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Insecticide effect of neem, pudina, lantana, pungam essential oil on the *Sitophilus oryzae*

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Abstract
Stored rice seeds and milled rice is prone to be infested by rice weevils, *Sitophilus oryzae* L. (Coleoptera: Curculionidae), causing heavy economic losses. Adult weevils feed on rice grains and female lay eggs within the grain surface and the larvae develop inside the grain thus feeding preferentially on the germ of the grain. Because both larvae and adults feed on germ of the grain, the grain is completely damaged beyond any use.
The Scope of the study is evaluating the insecticide activity from Neem, Pudina, Lantana, Pungam essential oils. Insecticides tests were performed in the laboratory by the direct contact method. The results of neem and pudina essential oil have shown that has been memorable insecticidal properties. Mortality of adult rice weevils on 72HAT, the highest mortality was recorded in Neem with 31.25 per cent, Pudina with 27.5 per cent, Lantana with 18.75 per cent, lowest mortality was recorded in Pungam with 16.25per cent, and control with 15 percent.

Keywords: essential oils; insecticides activities; neem, pudina, lantana, pungam; *Sitophylus oryzae*

Introduction

Damage due to insect pests during storage is one of the major limitations. In India nearly 32.1 per cent of the produce is lost due to insect pests (Board and Mital,1983). Loss may reach 10 per cent of the total product each year, which translates to 1, 00, 00, 000 tons of grain lost per year (Smiderle, 2007; Nanda *et al* ., 2012). The rice weevil, *Sitophilus oryzae* L. (Coleoptera: Curculionidae) is one of the most serious insect pest of stored cereals throughout the world (Yankanchi and Gadache, 2010). They cause damage to grains which are stored at 25-30°C and at low RH as these conditions favored the development of this pest (Batta, 2004). Deterioration of the quality and quantity of the food materials is a major problem in storage systems. Rice weevil feeds on rice, wheat, maize, soghum and barley. Stored rice seeds and milled rice is prone to be infested by rice weevils, *Sitophilus oryzae* L. (Coleoptera: Curculionidae), causing heavy economic losses. Adult weevils feed on rice grains and female lay eggs within the grain surface and the larvae develop inside the grain thus feeding preferentially on the germ of the grain. Because both larvae and adults feed on germ of the grain, the grain is completely damaged beyond any use (Fernando and Karunaratne, 2013). Feeding by *S. oryzae* larva and adult cause weight losses as much as 75% (Dal Bello *et al*., 2001) and decreases nutritional value of the grains. Dead insects, larval exuviae and products of metabolism make infested stored food products inedible (Nawrot *et al*., 1982).
The indiscriminate application of synthetic products (insecticides) had led to various problems including toxic residual effects, environmental pollution, and development of resistance in insects (Isman, 2006). The use of a mixture of insecticides also favors the development of resistant strains which then makes subsequent pest management difficult (Pereira *et al*., 1997). Fumigants like phosphine and methyl bromide were used to control the storage pest but it has been reported that causes ozone depletion (Lee *et al*., 2001a). The increasing public concern over pesticide safety and possible damage to the environment has resulted in increasing attention being given to natural products for the control of stored pests (Rajendran and Sriranjini, 2008).Botanical insecticides can represent the best option in developing countries for farmers for the stored grains insect pest management as they are cheap, effective, safe, easy to process and to apply (Belmain *et al*., 2001; Regnault-Roger *et al*.,2012). These cause negative effects on non-target organisms and also they do not affect food quality. Plant materials not only used as insecticides but also as insect repellents and insect antifeedants. Insect repellents are desirable chemicals as they drive away the insect pests from the treated materials by stimulating olfactory or other receptors of insects. Repellents from plant origin are considered safe in pest control operations as they minimize pesticide residues, and ensure safety to humans, food, and the environment (Talukder & Howse, 1995pesticides do not contribute to resistance development or pest resurgence, nor do they).

Materials and Methods

The experimental procedures adopted for studies on effects of different plant extracts on Rice weevil(*Sitophilus oryzae*) in various hosts viz., White sorghum and Split pulses(Green gram). The investigations were carried out at the Department of Agricultural Entomology, Imayam Institute of Agricultural and Technology, Thuraiyur during 2018-2019. The materials used and methods adopted in the study are presented in this chapter.

