

## Comparative efficacy of *Carica papaya* and *Azadirachta indica* on *Sitophilus oryzae*

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### Abstract

The rice weevil (*Sitophilus oryzae*) is a stored product pest which targets seeds of various crops, including wheat, rice, and maize. The rice weevil, *Sitophilus oryzae*, can be managed with several techniques, such as fumigants, insecticides, and natural pesticides. It has been demonstrated that extracts from plants such as *Gliciridia sepium*, *Ricinus communis*, *Calotropis gigantea*, *Lantana camara*, and *Carica papaya* are efficient against rice weevils. It has been demonstrated that plant powders such as *Ageratum conyzoides*, *Melia azedarach*, *Vitex negundo*, and *Ocimum sanctum* are efficient against rice weevils. It has been demonstrated that oils from African palm, groundnut, and coconut are beneficial against rice weevils. It has been demonstrated that oils like cumin and basil work well against rice weevils.

In the current study two plant powders, *Carica papaya* and *Azadirachta indica* were tested against *Sitophilus oryzae*. Different doses (5 gm, 10 gm, 15 gm) of both plants powder was sprayed. Maximum larval mortality (83%) was observed during 15 gm dose of papaya leaf on 28<sup>th</sup> day. While during the spray of neem leaf powder maximum larval mortality (76%) was observed during 15 gm dose on 28<sup>th</sup> day. It is amply documented from the studies that papaya leaf powder found to be more effective than neem for the control of rice weevil.

**Keywords:** *Carica papaya*, *Azadirachta indica*, *Sitophilus oryzae*, bioprotectants

### Introduction

The world's primary crop and staple grain is rice. With the largest area in the world, around 41.9 million hectares, and an annual production of 83.13 million tons, rice is the primary crop for over 50% of the world's population. In India, it is a major food crop. China is the leading country in rice production, with India in second place. Rice is classified as a kharif crop. Among the Indian states, West Bengal ranks as the top producer, followed by Uttar Pradesh, Andhra Pradesh, Bihar, and Odisha, among others. There are various pests that cause a great loss to rice. Almost all parts of the rice plant are affected by the pest but mostly the grain or seed has the severe damage. *Sitophilus oryzae* is one of the most destructive pests found in stored cereals (Rice, Barley, Maize). About 2-3 eggs are laid by females per day. The females drill hole within the grain using her strong mandibles, lays eggs into the hole and seals it with the help of ovipositor secretions. Their eggs are pear shaped, oval, shiny in appearance. The Pupa is legless, stout. the larva feeds within the green canal and it is the only growing stage for molting, increasing in size.

They are widely distributed in almost all parts of the world. They have the capacity to establish themselves where there is food, moisture, and suitable temperature available according to their requirements. Their development begins inside the seeds and they consume the endosperm of the host plant. Feeding results in heating, infested grain which is damp due to moisture added during metabolic activity of respiration performed by the insects. In absence of control, the stored grains can be destroyed even up to 100% (Ofuya and Credland, 1995). Increasing the temperature and humidity of the contaminated grains promotes the activity of *Sitophilus oryzae*, which in turn speeds up the development of secondary pests and establishes optimal conditions for

pathogens and additional infestations (Hardman, 1977; Longstaff, 1981 and Hill, 2002) [7, 8, 13]. There are various control measures which can be used to protect the grain. For the control of stored grain pests, synthetic insecticides are used in several countries; however, indiscriminate use has resulted in resistance and toxic residues in food grains. (Koul U.K. 2008) [11] Harvest of crop before maturation, drying of grains, maintenance of moisture level about 12%, plastic containers usage for the purpose of storage, proper cleaning of either storage room or sheds, all the following steps should be followed before storage. During storage of the crop, a very effective but highly labor-intensive method, i.e. sieving is used to remove adult weevils. We can also freeze the crops for many days and further provide them heat for 24 hours is also an effective method to manage the crop quality as well as crop quantity. Alternatives to pesticides, such as modified atmospheres, may be used to control stored insect pests (Kandel Pragya, et al.2021). We can also use chemicals methods for the control of rice weevil. Routine hygiene involves cleaning using malathion for the consumption of humans. The treatment involves use of phosphine which is a kind of fumigant, another one is *Beaveria bassiana*. Neem leaf powder is more effective at keeping them under control while being stored (Bakar Abu THST, et al. 2022) [3] Neem one of the most effective, beneficial natural plant and last but not the least is pyrethrins which are derived from Chrysanthemum flowers can also be used as a control method of rice weevil.

