

## Testing the Effect of Some Botanical Oils on Some Aspects of the Life Performance of Lesser Grain Borer *Rhyzopertha Dominica* ( F.) (Coleoptera: Bostrichidae )

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**Abstract:** The study was carried out in the laboratories of the Plant Protection Department / College of Agriculture `University of Basra during the period from 2019 to 2020. The results showed the fatal, attractive and repellent effect of botanical oils, *Cinnamomum camphora* (L.), *Aloe vera*, *Zea mays*, *Mentha suaveolens*, and *Peganum harmala*, a fatal effect on young adults. *Rhyzopertha dominica* and the average mortality was 89.79, 96.53, 87.48, 87.58, 92.82%, respectively, while all oils had an attractive, not a repellent, effect. The results showed that all oils with all their concentrations used caused a decrease in the number of members of the first generation resulting from the insect, which was reflected in the increase in the percentage of the amount of decrease in the members of the first generation. *Aloe vera* oil had the most impact, as the average number of individuals was 2.66, while the percentage of the decrease was 95.65% and the lowest The effect of corn oil, the number of individuals reached 21.33, and the percentage of decrease was 65.20%, while the number of individuals in the control treatment was 61.3. The highest germination percentage when treated with cactus oil was 88.87%, and the oils did not affect the vitality of the grains if the percentage germination did not differ significantly from the control.

**Key words:** *Rhyzopertha dominica*, botanical oils : *C. camphora*, *A.vera*, *Z. mays*, *M. suaveolens*, *P. harmala*

### **Introduction:**

The lesser grain boring *Rhyzopertha dominica* (Fabricius 1792) is one of the most widespread and important and dangerous pests. It can feed both internally and externally on the grassy grains. It is one of the main insects because it infects healthy grains (Bashir, 2002) and it consumes more than it needs in its food. The most important symptoms of infection representing by the feeding

by the larvae and adult insects on grains exhausting them of their contents and leaving only the outer shell (Mason, 2010). Insects can survive and develop in flour and residues resulting from grain budding .it is a major pest on wheat and corn stores also can attack tobacco ,nuts ,beans ,cowpeas ,dried fruits and dried meat . Infestation with small grain boring leads to giving an undesirable smell to the stored materials and an unpleasant taste when feeding on the infested materials (Al-Ruhban and Adwan. 2011 and Ismail, 2014). Chemical insecticides were used in one way or more to prevent the occurrence of insect infestations in the materials stored pain, and two types of insect poisons were used, such as toxic pesticides and respiratory toxins.i nsecticides were also used as grain protectors ,it has aresidual toxic and insect repellent effect after mixing them with grains and the use of insecticides such as Malathion, Lindane and pyrethrum and mixing them with grains intended for agriculture. However, the repeated use of insecticides led to an imbalance in the natural balance and the deterioration of the components of the environment. Researches tended to use other methods of control, including the use of vegetable oils and inert powders, as one of the modern trends for integrated pest control and as safe alternatives to human health and the environment. Camphor oil was used to control various insects, including Minor grain borer. Aloe vera, mint and corn oil were used. Al-Abadi et al. (2008) used *Lavanoula stoechus* botanical oil to control the lesser grain borer and found it to have a toxic and repellent action (Ebadollahi et al., 2010). *Laurus nobilis* oil had a toxic and repellent effect on *R. dominica* adults ( Ben jemaat et al. 2012) also used clove oil, myrtle, celery, black bean and sweet almond. The fatal, attractive and repellent effect of these oils varied in adults of the capillary beetle (Khalaf, 2016). Creso and Al-Mallah (2013) also tested the lethal effect of mixtures of oils and insecticides on the larvae of the capillary beetle, and Al-Obaidi (2015) emphasized the need to rely on biological control programs for pests of stored materials, as they are the safest and safest for the environment and for the agricultural ecosystem. In view of the importance of the insect and considering it as a universal spread and infecting grains and foodstuffs, this study was conducted with the aim of knowing the effect of plant oils on some aspects of life performance, such as the percentage of mortality and the percentage of germination of grains treated with oils to be used as seeds suitable for cultivation.

