



EFFECT OF SOME PLANT POWDERS ON ASPECTS OF THE BIOLOGICAL PERFORMANCE FOR SAWTOOTHED GRAIN BEETLE *ORYZAEPHILUS SURINAMENSIS* L. (COLEOPTERA: SILVANIDAE)

Ruaa Kamel Mahmood

College of Agriculture, Al-Qasim green University, Babylon. 51001 Iraq.

Corresponding author Email : ruisanno2010@yahoo.com

Abstract

The current study aimed to test the bi-activity for three plant powders (black caraway *Nigella sativa*, Sodom apple *Calotropisprocera*, and mint *Mentha*) against sawtoothed grain beetle. The results of the current study showed that the Sodom apple powder was the most effective on the different parameters of the growth of the sawtoothed grain beetle. where the study showed a positive relationship between the weight units for the used plant powder and the growth of the insect. The black caraway, Sodom apple, and mint powders at the weight unit (0.7 g) have affected on the percentage of larvae mortality, which amounted to (33.3, 20%), respectively, compared to the control which amounted to 0%. The powders also affected on the duration of the larval stage was (20.6, 23, 23.6 days) for the black caraway, Sodom apple, and mint powders compared to the control, which amounted to (19.6, 19.6, 20 days), respectively in the same weight unit. The powders used were also affected, The Sodom apple powder was excelled in the percentage of pupal mortality amounted to (30.5%) compared to the control which amounted to 0% followed by the black caraway powder and the mint powder. The duration of the pupal phase was (6.6, 8, 7.3 days) compared to the control, which amounted to (5.3, 6, 5.6 days), respectively in the same weight unit, as well as the percentage of adults emergence. The most effective was the Sodom apple powder, which was 36.1% compared to the control which amounted to 100%. It was also found that the Sodom apple powder had a significant effect on the percentage for the mortality of the fully completed sawtoothed grain beetle was 72.2% at the weight unit of 0.7 g compared to the control which amounted to (22.2%) followed by mint powder and black caraway powder where amounted to (61.1, 50), respectively compared to control (16.6, 11.1%), respectively. The used powders did not affect the vitality of the seeds after treating it with the powder (0.7 g / 10 g seeds), where amounted to (90, 93.3, 93.3%) compared to the control which amounted to 96.6%.

Keywords : Plant Powders (black caraway *Nigella sativa*, Sodom apple *Calotropisprocera*, and mint *Mentha*), Sawtoothed grain beetle

Introduction

Sawtoothed grain beetle (*Oryzaephilus surinamensis* L.) is considered one of the main stored grain pests, It is widespread in the world, the whole insects and larvae attack the grains and their products, as well as it infects other food products of plant and animal. It infects dry fruits such as stored dates, dried meat and many other products that are fed by humans such as sugar and types of sweets such as biscuits, and It infects types of flour and medicines. Adults and larvae can be observed in all types of rice that have already been infected with pests, which are poorly stocked (Al-Iraqi, 2010). The loss rate in the world is estimated to be seventy billion dollars a year due to the presence of this insect (Boxall, 2001), it is one of the most dangerous insects that infect grain. This insect is distributed geographically in many parts of the world (Thomas, 2006), The small size of this insect, the shape of its flat body and the speed of its running helped the insect to reach to the grain bags and stored materials. Increasing the risk of this insect, its ability to break grain and make tunnels inside it and increase its moisture and

aggregation, The accumulation of larvae and adults leads to poor grain taste and damage it (Highland, 1991). It also attacks all stages of plant growth, all its parts and causes mechanical damage to the plant, allowing it to be infected with bacteria and other pathogenic parasites. The sawtoothed grain beetle larvae develop in flour and grain products, the length of adults amounted to 2.5 mm and it is well adapted to enter into the cracks because their bodies are perfectly flat (Mason, 2003). Females lay their eggs either individually or in small groups that take about two months to develop from the eggs to adults. Adult females usually live from 10 to 6 months but can live up to three years in the most ideal conditions (Kilpatrick *et al.*, 2004). One of the most important methods used to prevent the spread of this insect is to monitor the cleanliness of the store, seal the bags, control the storage temperature and humidity, and use chemical materials (Kearn, 2006). The use of chemical materials is considered one of the most important means of used treatment in the controlling the Pests of stored materials because they are the easiest and most effective (Hidalgo *et al.*, 1998). However, pesticides have several serious

disadvantages such as the emergence of genetically resistant strains and their deadly effects in non-target organisms, the risk of contamination to users As well as cumulative toxic action on food and environmental pollution (Tapondjou, 2002). Due to the importance of the insect and as a result of the large damage caused to the grain and the fact that the pesticides affect human health and to find alternatives from plant origin that are safer for the environment and less expensive compared to those chemical pesticides, Some plant powders have been used and their effect on some aspects of the Biological performance for sawtoothed grain beetle.