Variety of crop used for the study

Freshly harvested sorghum seeds were obtained from farmers of Thuraiyur region. Seeds of the following crops like White sorghum and split pulses were used in the storage experiments.

Culturing of *Sitophilus oryzae*

Mass culturing of Rice weevil (*Sitophilus oryzae*) was done at the Entomology laboratory, IIAT, Thuraiyur. The Rice weevil (*Sitophilus oryzae*) adults were collected from sorghum and paddy seed samples of the Department of Seed Science and Technology and from Department of Plant Breeding and Genetics and utilized for mass culturing. These weevils were reared on sorghum grains following the method developed by Credland and Wright (1989). 500 g of sorghum seeds were placed in 600 ml plastic jars, into which approximately 50 pairs of freshly emerged rice weevils (*S. oryzae*) were introduced. The plastic jars were covered with muslin cloth and placed in dark to facilitate maximum oviposition maintained at a room temperature of 30 ± 5°C and 65 ± 5% RH throughout the period of study. After 25 to 30 days, adults that emerged from the culture were utilized for maintenance of sub cultures following the same procedure as described above. Sub culturing of this weevil was done at weekly intervals so as to get continuous supply of insects for experiments. Freshly emerged adults were used for conducting the experiments.

Collection of Aqueous extraction of plants

Leaves of above mentioned plants were shade dried for one week and ground into fine powder. Ten gram of each powder was soaked in 100 ml of distilled water and left for 24 hrs. Thereafter, the extracts were decanted and filtered using muslin cloth and the resultant solutions was used for laboratory study

T1- 10% Aqueous extract of Azadiracta indica
T2- 10% Aqueous extract of Mentha arvenis
T3- 10% Aqueous Extract of Lantana camera
T4- 10 % Aqueous Extract of Pongamia glabra

Insecticidal action of plant extracts

Twenty five grams of Seeds viz., White sorghum and split pulses of green gram were taken in plastic containers. Plant extracts were added to the those seeds at concentration of 10% and shaken thoroughly. Twenty newly emerged adults of S.oryzae were released into each plastic containers with treated seeds and were covered firmly and kept in the room temperature. Untreated seeds of sorghum and split pulses were maintained as control . Mortality (lack of locomotion and/or response to repeated probing) was recorded at 24 h intervals for three days. The experiments were conducted in Complete Randomized Block Design (CRBD) with five treatments and four replications

$$\text{Mortality (\%)} = \frac{\text{Number of insects dead}}{\text{Total number of insects released}} \times 100$$

Effect of plant extracts of *Sitophilus oryzae* in Sorghum

The results of insecticidal activity of different plant extracts *viz*.,Neem, Pudina, Lantana , Pungam on rice weevil, *Sitophilus oryzae* in Sorghum are furnished in Table 1. On 24HAT, the highest mortality was recorded in Neem with 11.25 per cent, Pudina with 8.75per cent, Lantana with 7.5per cent, lowest mortality was recorded in Pungam with 6.25per cent and control with 5.0per cent. On 48HAT, the highest mortality was recorded in Neem with 23.75per cent, Pudina with 20per cent, Lantana with 12.5per cent, lowest mortality was recorded in Pungam with 11.5per cent and control with 10 per cent .On 72HAT, the highest mortality was recorded in Neem with 31.25 per cent, Pungam with 27.5 per cent, Lantana with 18.75 per cent, lowest mortality was recorded in *Pungam* with 16.25per cent, and control with 15per cent.

Mean per cent mortality recorded in the Neem was higher with 22.1 per cent, followed by Pudina with 18.75 per cent, followed by Lantana 12.9 per cent, and the least mean percent mortality rate was recorded in Pungam with 10.4 per cent which is on par with control.

Table 1: Insecticidal Activity of 10% Aqueous Plant Extracts on *Sitophilus Oryzae* In Sorghum

Treatment	24 HAT	48HAT	72HAT	Mean
T1: *Azadirachta indica*	2.25 8.59)a	4.75 12.57)a	6.25 14.44)a	4.42
T2: Mentha arvensis	1.75 7.53)a	4.00 11.37)ab	5.50 13.51)a	3.75
T3- Pongamia glabra	0.50 3.19)b	2.25 8.59)bc	3.20 10.36)b	2.08
T4- Lantana camara	1.50	2.50	3.75	2.58

	6.12)ab	8.63)bc	10.98)b	
Control	1.00 5.73)ab	2.00 8.13)c	3.00 9.97)b	2.00
CD 5%		3.521	2.831	2.049

