Pesticidal effect of naphthalene and different botanicals against anguimous grain moth (*Sitotroga cerealella*)

T. K. Roy¹*, A. Sannat², S. Akter¹, S. M. M. S. Tonmoy³, T. Chakrobarty⁴, M. R. Hasan⁵ and M. N. Bari¹

¹Entomology Division, Bangladesh Rice Research Institute, BRRI
²Plant Pathology Division, Bangabandhu Sheikh Mujibur Rahman Agricultural University, BSMRAU
³Farm Management Division, Bangladesh Rice Research Institute, BRRI
⁴Rice Farming System, Bangladesh Rice Research Institute, BRRI
⁵Plant Breeding Division, Bangladesh Rice Research Institute, BRRI

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**ABSTRACT**

Anguimous grain moth is a strong seed destroyer causing economic losses to the marginal farmers. Treatments of seeds with different chemicals as remediation of this problem risks environment and creates health hazards. Pesticidal effects of some botanicals and naphthalene on anguimous grain moth inhabiting grains have been tested in this experiment. A total of eight treatments were performed against Anguimous grain moth with one control (T₅). The treatments contained: T₅=5 whole dried neem leaf, T₆=0.25 ml neem oil, T₇=0.25 g ginger powder, T₈=0.25 g neem leaf powder, T₉=0.25 g mixture of neem leaf powder and ginger powder, T₁₀=0.25 g naphthalene, T₁₁=5 whole tulsi leaf and T₁₂=0.25 g neem seed powder. Results indicated that T₂ (100%) showed better performance in case of insect mortality and no F₁ emergence followed by T₆ (53.33%), T₇ (43.66%) and T₉ (40%). Moderate performance was found T₄ and T₅ in case of insect mortality and number of F₁ emergence. But in case of seed germination T₈ (92.00%) showed better performance followed by T₆ (88.00%), T₇ (87.00%), T₉ (85.33%) and T₁₀ (80.33%). So, naphthalene, neem oil, neem seed powder and neem leaf powder considered as the best treatment among nine treatments for the management of the most destructive Anguimous grain moth.

**Keywords:** Anguimous grain moth (*Sitotroga cerealella*); Neem oil; Naphthalene; Neem leaf powder; Neem seed powder; Storage pest.

**Introduction**

Rice (*Oryza sativa L.*, Family: Poaceae) is one of the most important cultivated food crops in the world as well as in Bangladesh. In the rice cultivation, insect infestation which may be field or storage borne affects production. During cultivation of rice, insects are always present in the field as well as presence in storage condition. Rice needs a long storage period after harvesting until further use for consumption, seed purpose etc. Under storage, rice is infested by Rice weevil (*Sitophilus oryzae*), Anguimous grain moth (*Sitotroga cerealella*), saw-toothed grain beetle (*Oryzaephilus surinamensis*), Red flour Beetle (*Triobium castaneum*) and Indian Meal Moth (*Plodiainter punctella*) etc and cause extensive economic loss in the production. Anguimous grain moth (*Sitotroga cerealella*) is a prevalent insect species and often placed at the top of the list as major insect pest of stored rice. Tadesse (2020) reported that in order to ensure that a country has enough food, postharvest storage for proper grain is more crucial than intense and widespread farming. But there are many reasons for rice storage losses. Qu et al. (2021) demonstrated that lack of knowledge, inappropriate farming techniques, poor infrastructure and improper harvest management procedures were major causes of rice harvest losses. Reducing postharvest losses of food crops is essential to enhancing agricultural productivity in a sustainable manner (Stathers et al. 2020).
So, management of storage pest is important for reducing postharvest losses. Since 1950s, synthetic insecticides were used to manage storage pests of agricultural crops. However, synthetic chemicals for pest control effects human, wild and aquatic life and the environment at large (Köhler and Triebskorn, 2013; Muñoz-Quezada et al. 2013; Baltazar et al. 2014; Yuan et al. 2014; Meyer-Baron et al. 2015; Guyton et al. 2015). Besides, the use of adulterated and expired ineffective pesticides produces rapid evolution of pesticide resistance pathogens in the ecosystem (Stevenson, 2014). Therefore, alternate methods need for the management of rice storage pest which is non-toxic, environment friendly and also free from human health hazard is an urgent research issue. In Bangladesh, poor and marginal farmers store small quantities of rice for consumption and for use as seed and they cannot practice expensive control measures for storage pest. Botanicals containing bio-pesticidal properties in their bioactive components play vital role for the management of rice storage. Some plants are known to contain bioactive metabolites, which show anti-feedant, repellent and toxic effects on a wide range of insect pests (Stevenson, 2014). Examples of these mostly used important bioactive plants are catnip, pale persicaria, holy basil, artemisia, borage, dahlia, ginger, hyssop, chrysanthemum, lime, black pepper, clove, mahogany, neem and ginger etc. Plant extracts in powder or essential oil form from different bioactive plants are known to be effective repellents against different economic storage pests of grains, even for stored cereals (Khan and Gumbs, 2003). Anguimous grain moth cause economic loss, nutritional damage and reduce germination percentage on rice by breeding on grain and feeding of grain. Therefore our present study was undertaken to assess the effectiveness of neem, tulsi and ginger and naphthalene for the management of Anguimous grain moth (Sitotroga cerealella) of rice.

