Available online at www.journalijmrr.com

INTERNATIONAL JOURNAL OF MODERN RESEARCH AND REVIEWS

ISSN: 2347-8314

Int. J. Modn. Res. Revs.
Volume 3, Issue 6, pp 702-705, June, 2015

ORIGINAL ARTICLE

EFFECT OF VARIOUS MEDICINAL PLANT POWDER ON THE RED FLOUR BEETLE *TRIBOLIUM CASTANEUM* (HERBST) (COLEOPTERA: TENEBRIONIDAE)

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Article History: *Received 4th May,2015, Accepted June 29th 2015, Published 30th June,2015*

ABSTRACT

Present study were carried out to find out the activity of medicinal plant powders to control the insect *T.castaneum*. Encouraging results were obtained on samples stored for three weeks with grounded plants to study the weight loss in medicinal plant powder during different storage period of 7 days 14 day and 21 day, red flour beetle mortality on medicinal plant powder during different storage period. There was maximum mortality at 14 days in marutham and Nillavarai was 95% following to 90 % in Kandankathari and Vembu. However, even storage Finished 21 days did not reached cent percent mortality in Vembu (95%). It was given more preference to Aavaram, but there was no preference to Kandakaththari and vembe as well as less preference to Nillavarai and Serpillai. Red flour beetle larva also not prefer Vembu and Nillavarai. Even it was same Kandankaththari showed opposite result to Insect. Kandankaththari plants showed strong repellent action on the red flour beetle.

Keywords: *T.castaneum* - the red flour beetle (test insect), mortality- death rate

1.INDRODUCTION

Insects are one of the basic problems of stored grains throughout the world, due to the quantitative and qualitative losses they cause (Fields, 2006). The efficient control of stored grain pests has long been the aim of entomologists throughout the world. Synthetic chemical pesticides have been used for many years to control stored grain pests (Salem et al., 2007).

In fact, management of stored product pests using materials of natural origin is nowadays the subject which received much attention, because of their little environmental hazards and low mammalian toxicity (Nadra, 2006). Previous research indicated that some plant powders, oils and extracts have strong effects on stored grain insects such as high toxicity and the inhibition of reproduction (Emeasor et al., 2005; Nadra, 2006). In addition to high toxicity to insects, many natural products are also repellent or attractive (Mohan and Fields, 2002).

Peasant farmers and researchers often claim successful use of material of plant origin in insect pest control including spices and powders of plant parts (Akinneye et al., 2006).The mode of action of powders vary, but with low to moderate dosages, the effect is repellent or toxic, never mechanical (Rajapakse, 2006).

Traditionally, different parts of neem tree and other plant leaves have also been used as food grains protectants at farm level (Jilani & Ahmad 1982). The search for deriving effective insecticides from natural material became highly imperative. Hence present study was undertaken to screen the leaves of medicinal plants, growing under regional environmental conditions and also investigate their potential in controlling insect infestation.

Botanical plant products are environmentally safe, less hazardous and less expensive. The main advantage of botanical insecticides is that they can be easily used by farmers in hamlets and small scale industries. Among the botanical products spices are characterized by their flavour and odour due to the presence of aromatic oils. These volatile constituents can influence insect behavior and some can act as botanical pesticides.

Many repellents have been tested using laboratory bioassays; however, these tests do not mimic field conditions or require large amounts of grain to be treated. In the present study, we used a simple, rapid and reliable technique to determine if specific plant products are repellent to stored-product insects and exploits the oriented movement of insects away from or towards the product (Mohan and Fields, 2002).

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2.MATERIALS METHODS

Insects

Tribolium castaneum was obtained from laboratory cultures maintained for the room temperature at 26 ± 1°C and 65-75% r. h. This insect was reared on wheat flour mixed with yeast (10:1, w:w). In the present study adults of 1 week old were used for plant effect.

Plant materials

The 7 medicinal herbs were purchased from Medicinal Herbs Market (Thanjavur). Different formulations of each plant were selected for the study.