## Materials and methods

### Insect breeding

In current study, The specimens of *Rhyzopertha dominica* were collected from infected wheat grain which have been brought .

The study was conducted in the laboratories of the Plant Protection Department at the College of Agriculture, University of Basra , insects were placed in plastic bottles with a capacity of 2 kg, containing 1 kg of sterilized wheat grains by freezing - 18 AH for three days. To eliminate any infestation (Aref et al., 2015), its nozzle was covered with a boring cloth, tied with a rubber band, and incubated in the incubator at a temperature of  $27 \pm 2$  and a relative humidity of  $60 \pm 10\%$  to obtain insects and use them in subsequent experiments.

### Oil Extraction

For the implementation of this study, botanical oils were extracted from the leaves of the eucalyptus, *aloe vera*, mint, rue seeds and corn kernels using a Soxhlet device, with a weight of 5 gm of leaf powder for each plant separately, after drying them in the shade and placing them in the extraction beaker. The sample was covered with a quantity of glass wool, then the beaker was placed inside the extraction unit. Rotating the solvent ten times on the sample, then placing the flask containing the sample in an oven at a temperature of 105 °C for 5 minutes with the oven door slightly open to allow the ether to evaporate and then cooling the sample and weighing it. The difference in weight before and after extraction represents the amount of oil in the sample and the proportion of oil was calculated according to the equation next :

$$\% \text{ of crude oil} = \frac{\text{oil weight}}{\text{sample weight}} \times 100$$

Those oils were considered crude and concentrations of 2, 4 and 8% were prepared by diluting the oils with acetone by taking 1 ml of oil and 9 ml of acetone, then preparing a concentration of 10% and taking 2 ml of it and adding to it 8 ml of acetone, then preparing a concentration of 2%, and so on, the rest of the concentrations were used in all subsequent experiments.

### Effect of botanical oils on the percentage of adult mortality

The above botanical oils were added 1 ml to the sterilized wheat kernels at a concentration of 2, 6 and 8% for each oil separately and placed in sterilized plastic dishes containing 5 g of treated kernels of wheat, to which 10 insects were added, with 3 replicates for each concentration. As for the control

treatment, the insects were fed on healthy grains of wheat and the percentage of Percentage loss after 1, 3, 5 and 7 days of treatment.

### **Testing of repellent and attractive effect of botanical oil on insects**

Using sterilized plastic dishes with a diameter of 11 cm and a height of 2 cm, and small dishes with a diameter of 5 cm and a height of 0.5 cm were fixed in it. In the small dish, 5 g of wheat grains treated with concentrations of 2, 4 and 8% were added to each oil separately. Then 10 insects were added to each dish with a rate of 3 replicates. Then the number of insects outside the small dish was calculated after 24 hours of treatment, as for the control treatment, the grain was left without treatment. The percentage of expulsion was calculated according to the equation:

$$PR = 2 (C - 50) \%$$

PR = centrifugation percentage

C = percentage of insects outside the small dish

Note that PR becomes positive, and vegetable oil has a repellent effect if C is more than 50%, and vice versa, PR becomes negative, and oil has an attractive effect if C is less than 50%.

### **Effect of botanical oils on the rate of the first generation F1 individuals and the percentage of decrease**

The above botanical oils were added to the sterilized wheat grains at a concentration of 2% for each oil separately by 1 ml, and they were placed in sterilized plastic dishes containing 5 g of treated wheat grains. Male and female insects were added to it 5: 5 and at a rate of 3 replicates for each oil. As for the control treatment, the insects were fed on grain Healthy wheat, after three days of treatment, was preserved under the above-mentioned storage conditions, and after two months of treatment, the members of the first generation and the percentage of decline were calculated using the following equation: El-lakwah (et al., 1996).

$$\text{Decrease \%} = \frac{\text{Nu. of adults resulting from the comparison treatment} - \text{Nu. of adults resulting from the treatment}}{\text{The number of adults resulting from the comparison treatment}} \times 100$$

### **Effect of botanical oils on the percentage of germination of wheat grains**

To know the effect of oils on the germination of treated grains, a random sample of 10 healthy grains was taken and treated with different oils with concentrations of 2, 4 and 8% each separately and placed in sterile dishes. Control, the grains were left untreated and placed in the dishes to calculate the percentage of germination.