Materials and Methods

The Insect Breeding

The adults of sawtoothed grain beetle were collected from the local markets and from the rice stores in Babylon province. It was then raised and reproductive in glass bottles, with 15 cm long and 9 cm in diameter containing a quantity of rice seeds, placed on it 30 Individual of adults insect, the vial was sealed by a piece of Gauze cloth for ventilation and tied with a rubber band to seal the hole. The bottles were placed in the incubator at 30 ± 2 °C and relative humidity was 65 ± 65 °C. The insect was bred for several generations before testing (Mohamed *et al.*, 2012).

Preparation of Plant Powders

The plant samples used in the study were milled and placed it in plastic bags and stored in the refrigerator until use. These powders for the following plants:

English name	Scientific name	Family	The used plant part
The black caraway	<i>Nigella sativa</i>	Ronunculaceae	Seeds
Sodom apple	<i>Calotropis procera</i>	Asclepiadaceae	Leaves
mint	<i>Mentha</i>	Lamiaceae	Leaves

Test the effect of plant powders on the sawtoothed grain beetle insect

In this experiment, plastic bottles with a diameter of 5 cm and a height of 7 cm were used and placed in each of them a10 g of rice seeds each experiment for the purpose of feeding. A plant powder was then added with weight units (Mass fractions) (0.3, 0.5, 0.7 g) from plant powder. It was vibrated well to mixing the seed with the powder. As for the control treatment, it was without adding any powder to it and it then added 5 larvae per replicate, with three replicates per unit and for each weight unit. All the test tubes were covered with a cloth cover and tied with a rubber band and kept in suitable

breeding conditions. The following parameters were calculated: duration of the larval phase, the percentage of larvae mortality, duration of the pupal phase, percentage of pupal mortality and the percentage of adults emergence.

Testing the effect of plant powders on the adults of the sawtoothed grain beetle insect

The same previous method and the same weight units were used, where 6 adults insects (3 males + 3 females) were placed for each replicate and the percentage of adult mortality was calculated after 24 hours.

Effect of plant powders on the percentage of germination of rice seeds for the highest concentration only

To determine the effect of plant powders on the vitality of the embryo, several random seeds of rice seeds treated with the powder of (0.7 g / 10 g seeds) were selected for Sodom apple, and mint plants and the black caraway seeds, sterile and clean Petri dishes were prepared for this purpose, placed in it a filter paper saturated with distilled water, The seed was placed over it and allowed to it to germinate, with ten rice seeds per dish and for three replicates. A week later, the percentages of germination were estimated and compared with the control treatment which contained intact and sterilized seeds in Petri dishes containing wet and sterilized filter paper, with three replicates (Brasil, 1992).

Statistical Analysis

The experiments were conducted using the Completely Randomized Design (CRD), with three replicates, the average difference was then compared using a least significant difference test (L.S.D) at the 5% probability level (Al-Rawi, 1980).

Results and Discussion

Testing the effect of plant powders on the larvae of the sawtoothed grain beetle insect *Oryzaephilus surinamensis*

Table (1) shows that the treating of rice seeds with the black caraway, Sodom apple, and mint powders showed good efficiency in the percentage of larvae mortality placed by the sawtoothed grain beetle insect. where the Sodom apple powder was most influencing in the percentage of larvae mortality was 33.3% at the weight units of 0.7% compared to the control which amounted to 0% followed by the grain and the black caraway and mint, with percentage of 20% at the same weight unit, where it was observed that the higher the weight units, the greater the percentage of mortality. There are many reasons for the mortality was that the

Sodom apple powder (the highest effect) was first used in the control of the insect, where it was found to contain many chemical compounds, including glycosides, Flavonoids, methanol compounds, resins, Anthocyanins, and proteases enzyme. The duration of the larval phase showed significant differences between the treatments. The most influencing is a Sodom apple powder and mint powder at the weight unit was (0.7) which amounted to (23, 23.6 days) compared to the control treatment which amounted to (19.6, 20 days), respectively. As for the pupal mortality, the results showed significant differences between the treatments compared with the control. Where the percentage of mortality for the pupal phase for the Sodom apple powder at the weight units (0.3, 0.5, 0.7) amounted to (6.6, 20, 30.5%), respectively, followed by mint powder at the same weight units was (6.6, 15, 25) compared to control treatment which amounted to 0%. Followed by

black caraway powder, where the percentage of pupal mortality was (0, 15, 25%) at the same weight units compared to the control treatment which amounted to 0%. It was observed that the higher the weight units, the greater the percentage of pupal mortality.