List of plants and their family and the parts used for the preparation of Powder

Common Name	Scientific Name	Family	Parts used
Naval kottai	*Syngium cumini*	Myrtaceae	Seed
Marutham pattai	*Terminalia arjuna*	Combretaceae	Bark
Nillavarai	*Cassia angustifolia*	Fabaceae	Leaves
Kanndankaththari	*Solanum viriginiaum*	Solanaceae	Fruits
Vembu	*Azadirachta indica*	Azadirachta	Leaves
Serupeelai	*Aerva lanata*	Amaranthaceae	Leaves
Aavaram	*Senna auriculata*	Fabaceae	Leaves

Preparation of powder.

Plant parts were collected, washed with distilled water and shade dried at room temperature for one month. Thereafter, powders were prepared using domestic grinder followed by sieving through 60 mesh size sieve. Powders were kept in polythene bags at room temperature and properly sealed to prevent quality loss (Chayengia *et al*. 2010).

Mortality rate

Ten Insect per box were separated from stock cultures and transferred to pretreated box (just prior to experiment). All the box were covered with wire meshed lids. They were checked at regular intervals of 24 h to see the toxic effect of these plant powders. Dead larvae were identified by their brownish black colour and were removed from the cultures after noting their number. This was continued till all the ten insect were dead and noted the time needed for 100% mortality in each set. Experiments were repeated in three replicates and the data was subjected to statistical analysis.

Weight loss

One grams of samples were weighed with a sensitive balance scale into plastic jars.10 number of *T. castaneum* adults were introduced into the plastic jars. A plastic jar without any insects served as the control. The jars were covered with muslin cloth to allow aeration and prevent other pests from entering. The experiment was set up in triplicates. The first batch of twelve jars was left for seven days after which, the samples were removed and reweighed. Weight loss was determined as the difference between the weight of uninfested sample and that of infested sample as a proportion of the weight of uninfested sample expressed in percentage. Thus,

$$WL = [(Wc - Wt) / Wc] \times 100$$

where:
WL – percentage weight loss
Wc – weight of uninfested sample
Wt – weight of infested sample

The number of live *T. castaneum* adults present was recorded. The powdery waste was not discarded but returned into the jars. At fourteen days and twenty one days after infestation (DAI), samples were also removed from the second batch and third batch jars and the procedures followed were similar to those done for the first experiment of fourteen days and twenty one days storage.

Food preference of adult rust red flour beetle to the medicinal plant

The preference of adult rust red flour beetle for feeding to the medicinal plant conducted in this study was evaluated according to the free-choice of feeding test (F.A. Ajayi and S.A. Rahman, 2006)

For this test, rounded plastic tray were used. The tray classified in to 7 equal parts, each of them for one type of spices. And a center part represented the control. ten adults (one day old) of rust red flour beetle taken from the laboratory cultures were released in the tray center. The tray was covered with muslin cloth tightened with rubber band then placed in room temperature. The number of adults presented with each specimen of medicinal plant in each part of tray was recorded 24 hours after the onset the experiment. The tests repeated three times, with newly adults from the laboratory cultures at a time.

Food preference of rust red flour beetle larvae to the medicinal plant

Similar experiments as indicated later were conducted but in this case 100 of 4th instar larvae (after one day starvation) were released in the tray center instead of adult beetles.

Repellent effects of medicinal plant used to adult rust red flour beetle

The repellent effect of the different medicinal plant to adults were done using of chemotropometer apparatus (A. S. Dawood and N. M. Al-Mallah, 1993) with some modification. The apparatus consist of plastic made box having a mobile cover. Through the two opposite far sides of the box pass graduated glas tube (100 cm length and 3 cm diameter) with a hole in the middle to insert the tested insects from. The tube is open in both ends to insert the food in one side and medicinal plant in the other side after. 10 individuals of the tested insect were entered to the tube throughout the hole and the repellent percentage were calculated after 15 minutes from the begging of the test using for the following equations.

Each test were replicated three times.

$$\text{Repellent percentage} = \frac{\text{Number of insects move opposite the medicinal plant more than 25 cm away from the center}}{\text{Total insect number}} \times 100$$

3.RESULTS AND DISCUSSION

Weight loss in medicinal plant during different storage period of 7 days, 14 days and 21 days.

