Plant Archives Volume 20 No. 1, 2020 pp. 1355-1358 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF SOME PLANT POWDERS IN LARVAE STAGE OF HAIRY GRAIN BEETLE *TROGODERMA GRANARIUM (EVEST)* (COLEOPTERA: DERMASTIDAE)

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Abstract

The aim of this research studied effect of plant leaves Powder of *Eucalyptus camaldulensis, Laurus nobilis, Platycerium bifurcatum* and *Adhatoda vasica* on larvae mortality of *T. granarium* insect of ages (initial, intermediate, advanced) in the laboratory were used tow doses of 0.025 and 0.050g/kg respectively, the results of four powders indicated the efficacy of the eucalyptus leaves powder was the most influential compare to the other three powders,the results showed that the initial age was the most sensitive to the Eucalyptus powder in 0.025 and 0.050g/kg doses respectively, mortality rate was 70.0 and 80.0%, respectively after 50 days *and* the advanced ages were the least sensitive at the rate of mortality 20.0 and 43.33%, respectively at time (40 and 30) day, respectively. The leaves powder of the *Adhatoda vasica* was the least affected between the other three powders were the initial age most sensitive. In 0.025 and 0.050g/kg doses, respectively *and* the mortality rates were after 50 days (30.0 and 46.66%) respectively. The advanced ages were the least sensitive and in 0.025 and 0.050g/kg doses and were recorded rates of mortality (13.33 and 23.33%), respectively after 30 days. The result shows that the mortality rates are increased by increasing the exposure time of the treatments with the powder in 0.025 and 0.050g/kg doses.

Key words: plant powders, larvae, hairy.

Introduction

Using chemical insecticides in last years around the world has resulted demolition of the environment, pest resurgences, pest resistance to pesticides which have not been efficient for a long time to control storage insect, it was found that some beetles have a high degree of resistance to the chlordane group and have moderate resistance to HCH groups (Ayad and Alyouse, 1994), methyl bromide is considered one of the most widely used chemicals in the control of these stored insects, due to its deplete of the ozone layer, it was agreed to stop using it in 2005 in advanced countries and in 2015 in developing countries (Anon, 1997), effect lethal to non-target organisms in the agro-ecosystems, in addition to direct toxicity to users, it has now become necessary to research for the alternative means of pest control, which can reduce use of synthetic pesticides. The use of plant powders is the simplest and important method of grain protection to reduce or replace the synthetic pesticides (Deka *et al*., 2001), it has many properties. In order to reduce the damage of these storage insect. So researchers began using pesticides of plant origin, such as plant powders (Elhag, 2000), there are 2000 plants are recorded to possess some type of antifeedant, repellent or insecticidal compounds (Bouda *et al*., 2001).

It has been shown that the plant extracts of palm leaves and seeds of neem and cloves had an effect to prevent the development of eggs, ratio of productivity and the decline in progeny from the cowpea beetle. Plant pesticides were registered as repellency, antifeedance, insect growth regulatory, importance to control pests of agricultural (Prakashand Rao, 2003), for all these reasons, Plant pesticides can be a dependable alternative for chemical pesticides for having desired specifications including fast degradation, low toxicity of humans, animals, plant *and* not environmental contaminants as well as the lack of resistance to them by the treated pests (Pavela *et al*., 2004). Contact toxicity of many plant powders to insect pests and repellency effects have been demonstrated (Isman, 2004).

The newly study recommends the exploitation of *Tridex procumbens* and *W. somnifera* leaf powdered

form as a more practical control method for bruchids than essential oil, products derived from plants are used as pharmaceuticals worldwide and therefore could be considered less injury to humans than most traditional insecticides (Shukla *et al*., 2007). (Epidi *et al.,* 2008) tested the influence of 3 g of vegetable powder of *Vitex grandifolia* and *Dracaena arborea* added to 10 g of cowpea flour resulted in a decrease in the survival rate of maize weevil *Sitophilus zeamais* and *C. maculatus*, which reached 3.3% for both after 7 days of treatment, number of adult females was 9.33 and 11.0 respectively, while the number of control treatments was 15. (Yankanchi and Gonugade, 2009) they said there are many medicinal plants and spices have been used as pest control. (Yankanchi and Lendi, 2009) mentioned in their experiments were recored to evaluate the efficiency of leaf powders of *Tridex procumbens*, with *Withania somnifera*, *Pongamia pinnata* and *Gliricidia maculata*, to control the pulse beetle, *Callosobruchus chinensis*, which infests stored green gram seeds. Dried leaf powders of *T. procumbens* and *W. somnifera* (5 mg/g seed) was found to be more effective, causing 100% mortality, than leaf powders of *P. pinnata* and *G. maculata* (20 mg/g seed), revealed 73.1 and 69.2% mortality respectively, several studies have been conducted on the effect of cinnamon, coriander, nutmeg and ginger in the control of various insects, Cinnamon was used to control the yellow maize *Sitophilus zeamais* Motsch and moths (Ishii *et al*., 2010; De Assis *et al*., 2011). Plant powders were traditionally used as grain protectants (Isman, 2000; Rajasekhar *et al*., 2012). Also was used *Myristica fragrans* on the leaf pests *Vigna unguiculata* L. (Nat *et al*., 2013). The importance of the insect, its great damage and the effects of pesticides on human health lead us to find alternatives pesticide of plant origin such as powders of some plants and study their impact on the larvae of hairy grain beetle.

