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STUDIES ON THE GRAIN PROTECTION CAPABILITY OF A. MERMELOS LEAVES AGAINST THE INFESTATION OF RICE WEEVIL, S. ORYZAE ON TWO COMMONLY USED CULTIVARS OF STORED WHEAT GRAINS

Sheetal Bhopinder Singh Juneja

Department of Zoology, Dhote Bandhu Science College, Gondia, Maharashtra, India

**Corresponding author: sheetalbhaskar107@gmail.com*

ABSTRACT

Many plant species have the potential to be used as therapeutic and medicinal agents. *Aegle marmelos* (L.) Corr. (Rutaceae) is an example of a plant with numerous medicinal characteristics. Diarrhoea, dysentery, diabetes, cancer, leucoderma, asthama, constipation, peptic ulcer, and other ailments have all been treated with this herb in traditional medicine. The purpose of this study is to investigate the capacity of *A. mermelos* leaves to protect stored wheat from infestation by the rice weevil, *S. oryzae*. Toxicity of insect-resistant plants, percent grain damage, and percent weight loss were all measured in triplicates with four distinct concentrations. 0.3g, 0.6g, 1.2g and 1.8g/50g of wheat respectively. At lower concentration, the leaf powders do not showed any significant effect. At higher conc. i.e. 1.2g onwards, the leaf powder showed its effect with 100% mortality of *S.oryzae*, no grain damage and weight loss as compared to the control samples of wheat grain without test leaves.

Keywords: Grain protectant, Grain damage, Weight loss.

1. INTRODUCTION

Aegle marmelos (Rutaceae), also known as bilva, bel, sadaphal, and shriphal, is an aromatic tree native to India that has been utilised in the worship of Lord Shiva since ancient times and is hence known as 'Shivadurme.'[1] The tree is known as a "climate cleanser" [2] because its leaves and bark not only operate as a sink, absorbing dust and filthy and dangerous gases from the surrounding atmosphere and purifying them, but it also emits a higher percentage of oxygen when exposed to sunlight than other plants. *A. marmelos* has a plethora of applications. Since ancient times, almost every component of this tree, including the stems, barks, roots, leaves, flowers, and fruits, has been employed in numerous Ayurvedic treatments [3].

The rice weevil, *S. oryzae* is a major insect pest causing substantial loss to cereal grains during storage. Currently, the use of edible plant material as grain protectants has been emphasized. To evaluate and use the natural products, the toxicity of leaves of *A. mermelos* has been tested against *S. oryzae* and studied.

2. MATERIAL AND METHODS

2.1. Dosage preparation

The leaves were taken from the plants of closed vicinity, washed, and shade dried in an open laboratory before being ground into a fine powder with an electric blender. The powder was then sieved via pores of 1 mm2. Prior to usage, the powder was kept in a refrigerator at 4 degrees Celsius. For the treatment of Lokwan and Sharbati, dosages of plant leaf powder of 0.3g, 0.6g, 1.2g, and 1.8g were made in 100 ml clean plastic containers. Plant powders were not present in the seeds in the controls.

2.2. Applications

Plastic jars with a size of 100ml were used to evaluate the effect of plant products. The jars were cleaned well before being filled with 50g of disinfected *T. aestivum* wheat. Both Lokwan and Sharbati seeds were treated with dry leaf powder at four different concentrations per 50g of seeds: 0.3g, 0.6g, 1.2g, and 1.8g. The containers were gently shaken to ensure that the wheat seeds and treatment powders were thoroughly mixed. All treatments, including the control, were tested three times.

5 pairs of newly emerging *S. oryzae* male and female adults were collected from the culture and released in each jar. The jars were sealed with a perforated lid and placed in an incubator for a week. The jars were sealed

with a perforated cover and stored in an incubator at a temperature of 25°C (2°C) and a relative humidity of 70% (5%). Females were allowed to lay their eggs on the seeds. Adults were then taken from the jars after a week.

2.3. Estimation of weight loss

For loss estimation, 50gm of seed was placed in a container with a capacity of 100gm, 10 pairs of adults were released into the container, and the container's open top was covered with muslin cloth and secured with a rubber band. Tree times observations on seed damage and weight were taken for each treatment. Using the formula, weight reduction was achieved.

weight-loss percentage

$$\text{weight loss\%} = \frac{(UND)-(DNU) \times 100}{U\,(ND+NU)}$$

Where,

U - Weight of healthy grain
NU- number of healthy grain
D - Weight of infested grain
ND - number of infested grain

2.4. Grain Damage

The number of bored grains is counted from a random sample of grains. This should be done as soon as possible after sampling, preferably within a few days. The following formula is used to compute the proportion of damaged grains**:**

$\frac{\text{Number of bored grains}}{\text{Total no. of grains counted}} \times 100$ = percent bored grains in sample

3. RESULTS AND DISCUSSION

Pesticide residues are found in 51 percent of Indian foods, with 20 percent of them having pesticide residues exceeding the maximum residue threshold values. The desire for safe, cost-effective, and environmentally friendly solutions has risen in response to customer demand for food free of insecticide residues. Compounds with insecticidal action can be found in abundance in plants. Several researchers have already proved the usefulness of numerous plant derivatives against stored insects [1, 2, 3]. It's also well acknowledged on a global scale that some plant-derived insecticides can kill a limited number of nuisance insects while having no adverse effects on non-targeted organisms or the environment. Many plant-derived compounds have repellent and insecticidal properties against insects found in stored food goods, demonstrating their utility as a powerful control tool [4, 5]. *Azadirachta indica* A.Juss, the neem tree, have received the most attention [6]. To control pest insects, an age-old technique of combining dried neem leaves with grains is still used. Azadirachtin, a plant substance, was tested against a variety of insects and shown to be a storage feeding inhibitor and an oviposition deterrent [7, 8]. Rajesh Kumar et al. [9] found that *A. mermelos* leaf oil considerably reduced grain damage and weight loss in fumigated gramme and wheat samples infested with all insects except *T. castaneum*. Leaves of *A. mermelos* contain alkaloids, mermesinin, rutin, phenylethyl cinnamides, anhydromarmeline, and aegelinosides [10, 14], sterols, and essential oils [15].