## Results and discussion

Effect of botanical oils on the percentage of mortality of the insect *Rhyzopertha dominica*

The results shown in Table (1) showed the superiority of corn oil, peppermint and harem in its killer effect, as the percentage of mortality was 100%, and camphor oil was the least effective at 90.25%. % for concentrations 2, 4 and 8%, respectively. The results of the statistical analysis showed a significant difference in the average time effect, as the percentage of mortality increased when the exposure period was increased, reaching 95.5, 96.2, 98.8 and 100%, respectively, during 1, 2, 3 and 7 days.

oils	con. %	mortality % / day				rate oils	rate concentration
		1	2	3	7		
<i>Cinnamomum camphora</i>	2	73.3	73.3	86.6	94.54	89.79	83.81
	4	76.6	76.6	96.6	100		90.6
	8	100	100	100	100		97.99
<i>Aloe vera</i>	2	83.3	83.3	91.77	100	96.53	
	4	100	100	100	100		
	8	100	100	100	100		
<i>Zea mays</i>	2	73.5	73.6	87.54	91	87.48	
	4	76.3	76.6	86.77	100		
	8	84.53	100	100	100		
<i>Mentha suaveolens</i>	2	73.11	73.3	81.3	93.3	87.58	
	4	73.66	76	90	100		
	8	89	100	100	100		
<i>Peganum harmala</i>	2	88	83	83.6	90	92.82	
	4	83	100	100	100		
	8	86.3	100	100	100		
CONTROL	0	0	0	0	0	0	
days effect		84.02	87.71	93.61	97.92		

**Table (1) The effect of oils on the percentage of mortality of the insect *Rhyzopertha dominica***

RLSD 0.01 for the effect of oils = 7,76, for the effect of concentrations = 1.09, for the effect of days = 3.83, for the effect of interference = 5.71

The effect of eucalyptus oil is due to the fact that it contains large amounts of safrole, which makes it toxic when it enters the digestive system and causes

serious side effects, including death, and its toxicity appears quickly within 5 - 90 minutes. For many insects, including lice, bed bugs, and others (Abu Khalif, 2014). Al-Taie (2018) confirmed that mint contains menthol, limonene, pine nuts, eucalyptol and tannic acid. And mint oil contains many compounds that are considered secondary metabolites of the plant, and it is rich in terpene compounds.

Two types of oils were used to control the rusty red flour beetle and the small grain borer. It was noticed that the oils did not change in size significantly after six months of storage and that they slowly decomposed to release the effective turbines in the control (Gonzales et al., 2014).

### Effect of botanical oils on the percentage of expulsion and attraction

The study showed, as shown in Table (2), that the oils of camphor, *aloe vera*, corn, peppermint and harmel have a repellent effect. The percentage of oils varied depending on the contents of different compounds, which differ in their effect as repellents, disinfectants, or nutritional inhibitors. Al-Yahya (2007) found that the oil of Camphor contains a group of compounds that are considered to be insect repellent and lethal to some insects such as fleas, in addition to their toxicity to insects and bacteria. High inside the body of the insect or prevent the insect from moving freely on (Al-Bayati, 2013).