Materials and methods

The present study was conducted at Bangladesh Rice Research Institute (BRRI), Regional Station Rangpur laboratory during the period from June to October 2021. The experiment was carried out following complete randomized design (CRD). A total of eight treatments were performed against one control (T1) with three replications. The treatments were:

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Control (Untreated)</td>
</tr>
<tr>
<td>T2</td>
<td>Whole neem leaves, 5 in number</td>
</tr>
<tr>
<td>T3</td>
<td>0.25 ml neem oil</td>
</tr>
<tr>
<td>T4</td>
<td>0.25 g ginger powder</td>
</tr>
<tr>
<td>T5</td>
<td>0.25 g neem leaf powder</td>
</tr>
<tr>
<td>T6</td>
<td>0.25 g mixture of neem leaf powder</td>
</tr>
<tr>
<td>T7</td>
<td>0.25 g naphthalene</td>
</tr>
<tr>
<td>T8</td>
<td>Whole tulsi leaf, 5 in number</td>
</tr>
<tr>
<td>T9</td>
<td>0.25 g neem seed powder</td>
</tr>
</tbody>
</table>

ginger bulb (Zingiber officinale), fresh neem leaves (Azadirachta indica), ripe neem kernel and fresh tulsi (Ocimum tenuiflorum) leaf were collected and dried in the oven at 50°C to constant weight. Part of the ginger bulb, fresh dried neem leaf and ripe neem kernel were powderized by electric grinder machine then sieved (mesh number 25) to obtain fine and uniform material and the powderized materials were stored in airtight polythene bag until further treatment. Equal amount of neem leaf powder and ginger powder was mixed together to make mixture of neem leaf and ginger powder. Neem oil (pressed organic neem oil) and naphthalene (99% purity) were collected from the market. At the beginning of the experiment Sitotroga cerealella population was collected from the BRRI regional station Rangpur store and reared on rice (BRRI dhan87) in laboratory. The female and male moths were distinguished by visual observation of their abdominal tergites and the size of the body with the help of an electron microscope (Olympus Model SZ2-STU2, Tokyo, Japan and scanning objective lens was zoomed at 4×). Fresh and de-infected BRRI dhan87 were collected from BRRI Regional Station seed store house and fully sun-dried for 3 days. Then seeds were taken in 27 Petri dishes @ 25 g/Petri dishes. A weighing balance (KERN ABJ220-4NM, Balingen, Germany) was used to measure the powder extracts. After the application of treatments, 5 pairs of fresh adults were introduced in each replication and they were kept for 5 days for oviposition at 65% RH and 30°C. Number of dead insect were counted at 24 h after treatment, 48 h after treatment and 72 h after treatment and dead insect were removed. The Petri dishes were kept in regular observation for F1 adult emergence. Adults were removed and data collection was continued until no F1 moth was found. Insect mortality data were calculated by using the square root transformation formula. All data were subjected to statistical
Insect mortality (%) = \( \frac{\text{Number of dead insect at treated treatment}}{\text{Total number of insect treated}} \times 100 \)

was calculated by using the following formula.

