

Efficacy of some essential oil for the management of Rice Weevil (*Sitophilus oryzae*) on stored wheat

ABSTRACT

The experiment was conducted in Completely Block Design (CRD) at the laboratory of the Department of Entomology, Naini Agriculture Institute Sam Higginbottom University of Agriculture, Science and Technology, Prayagraj, Uttar Pradesh with three replications seven treatments and untreated control against Rice Weevil *Sitophilus oryzae* (L.) i.e. T1 (Neem Oil), T2 (Clove Oil), T3 (Lavender Oil), T4 (Karanj Oil), T5 (Eucalyptus oil), T6 (Lemongrass Oil), and T7 (Tea tree Oil) and T0 (control). The experiment was conducted on the efficacy of different essential oil for the management of rice weevil, *Sitophilus oryzae* and adult mortality at 24, 48 and 72 hrs of exposure. The treatments included Neem Oil (0.5ml/lit), Clove Oil (0.5ml/lit), Lavender Oil (0.4ml/lit), Karanja Oil (0.4ml/lit), Eucalyptus Oil (0.5ml/lit), Lemon grass Oil (0.5ml/lit) and Tea tree Oil (0.5ml/lit). Among the treatments the largest number of mortality was observed in neem oil (83.33%), followed by karanj oil (77.77%), and least mortality was observed in the lavender oil (31.11%), rest of the treatments were found intermediate as followed by clove oil (67.77%), followed by eucalyptus oil (57.77%), followed by lemon grass oil (54.44%) and tea tree oil (51.10%). Percent weight loss of treated wheat grains at intervals of 30, 60 and 90 days after treatment. The results revealed that neem oil (7.32%), followed by karanj oil (11.99%). Least weight loss was recorded in lavender oil (41.06%). Whereas rest of treatments were found intermediate. And the highest germination was found in neem oil treated wheat seeds. The present study clearly revealed that these naturally occurring indigenous plant products could be used to manage the storage insect pests in wheat.

Keywords: Sitophilus , Storage , neem , Eucalyptus

1. INTRODUCTION

Wheat is one of the most important and widely cultivated staple food crops among the cereals and is contributing about 30% to the food basket of the country. It is agronomically and nutritionally most important cereal essential for the food security, poverty alleviation and improved livelihoods.

After China, India is leading producer of wheat in the world. In India, wheat comes second in number after rice among cereals and cultivated in an area 30 million hectare with the production of 97.44 metric tons recorded in 2016-17 (Kumar et al.).

Botanical insecticides have long been treated as attractive alternatives to synthetic chemical insecticides (Isman, 2006). Different types of plant preparation such as powders, solvent, essential oils and whole plants are being investigated for their insecticidal activity including their action as fumigants, repellents, antifeedants, anti ovipositors, insect growth regulators (Weaver and Subramanyam, 2000).

The rice weevil, *Sitophilus oryzae* is a serious pest of products in India that cause severe damage in both quantity and quality of stored cereals so grains are non-viable as well as not suitable for human consumption (Chauhan et al., 2005; Sahaf et al., 2008). Effective management of *S. oryzae* is mainly depending upon the use of conventional liquid and gaseous insecticides (White and Leesch, 1995).

The growing awareness of environmental hazards caused by synthetic insecticides has led to search for safe and environment friendly alternatives. In this regard, a number of studies are being carried to find out the plant origin chemicals for their insecticidal properties against wide-range of insect pest including stored grain insect pests

2. MATERIAL AND METHODS

Studies on *Sitophilus oryzae* were conducted at Entomology department SHUATS, Prayagraj during 2022. Materials used and the techniques employed during the course of investigation for conducting experiment are presented below. The materials used and the methods followed in the present research are discussed in this chapter.

Rearing of test insect *S. oryzae*: The cultures of *S. oryzae* were obtained from the local markets of Prayagraj. Plastic containers of 1.5 kg capacity were used for insect rearing. About 500 gm of grains were kept in each container and about 600 adults of insects were released separately. They were allowed to lay eggs for 3 to 5 days and removed after 7 days, when the egg laying was over. These containers were kept at room temperature for the adult emergence of *S. oryzae*.

