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THE BIOLOGICAL EFFECT OF THREE AROMATIC PLANT OILS TO CONTROL SOME OF THE LIFE STAGES OF THE *TROGODERMA GRANARIUM* (EVERTS) (COLEOPTERA: DERMESTIDAE)

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Abstract

The study was carried out in the insect laboratory- Faculty of Agriculture -Al Muthanna University 2018. The study aimed to test the effect of both sweet bean oil, cactus oil and castor oil in some life stages of the *Trogoderma granarium*. The results showed a significant effect of plant oils on insect life and its different concentrations, There was an adverse effect for the plant oils in insect adults and with significant differences. The most pungent oils were castor oil, The percentage of expulsion was 100% after 20 minutes of treatment. In terms of the effect of oils on the egg hatching ratio, Using a costume The percentage of egg yolks was 83.3% at the concentration of 2%, and there was a clear effect of vegetable oils on the percentage of larvae killing the first, fourth and fifth larvae of the insect. Larvae of the first age at the concentration of 6% and all oils. The results also showed that the castor oil was superior in terms of the percentage of loss in insect adults at the concentration of 6%. The results showed that the highest percentage of adults from the treatment of larvae of the first age of the insect was treated with cactus oil, which was (82.7%) at the concentration of 2%, respectively, and the results did not show significant differences in terms of the effect of vegetable oils in the proportion of grain germination and can therefore be used plant oil in the protection of grain stored from the infection of insects without affecting the grain.

Key words: Aromatic plant oil, *Trogoderma granarium*.

Introduction

Insects cause severe damage to stored grains and their food products. Post-harvest losses from insects in India may reach 12% (Mohan, 2003). *T. granarium* is an important and serious pest for products stored in the Middle East, Africa and some regions of Europe and East Asia (EPPO, 2005). Insect damage comes from the larval role as larvae feed on a large number of stored products such as cereals, dried foods and animal products, especially wool and leather (Harris, 2007). As well as the contamination of the grain stored in their faces and skin and the bodies of the dead and decomposition, which reduces the marketing value (Jurani, 1991), and caused a loss in the weight of grain ranging from 5-30% and may reach the maximum cases to 70% (Dwivedi & Shekhawat, 2004). Marcio *et al*. (2007) reported that the rate of damage reaches more than 40% in developing countries. The risk of insects is due to their ability to tolerate harsh environmental conditions due to the ability of their larvae to survive for one year or more without food in a dormant state until food is available. The difficulty of controlling the insect Khabra as a result of its presence with food and the use of chemical pesticides leads to contamination of these materials and the repeated use leads to the emergence of resistance to the work of pesticides and the use of the gas is a danger to fight against them, as recent studies have shown that it is carcinogenic to humans And lead to mutations. A variety of different types of insects (Shaaban *et al.*, 1991). Therefore, studies were conducted on the use of preservatives from plant extracts to protect the stored seeds. Mehdi and Hamoudi (1984) used some plant oils to protect the seeds from the southern cow beetle *Callosobruchus maculates*. Castor oil in all doses had the highest effect, with a protection rate of 100%. He

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also tested the effect of some plant oils, such as clove oil, black seed oil, melon oil and marmalade oil, in the life performance of *T. granarium*. The results showed that the rate of expulsion of plant oil and melons was 100% (Behind, 2016). In view of the difficulty of controlling the insect and the economic damage caused to the grain and its products and the absence of effective and safe chemicals against this pest to combat it and to find alternatives to plant origin to protect the grain from infection and use as human food or make it suitable for agriculture, for this reason this study was conducted .

Materials and methods

Collection and breeding of the insect

In the province of Muthanna, the insect was fertilized in the laboratory during 2018-2017 on a natural diet consisting of wheat (Kassam, 1988). For the purpose of obtaining a pure insect farm, a certain number of adults were placed in 1.5 liter glass bottles for the purpose of obtaining the eggs later. Their mouths were covered with elastic cloth and tightened with rubber belts and placed in an incubator at a temperature of 2+30 m and 75% humidity. The eggs collected by female insects were collected and placed in a 9 cm diameter Petri dish equipped with a 5 kg graded wheat medium for subsequent treatment and obtained the first larval age. Their mouths were covered with a cloth and tightened with rubber belts and placed in a temperature incubator 2+30 m and moisture 75%. The other ages of the insect were obtained by collecting the first larval ages and distributing them to petri dishes equipped with the nutritional medium of the wheat and left to grow and turn to the other stages as they were identified through the skin of the skin.