### Material and methods

This topic provides information on the specific plant materials, approach, and procedures used in the study project: –

**Rearing of insect:** An infected rice store bin provided the original supply of *S. oryzae*. Insects were mass-produced in a climatized room with alternate light ± dark cycles lasting 12 hours, at 28°C, using 95% maize seeds and 5% brewer's yeast at 65% relative humidity.



**Fig 1:** Larva of *Sitophilus oryza*

The insects were housed in glass jars with a 0.25-liter capacity, filled with 200g of pesticide-free rice. After two weeks, the muslin cloth-covered jars were emptied of the original adults through sieving. After the adult weevils began to emerge, each jar was checked every day to gather

the offspring, which were housed in age-appropriate jars. The time span under these circumstances was roughly five weeks from egg laying to adult emergence. We used adult insects that emerged two to three weeks ago.

**Treatments:** The following plants powder used in the present study to detect their effect on adult emergence and mortality of insect: -

Scientific name	Common name	Parts used
<i>Carica papaya</i>	Papaya	Leaf
<i>Azadirachta indica</i>	Neem	Leaf

- T1- *Carica papaya*
- T2- *Azadirachta indica*
- T3- Control

**Collection of plant material**

Fresh leaves of *Carica papaya* and *Azadirachta indica* were collected from the different local areas. After carefully washing with distilled water, fresh plant materials were dried on blotting paper. Every plant material that was shed was dried at room temperature, or 25°C. A grinder was used to powder the plant materials.



**Dry Papaya leaves Dry**



**Papaya leaves powder**



**Dry Neem leaves Dry**



**Neem leaf powder**

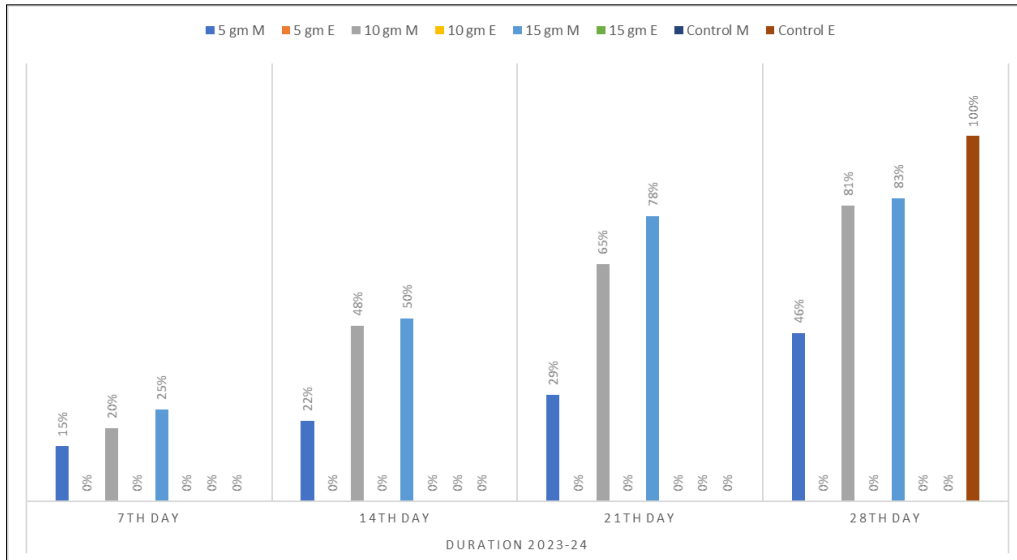
**Procedure of treatment application:** During the laboratory experiments, there were three doses applied on 50 gm rice grain consisting different stages of insect, 5gm, 10gm and

15gm dose of each biopesticide. Laboratory experiment was set up in three replications with one control for each plant protectant. Data were collected after 7 days interval.