Encouraging results were obtained on samples stored for three weeks with plant powders of Aavaram, Naval, Marutham, Serupeelai, Vembu, Kandankathari & Nillavarai which showed weight loss respectively. (Table **.1)**

Some tested plant derived materials are found to be highly effective against insecticide resistant pest insects (Arnason *et al*., 1989). Results showed that mortality increased with the increased the period of storage exposure to the plant powder. Mortality results showed that cent percent reach at 21 days in marutham, Nillavarai and kandankathari. There was maximum mortality reached at 14 days in marutham and Nillavarai was 95% following to 90 % in kandankathari and Vembu. (Table 1.) However, even storage finished 21 days did not reached cent percent mortality in Vembu (95%).

When red flour beetle was given a choice between the plant powders. It was given more preference to Aavaram, but there was no preference to Kandakaththari and Vembu as well as less preference to Nillavarai and Serpillai. (Table **.2)**

Table 2. Percentage number of adult rust red flour beetle found on the medicinal plant after 24 hrs. of exposure in the free choice test. (Preference of Red flour beetle in medicinal plant)

Sl. No	Plants name	Mean number of adult
1	Naval	12.50
2	Marutham	17.50
3	Nillavarai	2.50
4	Kanndankaththari	0.00
5	Vembu	0.00
6	Serupeellai	2.50
7	Aavaram	57.50

Simillíar test was taken for larva. Here also not prefer Vembu and Nillavarai by larva . Even it was same Kandankaththari showed opposite result to Insect. Because it was more larva fount in Kandankaththari. (Table 3.)

The result obtained from Kandankaththari plants showed strong repellent action on the red flour beetle. The results indicate that the less repellent response on Aavaram. (Table 4.) However at higher number of insects moved away from the Kandankaththari powder. This results indicated the Kandankaththari acts as a good repellent to these Insects.

4.CONCLUSION

Present study were carried out to find out the activity of medicinal plant powders to control the insect *T.castaneum*. Encouraging results were obtained on samples stored for three weeks with grounded plants . Aavaram, Naval kottai, Marutham, Serupillai, Vembu, Kandankathari & Nillavarai Showed weight loss respectively. Mortality results showed that cent percent at 21 days in marutham, Nillavarai and kandankathari. There was maximum mortality at 14 days in marutham and Nillavarai was 95% following to 90 % in Kandankathari and Vembu. However, even storage Finished 21 days did not reached cent percent mortality in Vembu

Table 3 . Percentage number of larvae rust red flour beetle found on the medicinal plant after 24 hrs. of exposure in the free choice test.

S.No	Plants Name	Mean number of larva
1	Naval	7.50
2	Marutham	10.00
3	Nillavarai	0.00
4	Kanndankaththari	35.00
5	Vembu	0.00
6	Serupeelai	12.50
7	Aavaram	17.50

Table 4. The repellent effects of different types of medicinal plant to the adult rust red flour beetle

Sl No	Plants Name	Repellent %
1	Naval	55
2	Marutham	60
3	Nillavarai	85
4	Kanndankaththari	95
5	Vembu	85
6	Serupeelai	75
7	Aavaram	35

(95%). It was given more preference to Aavaram, but there was no preference to Kandakaththari and vembe as well as less preference to Nillavarai and Serpillai. Red flour beetle larva also not prefer Vembu and Nillavarai. Even it was same Kandankaththari showed opposite result to Insect. Kandankaththari plants showed strong repellent action on the red flour beetle.

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Table 1. Weight loss in medicinal plant during different storage period of 7 days, 14 days and 21 days.

Sl.No	Medicinal plants Name	Weight Loss (%)					
1		7 DAS (Mean ± S.D)	%Mortality	14 DAS (Mean ± S.D)	%Mortality	21 DAS (Mean ± S.D)	%Mortality
2	Naval	3.47 • ± 0.54	65	3.50 ± 0.54	75	3.50 ± 0.54	100
3	Marutham	2.80 • ± 0.74	60	2.81 ± 0.72	95	2.81 ± 0.72	100
4	Nillavarai	0.79 • ± 0.28	25	0.80 ± 0.28	95	0.80 ± 0.28	100
5	Kanndankaththari	1.69 • ± 0.14	40	1.70 ± 0.15	90	1.70 ± 0.15	100
6	Vembu	1.92 • ± 0.75	65	1.92 ± 0.76	90	1.92 ± 0.76	95
7	Serupeelai	2.26 • ± 0.82	35	2.31 ± 0.86	80	2.32 ± 0.84	95
8	Aavaram	7.66 • ± 0.43	65	7.98 ± 0.01	75	7.99 ± 0.02	100

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