Effect of aromatic plant oils on some of the life stages of *T. granarium*

Preparation of plant oils concentrates

The following concentrations Prepared (2, 4 and 6) of plant oils by reducing the oils with acetone by taking 1 ml of plant oil and then adding 9 ml of acetone. We get a concentration of 10% called the Stock Solution. When preparing the concentration of 2% of the oil, we took 2 ml of the base solution in a glass tube and added 8 mL of acetone and so on the rest of the concentrations.

Studying the effect of the extruder or attractant of plant oils in insect adults

The method of Mc Donald and others (1970) was Adopted by the use of 9 cm diameter plastic dishes, where the dish was divided into two equal halves, a circle of 2 cm diameter was drawn in the middle, one was wiped with a piece of cotton wet with 1 ml of oil and the other half was washed with acetone and the dish was left to dry in the air And then placed 10 insects in the middle area and then covered the opening of the dish with a piece of cloth Almosolin and tied by rubber band and transferred to the incubator at a temperature of 30±2 m and 75% relative humidity and calculated the proportion of expulsion after (10, 20 and 30 minutes) of treatment, Then, the number of insects was calculated in the uncreated half (C) and by three factors for each oil in addition to the control treatment (use of acetone only) each treatment has three replicates, and the percentage of expulsion was calculated by the following equation:

PR = 2 (C - 50%)

Where PR =% for expulsion

C =% of insects in the untreated part

Note that if C is more than 50%, PR becomes positive and plant oil has a repellent effect and vice versa.

Effect of plant oils on the percentage of egg hatch

I took 10 eggs from the eggs of the insect at the age of one day from the colony, which was prepared previously and placed in a plastic dish which represents a repeat and by three replicates for each treatment (concentration) in addition to the control treatment (acetone only), the eggs sprayed above concentrations of vegetable oils, then covered the dishes with a piece of The cloth was welded and tied with a rubber band. The dishes were transferred to the incubator at the same temperature and humidity as previously mentioned. The percentage of egg hatch was calculated after 72 hours of treatment until the eggs were fully hatched.

Effect of plant oils on the percentage of killing of some larval stages of the insect

The plant oils were added to healthy wheat grains and the three previously mentioned concentrations were placed in plastic dishes with 100 tablets. They were added to 10 larvae of one day, three replicates per treatment, and the percentage of death was calculated after 5 days of treatment.

Effect of plant oils on percentage of adult mortality

The plant oils were added to healthy wheat grains and the three previously mentioned concentrations were placed in plastic dishes by 100 tablets. They were supplemented with 10 adult insecticides at one day, three replicates per treatment, and the percentage of death after 1, 3 and 5 days of treatment .

Effect of plant oils on the percentage of pupae that resulting from the treatment of larvae of the first instar of the insect

The plant oil was added to healthy wheat grains and the three concentrations mentioned above, which were placed in plastic dishes by 100 tablets, and inserted 25 larvae per replicate by three replicates per treatment and three treatments in addition to the control treatment, then according to members of the first generation through calculation: The number of insects that reached the stage of puberty, the percentage of grain damaged ,and the amount of loss in grain weight after a month of treatment.

Effect of plant oils on the percentage of wheat germination *Triticum aestivum*

I took 10 grains of healthy wheat and placed in a plastic dish diameter 9 cm containing a filter paper moistened with distilled water, sprayed the grain with the highest concentration of oil and by three replicates for each oil (treatment) and the three treatments in addition to the control treatment, and then placed on the grain and another filter paper and add a little of water to supply the grain with the necessary moisture for growth, the percentage of germination was calculated after one week of treatment.

Statistical analysis

The results of the study were carried out according to the random randomized design (CRD) and the statistical analysis of the results of the study was used in the analysis of the results of the study, comparing the differences between the tests with the least significant difference (0.05 and 2000). Abbott Method (1925).