Other materials:

Petriplates, plastic jars, muslin cloth, butter paper, marker and rubber bands.

Preparation of plant products:

All the treatments used were collected from the local markets.

Observation to be recorded

Evaluation based on mortality

The cereal grains (100g) were kept in plastic jar of 500gm capacity and test materials were mixed at respective doses thoroughly and properly by manual agitation until the materials are evenly distributed among the grains and ensure homogenous mixture, which was considered as one replication. Three replications were used in each case. Ten pairs of *Sitophilus oryzae* adults were released in each plastic container at an interval of 24, 42 and 72 hours after treatment. The plastic jars were covered with muslin cloth and tied with rubber bands. The percent adult mortality

was calculated based on the number of dead insects. The percentage mortality of the adults was calculated by using formula and then subjected to ANOVA.

$$\text{Percent adult mortality} = \frac{\text{Number of dead insects}}{\text{Number of insects released}} \times 100$$

Evaluation based on weight loss in free choice test

100g of wheat grains were taken and placed in a container at equi distance from the center. Approximately 50 pairs of 12 days old adult rice weevils are released in the center through giving free choice to the adults of orientation and then the containers were covered with muslin cloth. Same procedure was repeated for three replications. and the readings were counted at 30, 60 and 90 days after release. And the readings were calculated by using the formula mentioned below

$$\text{Percent weight loss} = \frac{\text{Initial weight of seeds} - \text{Final weight of seed}}{\text{Initial weight of seeds}} \times 100$$

Evaluation based on germination

To find out the effect of treatments on seeds germination test was conducted at 90 Days after treatment. Germination of the seeds was tested by paper towel method by maintaining three replications of each treatment. 50 seeds were selected randomly and kept on moist paper for 7 days and germination Percentage was calculated by using formula

$$\text{Percentage of seed germination} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds}} \times 100$$

Statistical analysis

Data will be subjected to Complete Randomized Design (CRD) after suitable transformations. The per cent data will be subjected to angular transformation before statistical analysis. Similarly, the data based on mean number of insects will undergo square root transformation with X+0.5 adding factor.

Results and Discussion

Percent adult mortality

The data pertaining to overall mean mortality of rice weevil at intervals of 24, 48 and 72 hours after treatment are mentioned in below table. The results revealed that T₁ neem oil was found effective and have highest mortality of 83.33% over the rest of the treatments. The minimum mortality was observed in T₃ lavender oil with 31.10 % mortality. Rest of the treatments were found intermediate as T₄ karanj oil (77.77%) followed by T₂ clove oil (67.77%)

followed by T₅ eucalyptus oil (57.77%) followed by T₆ lemon grass oil (54.44%) and T₇ tea tree oil (51.10%). whereas no mortality was observed in T₀ untreated control.

Table 1: Mortality of rice weevil as influenced by different essential oils in stored wheat.

treatments	dosage	mortality y%			
		24HAT	48HAT	72HAT T	Overallmean
Neem oil	5ml/kg	76.66	80	93.33	83.33
Clove oil	5ml/kg	63.33	66.66	73.33	67.77
Lavenderoil	4ml/kg	26.66	30	36.66	31.1
Karanjoil	4ml/kg	73.33	76.66	83.33	77.77
Eucalyptusoil	5ml/kg	53.33	56.66	63.33	57.77
Lemongrassoil	5ml/kg	50	53.33	60	54.44
Teatreeoil	5ml/kg	46.66	50	56.66	51.1
Untreatedcontrol		0	0	0	0
S.E.(d)		2.041	1.8	1.66	1.8
C.D		10.6	9.348	8.655	9.349
C.V		12.561	10.453	8.571	10.207

weight loss of treated grain under free choicetest

The data pertaining to overall mean percent weight loss of rice weevil at intervals of 30, 60 and 90 days after treatment are mentioned in below table. The results revealed that T₁ neem oil (7.32%) followed by T₄ karanj oil (11.99%). least weight loss was recorded in T₃ lavender oil (41.06%). whereas rest of the treatments were found intermediate as T₂ cloveoil (16.79%) followed by T₅ eucalyptus oil (22.77%) followed by T₆ lemon grass oil (26.73%) and T₇ tea tree oil (31.14%). Whereas in T₀ untreated control it was observed that 47.32% of weight loss was recorded.