**Germination percentage**

One hundred rice seeds were taken randomly in a Petri dish from each replication of each treatment. Rice seeds were taken separately for each replication. The seeds were placed on moist filter papers in the Petri dish and maintained at room temperature. The number of germinated seed were counted and recorded after completion of germination. The percentage germination was computed using the following formula.

Germination (%) = \( \frac{\text{Number of germinated seeds}}{\text{Total number of tested seeds}} \times 100 \)

### Results and discussion

**Number of dead insects**

The number of cumulative dead insects at 24 h after treatment and 48 h after treatment showed statistically significant results. Data presented in Table 1 showed that after 24 h of treatment the highest number of dead insects was recorded in T7 (2.97) treatment. The second most dead insect was observed in T8 (1.95) treatment. Statistically similar results were found in T9 (1.58) and T8 (1.58) treatment and T3 (1.34) and T5 (1.46) treatments. The lowest dead insect was found in T1 (0.71) treatment. After 48 h of treatment the highest number of dead insect was found in T9 (1.46) and T8 (1.46) treatment followed by T2 (1.34), T3 (1.34) and T5 (1.34) treatment and which were statistically similar. The lowest number of dead insects was found in T1 treatment. After 72 h of treatment, there were statistically no significant difference among the treatments but numerically different. Numerically highest dead insect were found in T7, T3, T5, and T8 treatment and lowest were found in T1 and T4 treatment. From the result, it might be concluded that highest number of dead insect was found at T1, i.e., naphthalene followed by T3 (neem oil), T9 (neem seed powder) and T8 (mixture of neem leaf and ginger powder). Highest dead insects were found at naphthalene due to its solid form that turns into toxic gas and due to the exposure of toxic gas it caused huge inhalation and its exposure did cause dermal contact, hemolytic anemia and neurological damage as well. Azadirachtin bioactive ingredients present in neem plant that are responsible to kill insect. Facknath (2006) reported that neem (\textit{Azadirachta indica} A. Juss.) can

### Table I. Effect of botanicals and chemicals against anguimous grain moth after different duration of treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No of dead insects after different duration of treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 hours</td>
</tr>
<tr>
<td>T1 (Control)</td>
<td>0.71 f</td>
</tr>
<tr>
<td>T2 (5 whole dried neem leaf)</td>
<td>1.34 cd</td>
</tr>
<tr>
<td>T3 (0.25 ml neem oil)</td>
<td>1.95 b</td>
</tr>
<tr>
<td>T4 (0.25 g ginger powder)</td>
<td>1.05 e</td>
</tr>
<tr>
<td>T5 (0.25 g neem leaf powder)</td>
<td>1.46 cd</td>
</tr>
<tr>
<td>T6 (0.25 g mixture of neem leaf &amp; ginger powder)</td>
<td>1.58 c</td>
</tr>
<tr>
<td>T7 (0.25 g naphthalene)</td>
<td>2.97 a</td>
</tr>
<tr>
<td>T8 (5 whole dried tulsi leaf)</td>
<td>1.22 de</td>
</tr>
<tr>
<td>T9 (0.25 g neem seed powder)</td>
<td>1.58 c</td>
</tr>
<tr>
<td>Level of significance</td>
<td>***</td>
</tr>
<tr>
<td>LSD</td>
<td>0.2583719</td>
</tr>
<tr>
<td>CV%</td>
<td>9.768086</td>
</tr>
</tbody>
</table>

* *, **, *** indicate significant at 5%, 1% and 0.1% level of probability, respectively and Ns indicates not significant. Values followed by the different letter(s) are significantly different from each other.
reduce insect populations infesting stored products through its toxic effects on the pests by disrupting the insect growth.