Results and discussion

Effect of aromatic plant oils on some of the life stages of *T. granarium*

Studying the effect of the extruder or attractant of plant oils in insect adults

The results of table 1 showed the presence of an effect and all plant oils in insect adults when using the highest concentration of each oil which amounted to 6%. The results showed a significant effect and all oils in insect languages. Castor oil showed the highest effect in terms of extruding effect After 20 minutes of treatment, followed by borage oil and cactus oil in terms of extruding effect, which reached after 30 minutes of treatment 96.6% and 90.0%, respectively. Khalaf (2016) remind when he studying the effect of extruding Almond oil, clove oil, raspberry oil and black bean oil against the adults of beetle *T. granarium* to the presence of a repellent effect of all vegetable oils in the direction of insect eggs also showed that the superiority of both melon oil and pregnancy in terms of percentage of expulsion Which amounted to 100%. The effect of the extruding effect on oils and their differences in terms of expulsion rates may be due to the possession of effective compounds that have an insect repellent effect or possess toxic compounds that act as repellents against many insects, including insects of stored materials (Tripathi *et al.*, 2002).

Table 1: Extruding effect of plant oils in adult beetles *T. granarium*

Name of oil	% Con. of oil	% To expel insect adults after		
		10 min.	20 min.	30 min.
Sweet Pill	6	76.7	93.3	96.6
Cactus	6	66.7	86.6	90.0
Castor	6	93.3	100	100
Control	00.0	00.0	00.0	0
L.S.D 0.05		9.41	3.33	5.44

Effect of plant oils on the percentage of eggs hatching

The results of Table 2 showed a significant effect of different vegetable oils on the percentage of eggs of the insect eggs and the three concentrations of each oil. The results of the study showed that the castor oil was superior in terms of the effect of insect eggs hatching (20.0, 73.3 and 00.0% In the concentrations (2, 4 and 6%) respectively, followed by borage oil and then cactus oil, which accounted for the percentage of egg hatch (76.7, 33.3 and 13.3%) and (83.3 , 46.7 and 16.7%) and for the same concentrations above, And the results showed that the lowest percentage of hatching in the eggs of the insect was at the concentration of 6% and for all oils and that the proportion of hatching less as the concentration of plant oil. Al-Zubaidi and others (2008)

Table 2: Effect of plant oils in the percentage of eggs of the Khapra beetle *T .granarium*

Name of oil	%Concentration of oil	%For egg hatch
Sweet Pill	2	76.7
	4	33.3
	6	13.3
Cactus	2	83.3
	4	46.7
	6	16.7
Castor	2	73.3
	4	20.0
	6	00.0
Control	0	03.3
L.S.D 0.05		5.13
L.S.D 0.05 for the interaction between oils and their concentrations		8.79

indicated that black seed oil and sweet bean oil had an effective effect on egg / female ratio and the percentage of yield of the Southern lobster beetle *Callosobruchus maculatus*, the best being black seed oil (46.51 and 47.41%) respectively. This may be due to the fact that the oily substances accumulate on the eggshell and surround them, thus preventing the fetus from exchanging oxygen with the outer environment (Baroni, 1991). Or it may be because substances and compounds that have been mixed with hexane from alkaline, turbo, or fatty substances have caused the fetus to die through its penetration (Harbone, 1984).

Effect of plant oils on the percentage of killing of some larval stages of the insect

The results of Table 3 showed that the three plant oils showed good efficiency in the larval mortality of the *T. granarium* beetle and the treatment of oils and all the concentrations used. The results showed that the castor oil was superior in the percentage of larvae (first instar, fourth and fifth) on the rest of the oils and was the highest concentration at 6% Where the percentage of killing (96.7, 73.3 and 66.7%) for the stages that above mentioned respectively. While the percentage of killing for larval instars above were treated with sweet bean oil and cactus oil and at the concentration of 6% (66.7, 43.3 and 36.6%) and (53.3, 36.7 and 33.3%) respectively, The lowest percentage of killing in the larval instars of the insect was at the concentration of 2% for Cactus oil, sweet bean oil and Castor, which was (16.6, 13.3 and 10.0%) and (23.3, 16.7 and 16.7%) and (33.3, 23.3 and 20%) respectively compared with control treatment that reached (00.0%) for the stages that above mentioned, The percentage of kill rates for larval instars (first, fourth and fifth) for insect and treated with sweet bean oil, cactus and castor was (18.9, 36.7 and 48.9) and (13.3, 22.2 and 41.1%) and (25.5, 48.9 and 78.8%) respectively, compared with the control treatment (00.0%). This is consistent with what Mansour and Iman said (2010) around them studies on the effect of the oil extracts of cactus and sweet bean plant Where the results showed the superiority of the extract of the sweet bean oil in the killing rates of Khabra larvae at 23.33%. While the percentage of killing for castor oil 11.16%. Bachrouch and others (2010) indicated the possession of *pistacia lentiscus* oil has a strong effect against the larvae of the red flour beetle *Tribolium castaneum* reached at 51%.