Material and Methods

Insect culture

The insect larvae were collected from the wheat grain infected with the insect from the laboratory of stored pests in the Protection of Plant Department / College of Agricultural Engineering Science/ University of Baghdad *and* the insect was diagnosed by isolating 10 pair of (males + females) to confirm the insect species. The insects kept in glass containers with wheat grains were placed in the refrigerator at -18°C for 2 weeks to ensure that they are not infected with other storage pests and then transferred to incubator at 35 ± 1°C and relative humidity 45% ± 5 For larval stage and obtain larval different ages. from the first to the last age, the larvae at the age, one week (initial), the age of three weeks (intermediate) and the age more of four weeks (advanced) age.

Preparation of plant powders

The leaves of test plants *Eucalyptus camaldulensis, Laurus nobilis, Platycerium bifurcatum, Adhatoda vasica,* collected from the gardens of the Agriculture college / University of Baghdad and dried on paper in the shade at laboratory temperature and then grinded plant samples in the laboratory with a small mill and then placed in plastic bags and kept in the refrigerator until they are used.

Effect of Powders on Mortality of *Trogoderma granarium* larvae

The powder was used in 0.025 and 0.050g/kg doses respectively, mixed with seeds and seeds were then divided into 20 g in every container and add 10 pairs of insect larvae of age (initial, intermediate, advanced) per container and three replicates per treatment and age separately.

The statistical analysis

(CRD) Complete Randomized Design tests showed less significant difference at the level of 5% probability to make sure the moral differences between the various treatment and used the analysis Nested Factorial Experiments and system software SAS for the year 2001 in the analysis of the results of these studies statistically.

Result

Effect powder of *Eucalyptus camaldulensis* on *Trogoderma granarium* larvae

The results of table 1 showed that the initial age was the most sensitive to the Eucalyptus powder in both doses 0.025 and 0.050g/kg respectively, the mortality rate after 50 days was 70.0 and 80.0% respectively, the advanced ages were the least sensitive at the rate of mortality 20.0 and 43.33% respectively, in time (40 and 30) a day respectively, as noted from the table that the rates of mortality increase with an increased exposure time to some treatment with powders and in both doses, result

Table 1: Effect powder of *Eucalyptus camaldulensis* on *Trogoderma granarium larvae.*

Doses g/kg	Ages	Time \ day				
		10	20	30	40	50
		Mortality %				
0.025	Initial	0.0	16.66	50.0	62.66	70.0
	Intermediate	0.0	10.0	10.0	30.0	40.0
	Advance	0.0	0.0	16.66	20.0	20.0
0.050	Initial	3.33	30.0	53.33	73.33	80.0
	Intermediate	0.0	10.0	30.0	40.0	46.66
	Advance	0.0	6.66	43.33	43.33	43.33
LSD.050 mortality = 6.33; LSD.050 doses = 10.46						

Table 2: Effect of *Laurus nobilis* leaf powder on *Trogoderma granarium* larvae.

Doses g/kg	Ages	Time \ day				
		10	20	30	40	50
		Mortality %				
0.025	Initial	0.0	30.0	36.66	43.33	55.0
	Intermediate	0.0	26.66	36.66	43.33	43.33
	Advance	0.0	20.0	30.0	30.0	30.0
0.050	Initial	30.0	46.66	46.66	50.0	66.66
	Intermediate	0.0	40.0	60.0	60.0	60.0
	Advance	0.0	36.66	46.66	46.66	46.66
LSD.050 mortality = 5.46; LSD.050 doses = 11.72						

showed significant difference in mortality rate and exposure time in both doses and for all age.

Effect of *Laurus nobilis* leaf powder on *Trogoderma granarium* larvae

The results of table 2 showed that the initial ages were the most sensitive to *Laurus nobilis* powder in both doses 0.025 and 0.050g/kg respectively, the mortality rates were after 50 days 55.0 and 66.66% respectively, while the advanced ages were less sensitive in both doses with mortality rates reached 30.0 and 46.66% respectively in 30 days. The result showed a significant difference in mortality rate and in most exposure time in both doses and for all ages.