**Percent insect mortality of anguimous grain moth**

Percent insect mortality showed statistically significant variation for commonly used different botanicals and chemical used as experimental treatments for the management of anguimous grain moth in stored rice grain (Figure 1). The highest (%) insect mortality was demonstrated in T\(_3\) (100%) and which was statistically different from others. The second highest (%) insect mortality was observed in T\(_3\) (53.33%) treatments which was also different from other treatments followed by T\(_5\) (43.66%) and T\(_6\) (36.33%) treatment and they were statistically significant. No insect mortality was recorded in T\(_1\) (control) treatment. From the figure I it might be concluded that naphthalene (T\(_9\)) was found as 100% mortality in case of insect mortality due to its emission of toxic gas and pungent smell. Naphthalene acts by the activation of cytochrome P450 enzyme in neuronal channel which triggers acute toxicity of neural cells (Li *et al.* 2011). Lin *et al.* (2015) reported that naphthalene-induced respiratory toxicity is related to lipid peroxidation, disruptions of membrane components, and imbalanced energy supply. The study of Obeng-Ofori *et al.* (1998) have shown that, the contact toxicity of naphthalene (concentrations between 100 μg and 100 mg) on stored product insect pest with mortalities above 70% in maize weevil, groundnut weevil, red flour beetle, and large grain borers. On the other hand, neem as a botanical pesticide has many excellent attributes including its broad-spectrum in insect growth regulatory effects, systemic action in some plants, minimal effects on natural enemies and pollinators, rapid degradation in the environment, and no toxicity to vertebrates. It is also reported that the lethality of neem oil is confirmed depending on the concentration applied and can be compared to neurotoxic insecticides and growth inhibitors, as a potent natural insecticide (Ismann, 2006; Mourão, 2016). Jibrin and Mohammed (2020) reported that active ingredients in neem tree that make the leaves bitter and azadirachtin bioactive ingredients in neem are useful for insect repellent and mortality role.
Number of $F_1$ emergence

Number of $F_1$ emergence showed statistically significant results for the application of experimental treatment for the management of Anguimous grain moth in storage rice grain (Figure 2). Highest number of $F_1$ emerged in T$_1$(73.00%) untreated control treatment due to highest $F_1$ emergence. Neem oil is a feeding inhibitor, delaying development and growth, reducing fecundity and fertility, changing behavior and causing anomalies in eggs, larvae and adults of insects or mites reported by Masood et al. (2006).

**Germination of seed**

Germination (%) of treated seed showed statistically significant variation for the application of experimental treatments of anguimous grain moth management in stored rice grain (Table II). The highest germination was found in T$_5$ (92.00%) and which was statistically differ from other treatments. T$_4$ (88.00%), T$_9$ (87.00%) and T$_6$ (85.33%) treatment showed statistically similar result for seed germination. The lowest seed germination was found in T$_1$(73.00%) untreated control treatment due to highest $F_1$ emergence, lowest insect mortality and damage by breed-
The present study was conducted at Bangladesh Rice Research Institute (BRRI), regional station Rangpur for the management of Anguimous grain moth (Sitotroga cerealella). Effective repellents against different economic storage insects need for the management of rice storage pest which is an urgent research issue. In Bangladesh, poor and marginal farmers store small quantities of rice in their houses, with poor storage conditions. Human health hazard is an urgent research issue. In order to control the pest density, different chemicals such as cypermethrin, dicofol, and malathion are used. However, these chemicals have some disadvantages, for example, poor and marginal farmers cannot afford to purchase these chemicals, pollution, and resistance development. Besides, the use of pesticides is regulated world, and uncertainty for the application of experimental treatments varies for the regulation of pesticides. The objective of the study was to evaluate the efficacy of different botanicals and chemicals against Anguimous grain moth in storage rice (Sitotroga cerealella)

Table II. Effect of botanicals and chemicals against Anguimous grain moth on germination (%) of seed