Effect of plant extracts on Rice weevil, *Sitophilus oryzae* in Green gram

The results of insecticidal activity of different plant extracts *viz*., Neem, Pudina, Pungam, Lantana on Rice Weevil *Sitophilus oryzae* in green gram is furnished in Table 2. On 24HAT, the highest mortality was recorded in Neem with 10 per cent, Pudina with 7.5 per cent, Lantana with 6.25 per cent, Pungam with 3.7 per cent and lowest mortality was recorded in control with 5 per cent. On 48HAT, the highest mortality was recorded in Neem with 88.75 per cent, Pudina with 75 per cent, Lantana with 61.25 per cent, Pungam with 53.75 per cent, and lowest mortality was recorded in control with 15percent. On 72HAT, the highest mortality was recorded in Neem 97.5 per cent, Pudina was 82.5 per cent, Lantana with 67.5 per cent which is on par with Pungam, and lowest mortality was recorded in control with 20 percent. Mean per cent mortality recorded in the Neem was higher with 65.4 per cent, followed by Pudina with 55 per cent, followed by Lantana with 45 per cent followed by Pungam with 40 per and the least mean percent mortality rate was recorded in control with 13.35 per cent .

Table 2: Insecticidal Activity of 10% Aqueous Plant Extracts on Sitophilus Oryzae in Green Gram

Treatment	24 HAT	48 HAT	72 HAT	Mean
T1: *Azadirachta indica*	2.00 (8.13)[a]	17.75 (24.91)[a]	19.50 (26.20)[a]	13.08
T2: Mentha arvensis	1.50 (6.12)[b]	15.00 (22,74)[b]	16.50 (23.95)[b]	11.00
T3: *Pongamia glabra*	0.75 (3.78)[c]	10.75 (19.08)[c]	12.50 (20.66)[c]	8.00
T4: *Lantana camara*	1.25 (5.66)[d]	12.25 (20.48)[c]	13.50 (21.55)[c]	9.00
T5:Control	1.00 (5.73)	1.00 (9.97)d	4.00 (11.537)d	2.67
CD (0.05%)		NS	1.774	1.371

Insecticidal effect of plant extracts on *S. oryzae* different hosts

At 72 HAT, the highest mean per cent mortality (65.4%) of rice weevil was observed in green gram seeds treated with 10 per cent aqueous extract of neem leaves. In the meantime, neem leaf powder extract exhibited 22.1 per cent mortality in sorghum seeds. Shimul Das *et al.* (2015) have studied the toxicity effect of Azadiracta *indica* leaf powder extract (1, 2 and 3%) on *Sitophilus oryzae* and reported 17.5 per cent mortality at 24 HAT. Insecticidal property of 3.33% neem leaf powder extracts shows 100 per cent mortality after 9 days of treatment was reported by Perera *et al.*,(2018) in his study.