Effect of *Platycerium bifurcatum* on *Trogoderma granarium* larvae

The results of table 3 showed that the initial ages were the most sensitive to the *Platycerium bifurcatum* powder in both doses 0.025 and 0.050g/kg, respectively, the rates of mortality after 50 days were 60.0 and 80.0 %, respectively, while the advanced ages were the least sensitive and in both doses and the rates of mortality were 26.66 and 30.0% respectively in an exposure time 20 days, and the rates of mortality increase with the most exposure time of the treatment and in both doses, result showed significant difference in mortality rate in both doses and for all ages.

Table 3: Effect of *Platycerium bifurcatum* on *Trogoderma granarium* larvae.

Doses g/kg	Ages	Time \ day				
		10	20	30	40	50
		Mortality %				
0.025	Initial	6.66	33.33	40.0	40.0.	60.0
	Intermediate	0.0	30.0	36.66	36.66	36.66
	Advance	0.0	26.66	26.66	26.66	26.66
0.050	Initial	16.66	40.0	60.0	70.0	80.0
	Intermediate	13.33	30.0	40.0	40.0	40.0
	Advance	0.0	30.0	30.0	30.0	30.0
LSD.050 mortality = 8.45; LSD.050 doses = 1.40						

Table 4: Effect of *Adhatoda vasica* leaf powder on *Trogoderma granarium* larvae.

Doses g/kg	Ages	Time \ day				
		10	20	30	40	50
		Mortality %				
0.025	Initial	6.66	13.33	20.0	26.66	30.0
	Intermediate	0.0	16.66	20.0	20.0	20.0
	Advance	3.33	10.0	13.33	13.33	13.33
0.050	Initial	6.66	23.33	26.66	30.0	46.66
	Intermediate	6.66	20.0	30.0	30.0	30.0
	Advance	0.0	20.0	23.33	23.33	23.33
LSD.050 mortality = 4.28; LSD.050 doses = 5.36						

Effect of *Adhatoda vasica* leaf powder on *Trogoderma granarium larvae*

The results of table 4, showed that the initial ages were the most sensitive to *Adhatoda vasica* powder in both doses 0.025 and 0.050g/kg respectively, after 50 days the mortality rates reached 30.0 and 46.66% respectively, the advanced ages were the least sensitive and in both doses, the rates of mortality recorded after 30 days were 13.33 and 23.33% respectively. The table also shows that the mortality rates are increased by increasing the most exposure time of the treatments with the powder and in both doses, but there was a halt in the mortality rates in advanced larvae age after 30 days of exposure because of the ability of advanced ages to resist the toxicity of plant powders *and* the result showed significant difference in mortality rate and exposure time in both doses and for all ages.

Discussion

The results of all tables indicated demonstrated the efficacy of leaves *Eucalyptus camaldulensis* leaves powder was the most influential among the four powders and powder of the leaves *Adhatoda vasica* was the least affected between the four powders in a both doses *and* the results of all tables showed low or stopped effect of the powder in advanced age of larvae in all the powder treatments, I suggest may be resulted from short time exposure to powders and turned to the pupae stage or my be to their ability to resist the toxicity of plant powders, all effects resulted from powders because they contain secondary metabolized compounds such as alkaloids, phenolic and terpeneoids *and* antifeeding or repellents that causing damage to insects as a result of hormonal imbalance inhibit or metamorphosis of the larval ages of the insect (El-Lakwah *et al.*, 1993). The effectiveness of plant powders was causing 100% mortality and completely inhibiting was determined as 20 mg/g (2% w/w) (Koona and Koona, 2006) *and* the powders of clove and leaf of *Tithonia diversifolia* effect at (5% w/w)

(Adedire and Akinneye, 2004). Plant powders often were traditionally used as grain protectants by preventing or reduce the emergence of adult beetles from the pupae. However, it is not clear if this effect is caused by larval mortality, or by the fact that the adults contact the plant powder a while emerging from the pupae stage (Isman, 2000, Rajasekhar *et al.,* 2012). The mode of action of plant powders may vary but with low to moderate dosages, the effect is repellant or toxic (Rajapakse, 2006). Salvadores *et al.*, (2007) showed that powders of *Piper nigrum*, *Cinnamomum annum* and *Cinnamomum zeylanicum* had a repellent effect on *Sitophilus zeamais*. In the study, at higher concentrations, 100 percent mortality was achieved by roots of *Inulara cemosa* produced high repellence to *Sitophilus oryzae* and also had strong insecticidal activities against the weevil.

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