Table 2: weight loss of treated seed grains under free choice test

treatments	dosage	%weightloss			
		30DAT	60DAT	90DAT	Overallmean

Neem oil	5ml/kg	4.21	7.96	9.8	7.32
Clove oil	5ml/kg	12.41	17.85	20.13	16.79
Lavenderoil	4ml/kg	36.05	42.4	44.75	41.06
Karanjoil	4ml/kg	7.66	13.36	15	11.99
Eucalyptusoil	5ml/kg	18.60	24.06	25.66	22.77
Lemongrassoil	5ml/kg	22.28	28.13	29.8	26.73
Teatreeoil	5ml/kg	27.13	31.91	34.38	31.14
Untreatedcontrol		41.36	48.46	52.15	47.32
S.E.(d)		0.268	0.221	0.23	1.353
C.D		1.393	1.15	1.197	7.028
C.V		3.794	2.481	2.388	15.831

Effect on germination percentage of wheat grains

Results revealed that highest germination percentage was recorded in T₁ neem oil (93.33%) followed by T₄ karanj oil (86.66%). Least germination was recorded in T₃ lavender oil (46.66%), Remaining treatments found intermediate as T₂ clove oil (73.33%) followed by T₅ eucalyptus oil (66.66%) followed by T₆ lemon grass oil (63.33%) and T₇ tea tree oil (53.33%). whereas T₀ untreated control has 23.33% was observed.

Table 3: Effect on germination percent on wheat grains

Treatments	dosage	germination%
Neem oil	5ml/kg	93.33
Clove oil	5ml/kg	73.33
Lavender oil	4ml/kg	46.66
Karanj oil	4ml/kg	86.66
Eucalyptus oil	5ml/kg	66.66
Lemongrass oil	5ml/kg	63.33
Tea tree oil	5ml/	53.33

	kg	
Untreated control		23.33
S.E.(d)		1.92
C.D		9.99
C.V		9.11

4. DISCUSSION

Efficacy of different essential oils on adult mortality of rice weevil, Sitophilus oryzae Linn. on stored wheat.

All the treatments were found to be significantly superior to control in enhancing adult mortality. From the results maximum mortality was recorded in T₁ neem oil and results are similar to **poudelet al. (2023)**. among all the treatments the next best treatment is T₄ karanj oil and the results are similar to **gayatreeet al. (2022)**. the next best treatment T₂ clove and results are supported by **bhattarajet al. (2023)** followed by T₅ eucalyptus oil as supported by **yang et al. (2020)** followed by T₆ lemongrass oil as supported by **poudelet al. (2023)** followed by T₇ tea tree oil as supported by **yang et al. (2020)**. lavender oil showed least effect and results are similar to **germinaraet al. (2017)**.

Efficacy of different essential oils on weight loss of treated grain under free choice test.

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Conclusion

In the research, it was the percent mortality was highest in treated grains with treatment T₁ neem oil followed by T₄ karanj oil. The least mortality was observed in T₃ lavender oil. Efficacy of different essential oils on weight loss of treated grain under free choice test the percent weight loss was highest in treated grains with treatment T₁ neem oil followed by T₄ karanj oil. The least mortality was observed in T₃ lavender oil. Effect on germination percentage of wheat grains

The germination percentage was highest in treated grains with treatment T₁ neem oil followed by T₄ karanj oil. The least mortality was observed in T₃ lavender oil.

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DEFINITIONS, ACRONYMS, ABBREVIATIONS

Here is the Definitions section. This is an optional section.

Term: Definition for the term