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Seed germination (%)</th>
<th>% Germination seed over control</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (Control)</td>
<td>73.00 e</td>
<td>--</td>
</tr>
<tr>
<td>T2 (5 whole dried neem leaf)</td>
<td>78.00 cd</td>
<td>6.85</td>
</tr>
<tr>
<td>T3 (0.25 ml neem oil)</td>
<td>80.33 c</td>
<td>10.05</td>
</tr>
<tr>
<td>T4 (0.25 g ginger powder)</td>
<td>78.00 cd</td>
<td>6.85</td>
</tr>
<tr>
<td>T5 (0.25 g neem leaf powder)</td>
<td>92.00 a</td>
<td>26.03</td>
</tr>
<tr>
<td>T6 (0.25 g mixture of neem leaf &amp; ginger powder)</td>
<td>85.33 b</td>
<td>16.90</td>
</tr>
<tr>
<td>T7 (0.25 g naphthalene)</td>
<td>88.00 b</td>
<td>20.55</td>
</tr>
<tr>
<td>T8 (5 whole dried tulsi leaf)</td>
<td>77.00 d</td>
<td>5.48</td>
</tr>
<tr>
<td>T9 (0.25 g neem seed powder)</td>
<td>87.00 b</td>
<td>19.18</td>
</tr>
<tr>
<td>Level of significance</td>
<td>***</td>
<td>--</td>
</tr>
<tr>
<td>LSD</td>
<td>2.839869</td>
<td>--</td>
</tr>
<tr>
<td>CV%</td>
<td>2.017103</td>
<td>--</td>
</tr>
</tbody>
</table>

*, **, *** indicate significant at 5%, 1% and 0.1% level of probability, respectively. Values followed by the different letter(s) are significantly different from each other.

Discussion

Among the eight treatments against one control, highest insect mortality was found highest in neem leaf powder (T9) followed by naphthalene (T7), neem seed powder (T3), T8 (mixture of neem leaf powder and ginger powder) and T1 (neem oil). Hussain et al. (2018) reported that, dried neem leaf powder showed the highest percent of seed germination over control. From our study, the trend of efficiency among different botanicals and chemical in terms of percent seed germination was T9 (neem leaf powder) > T7 (naphthalene) > T3 (neem seed powder) > T8 (mixture of neem leaf powder and ginger powder) > T1 (neem oil) > T2 (white dried neem leaf) > T4 (ginger powder) > T6 (white dried tulsi leaf) > T1 (control).

Conclusion

Findings of the study concluded that among the eight treatments against one control, highest insect mortality was found in T5 (0.25 g naphthalene) treatment followed by T1 (0.25 ml neem oil) in case of insect mortality. No F1 emergence was found in T5 (0.25 g naphthalene) and lowest F1 emergence was observed in T1 (0.25 ml neem oil) followed by T4 (0.25 g neem seed powder). The highest seed germination was showed in T9 (0.25 g neem leaf powder) followed by T5 (0.25 g naphthalene) and T6 (0.25 g neem seed powder) in case of percent seed germination.

Acknowledgement

Authors are greatly thankful to principle scientific officer and head, Bangladesh Rice Research Institute (BRRI), regional station Rangpur for the fund and immense assistance for conducting the experiment.

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There are several studies that have assessed the effectiveness of neem, tulsi, and ginger and naphthalene as repellents against different economic storage pests. Stevenson (2014) used various botanicals, including holy basil, artemisia, borage, dahlia, ginger, and hyssop, to assess their repellent properties against these pests. Examples of these mostly used in developing countries like Bangladesh, poor and marginal farmers store small quantities of rice to manage storage pests.

Also, the use of naphthalene (99% purity) has been collected from the market. After the application of treatments, 5 pairs of fresh BRRI dhan87 were collected from Tokyo, Japan, and scanning objectives were zoomed at 4×. The effectiveness of the treatments was assessed by counting the number of germinated seeds in each replication of each treatment. Rice seeds were collected from the BRRI regional station Rangpur store and reared on rice (BRRI dhan87) in the laboratory. The female was collected from the BRRI regional station Rangpur for the fund and immense assistance for their abdominal tergites and the size of the body with the help of an electron microscope (Olympus Model SZ2-STU2).