**Experimental Findings:** After the treatment of different doses of papaya leaf powder and neem leaf powder following results has been obtained:-

**Table 1:** Effect of papaya leaf (*Carica papaya*) leaf powder on larval mortality and emergence of *Sitophilus oryzae*

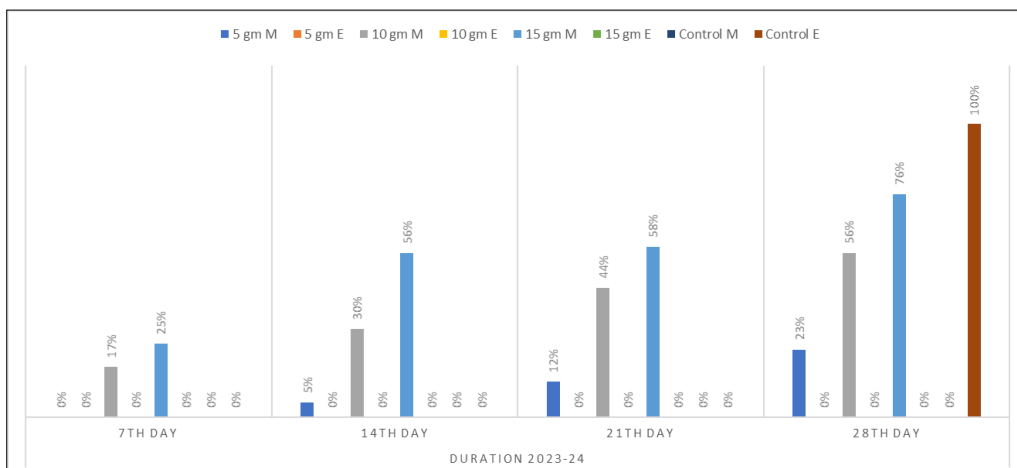
Doses		Duration 2023-24			
		7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>th</sup> day	28 <sup>th</sup> day
5 gm	M	15%	22%	29%	46%
	E	00%	00%	00%	00%
10 gm	M	20%	48%	65%	81%
	E	00%	00%	00%	00%
15 gm	M	25%	50%	78%	83%
	E	00%	00%	00%	00%
Control	M	00%	00%	00%	00%
	E	00%	00%	00%	100%



**Fig 1:** Effect of Papaya leaf powder on larval mortality and emergence of *Sitophilus oryzae*

**Table 2:** Effect of neem leaf (*Azadirachta indica*) leaf powder on larval mortality and emergence of *Sitophilus oryzae*

Doses		Duration 2023-24			
		7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>th</sup> day	28 <sup>th</sup> day
5 gm	M	00%	5%	12%	23%
	E	00%	00%	00%	00%
10 gm	M	17%	30%	44%	56%
	E	00%	00%	00%	00%
15 gm	M	25%	56%	58%	76%
	E	00%	00%	00%	00%
Control	M	00%	00%	00%	00%
	E	00%	00%	00%	100%



**Fig 2:** Effect of neem leaf powder on larval mortality and emergence of *Sitophilus oryzae*

## Result and Discussion

It is amply documented from observation that the effect of 5 gm Papaya leaf powder (*Carica papaya*) on larval mortality 15%, 22%, 29% and 46% mortality being 7 days, 14 days, 21 days and 28 days respectively.

The 10-gm dose treatment on the 7 days, 14 days, 21 days and 28 days represents mortality of 20%, 48%, 65% and 81%.

In 15 gm concentration mortality was brought on the 7 days observation was 25%, 14 days 50%, 21 days 71% and 28 days 83% mortality.

The treatment of 5 gm of neem leaf powder (*Azadirachta indica*) caused 5% mortality on 14 days, 12% on 21 days and 23% mortality on 28 days. In 10 gm dose 17% mortality noticed on 7 days, 30% on 14 days and 44%, 56% mortality on 21 days and 28 days respectively. In 15 gm dose, 25% mortality in 7 days, 56%, 58% and 76% being on 14 days, 21 days, and 28 days respectively. Comparable results were found by Akhtar Mumtaz, *et al.* (2013)<sup>[1]</sup>, Das Shimul, *et al.* (2015)<sup>[6]</sup>, Choupanin Marziyeh, *et al.* (2017). Fauzi slamet load, *et al.* (2021) stated that most effective treatment for producing repellency was 10 gm of pandanus, which had a percentage of 87.5%.

Meanwhile, the most effective treatment for producing pest mortality and lowering the likelihood of rice weight loss from *Sitophilus oryzae* was 10 gm of neem which had a percentage of 76.25% and 3.14%. According to this study, Chemicals found in neem leaves are more effective in producing death in *Sitophilus oryzae*.

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