

Original Research Article

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**Repellency of Neem Oil against Red Rust Flour Beetle, *Tribolium castaneum* Herbst, (Coleoptera:Tenebrionidae) and Lesser Grain Borer, *Rhyzopertha dominica* (Fabricius) (Coleoptera: Bostrichidae)**

**Rashmi Joshi\*, Neeta Gaur, Ashish Devrani and Mritunjoy Barman**

Department of Entomology, College of Agriculture, GBPUA&T,  
Pantnagar, Uttarakhand, India

\*Corresponding author

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A study was conducted to evaluate the repellent activity of Neem oil (*Azadirachta indica*) against Red rust flour beetle (*Tribolium castaneum*) and lesser grain borer (*Rhyzopertha dominica*). The ethanolic concentrations of oil at 1%, 2% and 3% were tested against two stored product beetles and the readings were taken for 2 hours at half an hour interval. It was found that repellent activity was proportional to the concentration and higher concentration has stronger effect. Moreover the repellent effect was better on *T. castaneum* as compared to *R. dominica*. *T. castaneum* showed 88.31, 95.08 and 97.81% repellent activity at 1, 2 and 3% concentration of essential oil respectively while *R. dominica* showed 80.49, 85.10 and 87.51% repellent activity at 1, 2 and 3% concentrations of test oil respectively. Thus, it indicates the effect of plant originated essential oils as repellent against insect pests of stored grains.

**Introduction**

*T. castaneum* is one of the key pest of stored products and stored grains throughout the world (Sinha and Walters, 1985) and the Lesser grain borer, *R. dominica*, is one of the most important internal feeders of stored grains (Chanbang *et al.*, 2007). *R. dominica*, a primary coloniser of stored products is capable of infesting stored grain kernels easily, while grain kernels, flour or grains already infested by primary coloniser (Vayias *et al.*, 2010). Fumigation plays a major role in insect pests' elimination in stored products. Currently

phosphine and methyl bromide are two common fumigants used for stored product protection world over. Insect resistance to phosphine is a global issue now and control failures have been reported in field situations in some countries (Taylor, 1989; Collins *et al.*, 2002). Methyl bromide, a broad spectrum fumigant, has been declared as ozone depleting substance and therefore, is being phased out completely.

With the high cost of synthetic products and the current lack of effective pesticides for stored-product protection, evaluation of local

plant as sources of protectants is very desirable to help farmers use locally available and environment friendly products to limit post-harvest losses of their produce (Bouda *et al.*, 2001). It is already well established that the seeds of neem contain compounds that can control over 100 species of insects, mites and nematodes on field and vegetable crops (Ahmed and Grainage, 1985). Some of these compounds have been found to be effective against many species of stored product Coleoptera (Grainage *et al.*, 1985). The most important compound is a triterpenoid, Azadirachtin, although other compounds such as nimbin, nimbidin and salanin are also found. These compounds possess insecticidal, ovicidal, antifeedant and growth inhibiting effects against many spp. of insect pests (Stoll, 1988; Vietmeyer, 1992). Many neem based products are approved for use as organic insecticides and marketed. The present study was therefore undertaken to evaluate the repellent activity of neem oil against *R. dominica* and *T. castaneum*.

## Materials and Methods

### Essential oil

Oils selected for the study were extracted from the locally available plants by steam distillation at Medicinal and Aromatic Plants Research and Development Centre, Pantnagar.

### Method for repellency test

Repellency test was conducted following the method of Talukdar and Howse (1993). Petri dishes 9cm in diameter were used to confine insects during experiment. The essential oils were diluted in ethanol to different concentrations (1.0%, 2.0% and 3.0%) and absolute ethanol was used as control. Filter paper with a 9 cm diameter was cut in half and 1ml of each concentration was applied separately to one half of the filter paper as

uniformly as possible with a micropipette. Another half (control) was treated with 1ml of absolute ethanol. Both the treated half and the control half were then air dried to evaporate the solvent completely. A full disc was carefully remade by attaching the treated half to the control half with tape. Care was taken so that the attachment did not prevent free movement of insects from the one half to another, but the distance between the filter paper halves remained sufficient to prevent diffusion of test sample from one half to another. Each remade filter paper was placed in a petri dish. Twenty insects were released in the centre of each filter paper disc and cover was placed over the petri dish. Three replicants were used and experiment was repeated twice. Counts of the insects present on each half were made after every half an hour and up to fifth interval. Percent repellency of each oil was calculated by using the following formula from Abbott (1925):

$$\text{Percent Repellency} = \frac{A - B}{A} \times 100$$

Here,

A = Average number of insects present on untreated portion

B = Average Number of insects present on treated portion

The percentages of repellency were then categorized according to the following scale by the method of Roy *et al.*, (2005):

Class	Repellency Rate (%)
<b>0</b>	>0.01-0.10
<b>I</b>	0.10 to 20.00
<b>II</b>	20.10 to 40.00
<b>III</b>	40.10 to 60.00
<b>IV</b>	60.10 to 80.00
<b>V</b>	80.10 to 100.00

## Results and Discussion

### Repellent activity of Neem oil against *R. dominica*

Among the tested concentrations highest

repellency was observed in 3% concentration of essential oil i.e. 87.51 (Table 1), *R. dominica* at 1% and 2% showed less repellent activity as compared to 3% i.e. 80.66 and 90.06, respectively.

**Table.1** Repellency of Neem oil against *R. dominica*

Concentration	Percent repellency of Neem oil against <i>R. dominica</i>				Mean repellency	Repellency class
	30min	60min	90min	120min		
1%	66.67	82.08	84.53	88.66	80.49	V
2%	77.45	88.66	81.48	92.79	85.10	V
3%	86.70	88.66	74.67	100.00	87.51	V

**Table.2** Repellency of Neem oil against *T. castaneum*

Concentration	Percent repellency of Neem oil against <i>T. castaneum</i>				Mean repellency	Repellency class
	30min	60min	90min	120min		
1%	84.03	86.48	92.36	90.61	88.37	V
2%	92.79	94.54	96.49	96.49	95.08	V
3%	94.74	96.49	100.00	100.00	97.81	V

### Repellent activity of neem oil against *T. castaneum*

All the tested concentrations against *T. castaneum* showed good results (Table 2) and 88.37, 95.08 and 97.81 percent repellency was observed at 1%, 2% and 3% respectively.

The results of the above two studies indicate that the plant essential oils are as effective as chemical grain protectants for protection of grains.

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