Results and discussion

After the application of treatments, the highest number of dead insects were found in the control (T 7) i.e., naphthalene followed by T 3 (neem leaf). From the result, it was found that the mortality data were calculated by using the square root transformation. The number of germinated seeds was counted on moist filter papers in the Petri dish and maintained at room temperature. The number of germinated seeds was found to be statistically significant. The germination percentage of the treated seeds was found to be numerically different. The numerically highest dead insect mortality was observed in T 3 (53.33%) followed by T 7 (50%). From the results, it might be concluded that the use of naphthalene and neem as a repellent is important for reducing the pest population and due to the exposure of toxic gas it caused huge mortality.

Acknowledgments


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Tadesse M (2020), Post-harvest loss of stored grain, its causes and reduction strategies, Food Science and Quality Management. 96: 26-35. DOI: 10.7176/FSQM/96-04
Therefore our present study was undertaken to assess the efficacy of various botanicals for Sitotroga cerealella (Oliv.) and Sitophilus oryzae (L.) infestation, to explore their potentiality for stored grain pests management in stored rice grain. To achieve this objective, rice seeds were used to manage storage pests of agricultural crops. So, management of storage pest is important for reducing losses in the rice harvest process: a review,

Acknowledgement

https://doi.org/10.1080/096708798228112
However, synthetic chemicals for pest control effects were used to manage storage pests of agricultural crops. Since 1950s, synthetic insecticides were invented and have been used to manage storage pests. Management of storage pests is important for reducing postharvest losses. In Bangladesh, poor and marginal farmers store small quantities of rice for consumption and for use as seed and they may adulterate and use ineffective pesticides produced by the pesticide manufacturing companies. Therefore, management of rice storage pests is important for ensuring the quality of rice offered for sale. Therefore, the present study was conducted to test the effectiveness of commonly used botanicals and chemicals in controlling the storage pest in Bangladesh. Neem is non-toxic, environment friendly and also free from pollution. It has many excellent attributes including its toxicity to vertebrates. It is also reported that the lethality of synthetic insecticides is non-selective, pollinators, rapid degradation in the environment, and no residue. Neem leaves contain a compound called neemazatin that is insecticidal and anti-ovipositional and causing anomalies in eggs, larvae and adults of insects or mites reported by Masood et al. (2023), Toxicity of seed oils of neem (Azadirachta indica L.) leaf were collected and dried in the electric grinder machine then sieved (mesh number 25) to obtain a fine powder. Neem oil (pressed organic neem oil) and naphtha mixed together to make mixture of neem leaf and ginger powder. Neem oil is confirmed depending on the concentration to reduce insect populations infesting stored products (Facknath S 2006), Combination of neem and physical pesticide has many excellent attributes including its repellency effect of modern agriculture and an increasingly need for the management of rice storage pest which reduce insect populations infesting stored products (Jibrin MM and Mohammed AD 2020), Repellency Effect of Prepared Neem Tree Leaves Smoke against Mosquito, Author are greatly thankful to principle scientific officer and Baltazar MT, Dinis-Oliveira RJ, de Lourdes Bastos M, F, Kluetzman K and Ding X (2011), Generation and Blighia sapida}
laboratory during the period from June to October 2021. Research Institute (BRRI), Regional Station Rangpur

Sitotroga effectiveness of neem, tulsi and ginger and naphthalene pests of grains, even for stored cereals (Khan and oil form from different bioactive plants are known to be chrysanthemum, lime, black pepper, clove, mahogany, holy basil, artemisia, borage, dahlia, ginger, hyssop, contain bioactive metabolites, which show anti-feedant, management of rice storage. Some plants are known to insect. Botanicals containing bio-pesticidal properties in ecosystem (Stevenson, 2014). Therefore, alternate meth-

2014; Meyer-Bar-

So, management of storage pest is important for reducing population was recorded in T 7 (2.97) treatment. The second most dead after 24 h of treatment the highest number of dead insects was collected from the BRRI regional station Rangpur store ( ), ripe neem kernel and fresh tulsi powder. Neem oil (pressed organic neem oil) and naphtha-

Percent insect mortality showed statistically significant variation for commonly used different botanicals and chemi-
al. (2004) reported that azadirachtin is the main azadirachtin that was higher toxic by feeding and thus emergence. Neem oil contain bioactive ingredient

Bruce (2014) reported that azadirachtin is the main disease and other neurodegenerative diseases-AMECH-

Germination (%) of treated seed showed statistically significant t234-245.