Effect of plant oils on percentage of adult mortality

The results of Table 4 indicated that the effect of plant oils in the percentage of killing of insect adults when treated the grains with it to the effectiveness of oils and clearly in the killing rates, and the effectiveness of oils emerged after the third day of treatment with oils and the highest killing was after the fifth day. The results was indicated to superior of castor oil in percentage of the insect adults killing were the highest percentage of killing at concentrate 6% after (3 and 5 days) it was (36.6% and 63.3%) respectively, followed by sweet bean oil and cactus oil were the killing rate was reached (23.3% and 33.3%) and (13.3 and 30.0%) respectively, compared with control treatment that reached (00.0 and 06.6%). While the results indicated that there was no effect of plant oils on the percentage of adult killing after 1 day of treatment, with the death rate (00.0%). The results showed that there were significant differences between the plant oils in the percentage of insect larvae killing and significant differences between the concentrations used for plant oils. The highest rate of killing was in the insect adults at the concentration of 6% and for castor oil, sweet bean oil and cactus oil, which reached (33.3 and 18. 9 and 14.4%) respectively, compared with control treatment was (2.23%). Al-Mansour and Iman (2010) remained that the extract of the baraka bean oil gave the highest rate of loss in the adult khapra beetle reached 56.66 and the lowest rate of loss in insect adults was 47.77% when treated with the extract of melon oil. Daoud (1991) pointed out that the lethal effect of vegetable oils in the killing of insect pests may be

Table 3: Effect of aromatic plant oils in the percentage of larvae of some larval stages of the Khapra beetle *T .granium* after 5 days of treatment.

Name of oil	% Conc. of oil	%To kill first instar larvae	To kill fourth instar larvae	To kill fifth instar larvae	Killing rate for larval instar / concentration
Sweet Pill	2	23.3	16.7	16.7	18.9
	4	50.0	33.3	26.7	36.7
	6	66.7	43.3	36.6	48.9
Cactus	2	16.6	13.3	10.0	13.3
	4	33.3	16.7	16.7	22.2
	6	53.3	36.7	33.3	41.1
Castor	2	33.3	23.3	20.0	25.5
	4	63.3	43.3	40.0	48.9
	6	96.7	73.3	66.7	78.8
control	0	00.0	00.0	00.0	00.0
L.S.D 0.05		6.01	7.02	6.28	2.89
L.S.D 0.05 for the interaction between oils and their conc.		10.31	12.04	10.77	4.97

Table 4: The effect of plant oils on the percentage of adult mortality of Khapra beetle *T. granarium*

Name of oil	% Conc. of oil	% for destruction insect adults after			Destruction rate per oil concentration
		1day	3day	5day	
Sweet Pill	2	00.0	00.0	13.3	4.43
	4	00.0	10.0	23.3	11.1
	6	00.0	23.3	33.3	18.9
Cactus	2	00.0	00.0	10.0	3.33
	4	00.0	06.7	13.3	6.66
	6	00.0	13.3	30.0	14.4
Castor	2	00.0	03.3	16.7	6.67
	4	00.0	23.3	36.7	20.0
	6	00.0	36.6	63.3	33.3
control	0	00.0	00.0	06.6	2.23
L.S.D 0.05		00.0	4.44	6.78	2.90
L.S.D 0.05 for the interaction between oils and their conc.		00.0	7.62	11.6	4.98

due to neurological shock and then paralysis in the movement of adults treated with plant oils and next death it.