As for the duration of the pupal phase, there were significant differences between the treatments. The most influencing powders were Sodom apple and mint powders followed by the black caraway powder (6.6, 7.3, 8 days) compared to the control which amounted to (5.3, 5.6, 6 days), respectively. There was also a significant difference in the percentage of adults emergence. The most influencing powder was Sodom apple powder compared to the rest of the used powders in the experiment amounted to (93.3, 60, 36.1%) at the weight units (0.3, 0.5, 0.7) compared to the control which amounted to 100% followed by mint powder then the black caraway powder with varying proportions.

Table 1: Testing the effect of plant powders on the larvae of the sawtoothed grain beetle insect *Oryzaephilus surinamensis*

Type of plant powder	The weight units	The duration of the larval phase (day)	The percentage of larval mortality (%)	The duration of the pupal phase (day)	The percentage of pupal mortality (%)	Adults emergence (%)
The black caraway	0.3	19.6	0	6	0	100
	0.5	20.6	13.3	6.3	15	71.66
	0.7	20.6	20	6.6	25	55
	0	19.6	0	5.3	0	100
Sodom apple	0.3	21.6	0	7.3	6.6	93.3
	0.5	22	20	7.3	20	60
	0.7	23	33.3	8	30.5	36.1
	0	19.6	0	6	0	100
mint	0.3	22.3	0	6.3	6.6	93.3
	0.5	23	6.6	7.3	15	78.3
	0.7	23.6	20	7.3	25	55
	0	20	0	5.6	0	100
LSD value		1.35	5.62	0.84	3.06	17.20

Testing the effect of plant powders on sawtoothed grain beetle *Oryzaephilus surinamensis* L.

Table (2) shows that there were significant differences between the treatments compared to the control, the most influencing powder among the used powders was the Sodom apple powder. Where the percentage of adult mortality amounted to (55.5, 61.1, 72.2%) at the weight units (0.3, 0.5, 0.7), respectively, compared to the control which amounted to (22.2%). The reason of effect may be due to its containment of phenolic and glycosides compounds and active substances acting as antifeedants or repellents that cause insects to die as a result of hunger or cause hormonal

imbalance, which inhibits the oviposition process or Moulting the larval phase for the insect (El-lakwahet, 1993). Followed by mint powder which gave a percentage of mortality amounted to (50, 55.5, 61.1%) at weight units (0.3, 0.5, 0.7) compared with control treatment which amounted to 16.6% followed by black caraway powder, where the percentage of adults mortality amounted to (38.8, 44.4, 50%). The reason may be due to the repellent effect of plants because they contain essential oils, for example, black caraway seeds contain 1.5-1.5% aromatic oils, including Nigellone, Zymohydroquinone, 40% Fixed oils, and Melanin substance (Chevalier, 2010).

Table 2: Testing the effect of plant powders on sawtoothed grain beetle *Oryzaephilus surinamensis* L.

Type of plant powder	The weight units	The percentage of mortality (%)
The black caraway	0.3	38.8
	0.5	44.4
	0.7	50
	0	11.1
Sodom apple	0.3	55.5
	0.5	61.1
	0.7	72.2
	0	22.2
mint	0.3	50
	0.5	55.5
	0.7	61.1
	0	16.6
LSD value		21.36

Effect of plant powders on the percentage of rice seed germination for the highest concentration only

Table (3) shows that the percentage of germination amounted to (90, 93.3, 93.3%) compared to the control which amounted to (96.6%). These results confirm the possibility of using these powders for seed treatment and protection it in the store as well as for domestic use. These results agree with (Al-Ghazali *et al.*, 2011; Zaidan *et al.*, 1993) that the percentage of germination of cowpea seeds treated with powders was not significantly affected.

Table 3: Effect of plant powders on the percentage of rice seed germination for the highest concentration only:

Plant powder	The black caraway	Sodom apple	mint	Control
the percentage of germination	90	93.3	93.3	96.6

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