Plant materials, with their rapid and gradual actions, proven to be particularly effective in protecting stored grains, according to our experimental investigations. When *A. mermelos* leaf powder was blended with wheat grain, mortality was 90% in the Lokwan cultivar with a dose of 1.2g /50g grains, and 100% in the Sharbati cultivar (Table 1).

Table 1: Mortality observed in Sitophilus oryzae of grain treated with A. marmelos powder

Concentration	Mortality %	
	Sharbati	Lokwan
0.312	60.0 ± 0.13	20.00 ± 0.00
0.624	83.33± 0.25	23.33± 0.11
1.2	100 ± 0.00	90.00± 0.00
1.8	100 ± 0.00	100 ± 0.00

3.1. Grain damage

Grains were treated with leaf powders and infested with *S. oryzae*. The results of both Sharbati and Lokwan variety treated with leaf powder of *A. marmelos* per 50g grain resulted very less infestation i.e 0.24 % and 0.71% (Table 2 a, b) as compared to about 12.5% in control wheat grains of Lokwan and 11.36 % Sharbati cultivars respectively.

3.2. Weight Loss

The weight loss was 7.97% in control wheat of Lokwan and 4.65 % in Sharbati cultivar wheat grains. At low concentration (0.3g) of *A. marmelos*, the damage was respectively in Sharbati cultivar. The loss of weight in wheat treated with higher concentration was less as compared to those with lower concentration (Table 3a, b).

Table 2a: Effect of *A. marmelos* leaf powders on damage of Triticum (Lokwan Cultivar) by *S. oryzae*

Treatments	Dose/50g of grain. (g)	Total no of grains/50 g	Av. no of infested grains	Grain damage (%)
Control	-	1248 ± 5.78	156 ± 0.50	12.5 ± 0.55
Lokwan Cultivar	0.3	1254 ± 4.47	5.0 ± 0.66	0.24± 0.03
	0.6	1201 ± 5.80	4.0± 0.55	0.15± 0.08
	1.2	1157± 2.2	0.0± 0.00	0.00± 0.00
	1.8	1187± 1.5	0.0± 0.00	0.00± 0.00

Table 2b: Effect of *A. marmelos* leaf powders on damage of Triticum (Sharbati cultivar) by *S. oryzae*

Treatments	Conc./50g. of grain (g)	Av. Total no. of grains/50 g	Av.no. of infested grains	Grain damage (%)
Control	-	1197± 3.46	136 ± 0.31	11.36 ± 0.18
Sharbati cultivar	0.3	1116 ± 2.3	8.00 ± 0.52	0.71 ± 0.06
	0.6	1134 ± 0.88	4.00 ± 0.30	0.35 ± 0.02
	1.2	1113 ± 1.20	0.00 ± 0.00	0.00 ± 0.00
	1.8	1200 ± 2.96	0.00 ± 0.00	0.00 ± 0.00

Table 3a: Effect of *A. marmelos* leaf powder impregnation on *Triticum sps.* (Lokwan cultivar) *S. oryzae*

Treatment	Dose / 50g of grain (g)	Initial wt. of the sample(g)	Final wt. of the sample(g)	Wt. Loss(g)	Wt. loss(%)
Control	-	50	46.0113±0.00	3.989±0.05	7.978±0.03
Lokwan cultivar	0.3	50	48.33±0.20	1.67±0.10	3.34±0.012
	0.6	50	49.026±0.12	0.974±0.50	1.94±0.15
	1.2	50	50.00±0.00	0.00±0.00	0.00±0.00
	1.8	50	50.00±0.00	0.00±0.00	0.00±0.00

Table 3b: Effect of *A. marmelos* leaf powder on damage of *Triticum sps.* (Sharbati cultivar) by *S. oryzae*

Treatment	Dose / 50g of grain	Initial wt. of the sample (g)	Final wt. of the sample(g)	Wt. Loss(g)	Wt. loss(%)
Control	-	50	47.071±0.12	2.328 ±0.18	4.656±0.08
Sharbati cultivar	0.3	50	49.355±0.28	0.645±0.040	1.29±0.02
	0.6	50	49.981±0.14	0.019±0.001	0.038±0.00
	1.2	50	50.00±0.00	0.00±0.00	0.00±0.00
	1.8	50	50.00±0.00	0.00±0.00	0.00±0.00

4. CONCLUSION

The varied efficacy of several grain protectants against the test beetles as well as on different species of stored food was an interesting finding of the current investigation. In two separate types of the pest, the same concentration resulted in varied levels of pest protection. This could be owing to differences in grain shape, texture, dust deposition, and degree of adherence to the kernel, all of which could have altered the efficiency of various materials. As a result, grain protection doses should be recommended based on the commodity variety.

To use the *A. mermelos* leaves as a grain protectant against additional cereal grain pests, more testing at different concentrations is required. Farmers will be able to save grains and enjoy their hard work if they employ ethnobotanicals in large quantities, as well as a few selected chemical insecticides in modest amounts.

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Conflict of Interest

There is no Conflict of Interest.

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