F1 emergence was found in T 7 (0.25 g naphthalene) and produced toxicity in the lung and nasal olfactory mucosa,

F1 emergence was found in T 7 (0.25 g naphthalene) treatment followed treated seed was found highest in neem oil) followed by T 9 (0.25 g neem leaf and seed powder) > T 7 (naphthalene) > T 9 (neem seed oil) followed by T 9 (0.25 g neem seed powder). The seed germination over control was found highest in neem oil)

Oncology

16-27. https:// -

Qu X, Daizo K, Laping W and Mitsuyoshi A (2021), The can be found in fruits and leaves. Alexander et al.

Köhler HR and Triebskorn R (2013), Wildlife ecotoxicology

Facknath S (2006), Combination of neem and physical

Alexander MM, Mohammed MA, Emmanuel O and Ali S

Baltazar MT, Dinis-Oliveira RJ, de Lourdes Bastos M,

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Asian Journal of Research in Zoology

Discovery e69d1255

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Sustain. Nat

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Cerealella Sitotroga loss, nutritional damage and reduce germination percentage of rice. Therefore, alternate methods.

2013; Baltazar et al. Rapid evolution of pesticide resistance pathogens in the ecosystem (Stevenson, 2014). Therefore, alternate methods.

So, management of storage pest is important for reducing pest. Besides, the use of neem tree that make the leaves bitter might be concluded that highest number of dead insect were found in T 1 and T 4 treatment. From the result, it was collected from the BRRI regional station Rangpur store treatment and 72 h after treatment and dead insect were statistically no significant difference among the treatments but similar results were found in T 6 (1.58) and T 9 (1.58) treatments which was also different from other treatments with significant results. Data presented in Table I were stored in airtight polythene bag until further treatment. ginger bulb (Ocimum tenuiflorum Azadirachta indica) and naphthalene (99% purity) were collected from the market. At the treatment and 72 h after treatment and dead insect were statistically no significant difference among the treatments but similar results were found in T 6 (1.58) and T 9 (1.58) treatments which was also different from other treatments with significant results. Data presented in Table I.

Germination percentage was collected from each replication of each treatment. Rice seeds were stored in airtight polythene bag until further treatment. ginger bulb (Ocimum tenuiflorum Azadirachta indica) and naphthalene (99% purity) were collected from the market. At the treatment and 72 h after treatment and dead insect were statistically no significant difference among the treatments but similar results were found in T 6 (1.58) and T 9 (1.58) treatments which was also different from other treatments with significant results. Data presented in Table I.

For 3 days. Then seeds were taken in 27 Petri dishes @ 25 oven at 50oC to constant weight. Part of the ginger bulb, fresh powder. Neem oil (pressed organic neem oil) and naphthalene (solid form that turns into toxic gas emission of naphthalene and thus acted as poison for grain (Figure 2). Highest number of F 1 emerged in T 1 (0.25 g naphthalene) and management of Anguimous grain moth in storage rice grain (Figure 2). Highest number of F 1 emerged in T 1 (0.25 g naphthalene) and management of Anguimous grain moth in storage rice grain (Figure 2). Highest number of F 1 emerged in T 1 (0.25 g naphthalene) and management of Anguimous grain moth in storage rice grain (Figure 2). Highest number of F 1 emerged in T 1 (0.25 g naphthalene) and management of Anguimous grain moth in storage rice grain (Figure 2). Highest number of F 1 emerged in T 1 (0.25 g naphthalene) and management of Anguimous grain moth in storage rice grain (Figure 2). 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