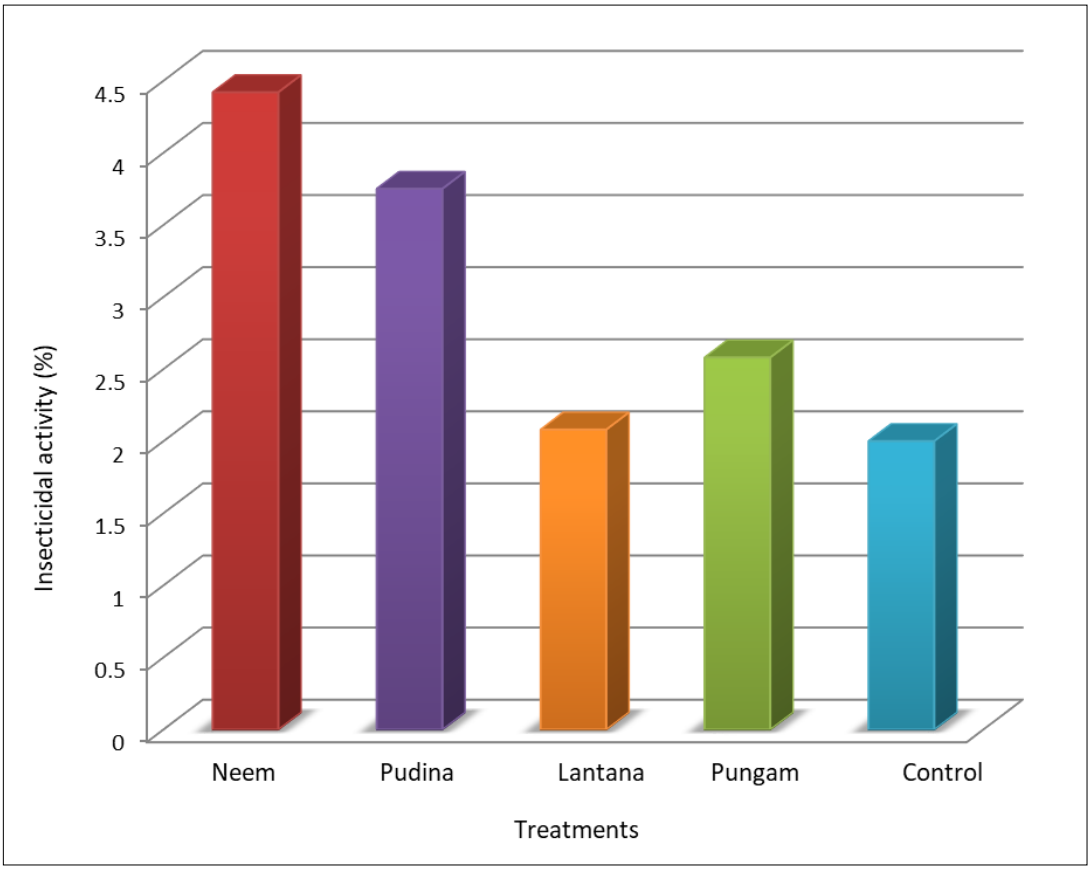

Fig 1: Insecticidal activity of 10% aqueous plant extracts on *S.oryzae* in Sorghum

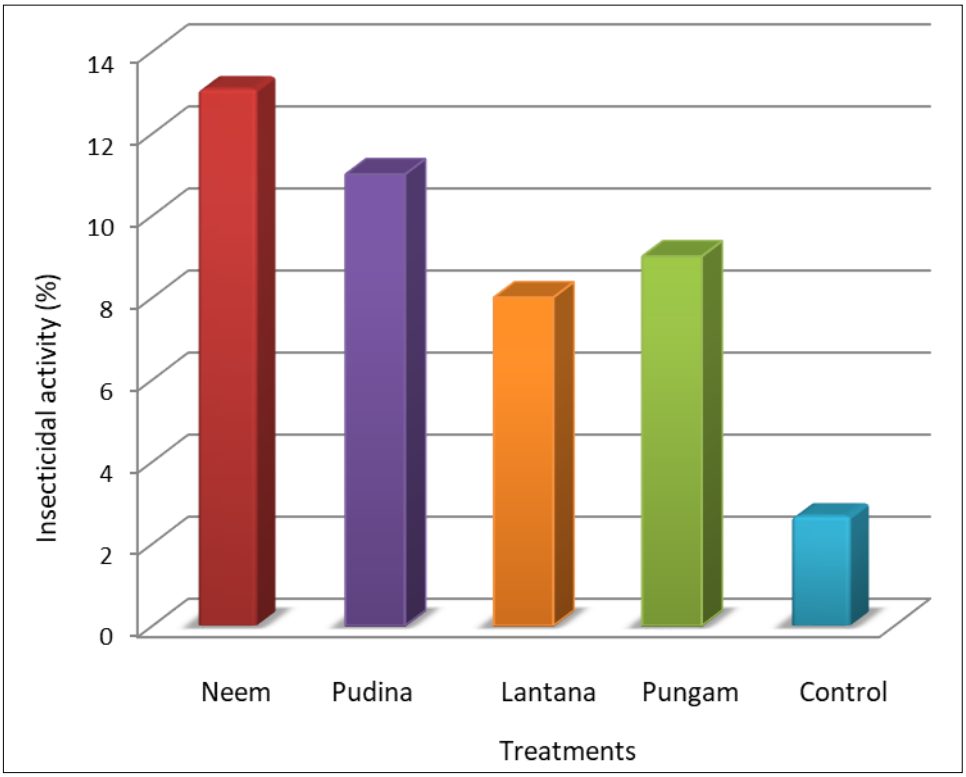

Fig 2: Insecticidal activity of 10% aqueous plant extracts on *S.oryzae* in Green gram

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