**Table (2) The effect of botanical oils on the percentage of repulsion and attraction**

oils	rate number of insects	expulsion %	effect of oils
<i>Cinnamomum camphora</i>	13	-74ab	attraction
<i>Aloe vera</i>	33	-34c	attraction
<i>Zea mays</i>	20	-60ab	attraction
<i>Mentha suaveolens</i>	13	-74ab	attraction
<i>Peganum harmala</i>	6	-88 a	attraction
CONTROL	0	0	-

### Effect of botanical oils on the rate of the first generation F1 individuals and the percentage of decrease

The results shown in Table (3) showed the superiority of *aloe vera* oil in reducing the numbers of the first generation F1, as the average effect was 2.66 individuals/female, while corn oil had the lowest effect, and the resulting number of individuals reached 21.33 compared with the control treatment, which amounted to 61.33 individuals/female. The results showed, as shown in Table 3, that there were significant differences in the effect of concentrations on the number of members of the generation, which amounted to 18.32, 11.19 and 8.06 for concentrations 2, 4, 8, respectively. The results showed an inverse relationship between the concentrations and the resulting number of individuals. The results also showed an increase in the percentage decrease with the increase in concentrations, which amounted to 70.09, 81.72 and 86.84% for the concentrations of 2, 4, and 8%, respectively, and the most influential of which was aloe vera oil, as the percentage of decrease was 95.65% and the least The effect of corn oil was 65.20%. The reason for the effect of oils on the average number of individuals is due to its effect as a feeding inhibitor (Suthisut et al., 2011) or its effect on the process of ovulation and reducing the number of eggs produced by insects that were fed on oil-treated grains (Ebdollahi, 2011). Dhen et al. (2014) confirmed that some oils have a high toxic effect on the small grain borer and therefore can be used to protect the grains from pests of the store.

**Table (3) Effect of oils on the rate of the first generation F1 individuals and the percentage of decrease**

Oils	F1 first generation			Oil rate	decrease generation%			Effect rate oils of decrease generation %
	% التراكيذ				Con. %			
	2	4	8		2	4	8	
<i>Cinnamomum camphora</i>	24.33	12	9.66	15.33	60.30	80.42	84.24	74.98
<i>Aloe vera</i>	3.66	3	1.33	2.66	94.02	95.10	97.83	95.65
<i>Zea mays</i>	29.66	20	14.33	21.33	51.61	67.37	76.62	65.20
<i>Mentha suaveolens</i>	27.33	15.66	12	18.33	55.41	74.45	80.42	70.09
<i>Peganum harmala</i>	6.66	5.33	3.0	4.99	89.13	91.30	95.10	91.84
CONTROL	61.3	61.3	61.3	61.3	-	-	-	-
effect rate concentrations	18.32	11.19	8.06		70.09	81.72	86.84	

RLSD 0.01 for the effect of oils in f1 = 2.4, for the effect of con. in decrease% = 4.12, , for the effect of oils in decrease% = 4.41, for the effect of con. in f1= 2.13

## Effect of botanical oils on the percentage of germination

The results shown in Table (4) showed that there were no significant differences in the effect of oils on the percentage of germination when compared with the control treatment, meaning that the oils did not affect the vitality of the seeds, while the results of the statistical analysis showed a significant difference in the average effect of concentrations on the percentage. For germination, the average effect of the concentrations was 90.65, 83.98 and 79.99%, respectively. Thus, it can be used to protect the grains from injury and to be used as seeds.

**Table (4) Effect of oils on the percentage of germination after 7 days of treatment**

oils	con. %	germination rate	percentage of germination %	oil rate	con.rate
<i>Cinnamomum camphora</i>	2	28	93.32	86.65	90.65
	4	26	86.65		83.98
	8	24	79.99		79.99
<i>Aloe vera</i>	2	28	93.32	88.87	
	4	28	93.32		
	8	24	79.99		
<i>Zea mays</i>	2	26	86.65	82.21	
	4	24	79.99		
	8	24	79.99		
<i>Mentha suaveolens</i>	2	28	93.32	84.43	
	4	24	79.99		
	8	24	79.99		
<i>Peganum harmala</i>	2	26	86.65	82.21	
	4	24	79.99		
	8	24	79.99		
CONTR OL	2	0	89.99	89.99	

RLSD 0.01 for the effect of oils = NS, for the effect of interference = 4.01, for the effect of concentrations = 3.81

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