Effect of plant oils on the percentage of adult semergence from the treatment of larvae of the first instar for the insect

The results of Table 5 showed significant differences between vegetable oils in the percentage of adults emergence from the treatment of wheat grains fed by the first larvae of the *T. granarium* beetle in terms of percentage of emergence adults, percentage of decrease in adults, percentage of grain damaged and loss of weight The results showed that the highest percentage of adults from the treatment of larvae of the first instar of the insect was treated with cactus oil, followed by sweet bean oil and castor oil, which reached (82.7, 77.3 and 70.7%) by using concentration 2% respectively, And the lowest percentage of the emergence adults were treated with castor oil at a concentration of 6% that reached (48.0%) followed by sweet bean oil and cactus oil (56.6 and 69.3%) at the concentration of 6% respectively, compared with the control treatment that reached (98.7%). While the highest percentage decrease in the adults of the insect was treated with castor oil at concentration 6% that reached (52.0%). The results showed also that the lowest percentage of grains damaged by insect feeding and oil treatment was treated with castor oil followed by sweet bean oil and then cactus oil that reached (49.3, 58.0 and 69.0%) at the concentration of 6% respectively. While The highest percentage of affected grains was at the concentration of 2%, which reached (70.6, 75.0 and 81.3%) respectively, compared with the control treatment which reached (91.0%). In terms of the amount of loss in grain weight, the results showed that the lowest weight loss was treated with castor oil followed by sweet bean oil and cactus oil was (1.19, 1.68 and 1.85 g/5 g) at the concentration of 6% respectively, And the highest was at concentration of 2% that reached (1.74, 2.16 and 2.06 g/5g), respectively, compared with the control treatment was (3.17 g/5g). The results show that the higher the concentration of plant oils, the lower the percentage of adults produced and the lower the decrease in adults and the percentage of grain damaged and the amount of loss in the weight of grain, that is the reverse relationship. Khalaf (2016) pointed out that the oil of Hormel had an effect on the rate of first-generation members of Al-Khabra. The percentage of the resulting individuals was 43.0% while the rate of decline was 54.3%. And showed Muhgoubb and Al-Sisi (1997) that plant oils may work in the form of lethal substances or Mating inhibitors or growth or nutrition that leading to a decline in the rate of first-generation individuals.

Effect of plant oils on the percentage of wheat germination *Triticum aestivum*

The results of Table 6 showed that there was no significant effects on the percentages of germination of wheat grains when treated with sweet bean oil, cactus

Table 5: Effect of plant oils on the percentage of adults emergence from the treatment of the first-instar larvae of the khapra beetle *T. granarium*

Name of oil	% Conc. of oil	% of the emergence individuals	% For the reduction of indi-iduals	% For the damaged	Amount of loss by weight of 5 g
Sweet Pill	2	77.3	29.3	75.0	2.06
	4	69.3	30.7	71.0	1.85
	6	56.6	43.3	58.0	1.16
Cactus	2	82.7	17.3	81.3	2.16
	4	77.3	22.7	74.6	2.07
	6	69.3	30.6	69.0	1.68
Castor	2	70.7	29.0	70.6	1.74
	4	59.3	40.7	61.7	1.55
	6	48.0	52.0	49.3	1.19
control	0	98.7	1.33	91.0	3.17
L.S.D 0.05		5.30	3.59	4.34	3.05
L.S.D 0.05 for the interaction between oils and their conc.		5.66	6.15	5.73	5.34

Table 6: Effect of plant oils in the percentage of wheat germination *Triticum aestivum*

Name of Oil	%Concentration of oil	% for grains germination
Sweet Pill	6	93.6
Cactus	6	96.3
Castor	6	93.6
Control	0	96.7
L.S.D 0.05		10.8

oil, castor oil and the highest concentration of each oil, which is 6%. The results of the statistical analysis showed no significant differences between oil treatments and treatment The results showed that the percentage of germination for oil (sweet bean, cactus oil and castor oil) was (93.6, 96.3 and 93.6%) respectively, compared with the control treatment that reached (96.7%). Shaaban (1991) noted that plant oils do not have a significant effect in reducing seed germination that treated with it. The results of this study show that the plant oils used in the research have a good and moral effect in the life of the Khapra beetle when the treatment of wheat grain and reduce the proportion of infection of insect, especially grain for human consumption or when used as grain for cultivation, as these oils can make as repellants or antifeeding oral substances that have the ability to kill the insect. Therefore, I recommended that these oils be used with other stored insects to test their effect on those insects that infect the stored grains or its products in storage.

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