/ml)				
	0	10	20	40	80
Parsley	161.4 a	71.28 c	60.31 e	49.66 h	37.46 j
Mint	161.4 a	76.46 bc	60.12 e	49.19 gh	33.33 j
Thyme	161.4 a	81.18 b	66.88 d	57.47 f	42.54 i

Results are significantly different at 1 % level by Duncan's multiple range test

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