

Insecticidal Activity of Plant Powders against Rice Weevil, *Sitophilus oryzae* L. (Coleoptera: Curculionidae)

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Abstract

Laboratory studies were conducted to study the effect of five leaf powders viz. *Justicia adhatda* (*Adathodai*), *Azadirachta indica* (*Neem*), *Carica papaya* (*Papaya*), *Ocimum tenuiflorum* (*Tulsi*) and *Annona squamosa* (*Annona*) on rice weevil *Sitophilus oryzae* L. infested rice in storage. The experiment was laid out in a completely randomized design (CRD) with five replications. Five grams of each plant powder were used to treat 100 g of rice grains. A control treatment having no any botanical was set up to compare the results in order to choose effective plant powder to control the rice weevil in storage. Six pairs of rice weevils were introduced to each treatment. The cumulative mortality percentage of adult weevil in different botanical treatments was recorded at two weeks interval. It was revealed that the use of powders from the selected indigenous botanical plants increased adult mortality of the rice weevils. *Annona* leaf powder recorded 100% mortality of the weevils at 10th week after the treatment and showed significantly ($p < 0.05$) highest efficacy in controlling the adult weevils among the botanicals tested. Furthermore, *Annona* was followed by *Tulsi* to kill the weevils effectively in rice storage. Moreover, *Adathodai* had no significant ($p = 0.05$) influence on the mortality of rice weevils. Therefore, the resource poor farmers can use ground botanicals namely, *Annona* and *Tulsi* in controlling rice weevils as they may not afford to buy chemical pesticides due to high cost.

Keywords: Botanical insecticides; Insect mortality; Rice weevil; Storage pest

Introduction

Rice is the single most important and staple food of eighteen million people of Sri Lanka as in many other Asian countries. Every year 30-50% of the total paddy production is stored by farmers for their consumption, future sale, wages and seed purposes (Gunatathna and Karunaratna, 2009).

Rice weevil, *Sitophilus oryzae* L. is a major pest of cereals like rice, sorghum, wheat, barley and maize both in field before harvest and storage. One pair of *Sitophilus Oryzae* can reproduce about one million of its species with in a period of three months under favorable conditions (Thomas *et al.*, 2002) and the adults are internal feeders and cause serious quantity and qualitative losses to the grains. Control of

weevil populations worldwide has been provided principally by the use of synthetic chemical insecticide. However these insecticides are expensive and mostly out of reach of most small holder farmers led to insect resurgence, resistance and negative effect on non target organisms (Duke *et al.*, 2003).

Therefore there is a need to look for an alternative organic that are the readily available, less poisonous and less detriment for pest control (Talukder and Howse, 1995). However, very little research has been performed on the development of affordable organic pesticides which offer same control levels as synthetic to weevils (Cosmas *et al.*, 2012). Hence this present research aimed to

examine the effect of five locally available botanicals on mortality of *Sitophilus oryzae* in storage.

Methodology

The experiment was conducted in the Department of Agricultural Biology, Eastern University, Sri Lanka, from March to June 2015. Fresh leaf samples of *Justicia adhatda* (Adathodai), *Azadirachta indica* (Neem), *Carica papaya* (Papaya), *Ocimum tenuiflorum* (Tulsi) and *Annona squamosa* (Annona) were collected and dried under shade at room temperature of 29 °C – 31 °C for five days. The dried leaves were ground to fine powder using an electric grinder and sieved through a mesh sieve (0.1 mm pore size) to obtain uniform particle size. The leaf powders were kept separately in glass containers in a dark place until used in the investigation.

Rice grains were cleaned and oven dried in the laboratory at 40 °C for 48 hours. They were well sieved by using 1 mm diameter sieve. Cleaned rice grains were put in thirty boxes separately as 100 g in each and six pairs of rice weevil insects were introduced to each box. Five grams of powder from each botanical were added separately to five boxes (five replicates) containing rice grains and rice weevils. Six treatments (*i.e.* five botanicals and a control treatment) and five replications were set up and arranged in a completely randomized design (CRD). The cumulative

mortality percentage of adult weevil in different botanical treatments was recorded at two weeks interval and compared with the control treatment (without any botanical application) in order to choose effective plant powder to control rice weevil. Proc. PROBIT was done for the data analysis of rice weevil mortality percentage using the SAS 9.1 package and the means were separated. Statistical significance was tested at $\alpha=0.05$.

Results and Discussion

The results of the experiment showed that the powders of plant leaves *Annona squamosa* (Annona) destroyed almost all weevils by about 10th week after treatment indicating significantly ($p<0.05$) more effective than all other botanicals and control included in this investigation (Table 1). Asawalam *et al.* (2012) reported that the plant powders can lead to suffocation and death of storage insect pest. It was found that after 8th week the botanical Annona killed 98.3% of the adult weevil and no weevils were found alive from 10th week onwards. *Ocimum tenuiflorum* (Tulsi) recorded 91.7% of weevil mortality 12 weeks after the treatment. Among the different plant powders tested, *Justicia adhatoda* (Adathodai) had no significant ($p=0.05$) influence on the mortality of rice weevils, because mortality percentage of this treatment did not significantly vary with that of control treatment. Hence, Annona has the highest potential to control of *Sitophilus oryzae* among the botanicals tested.

Table 1. Effect of botanicals on mortality percentage

Treatment	Percentage of Mortality					
	2 nd week	4 th week	6 th week	8 th week	10 th week	12 th week
<i>Justicia adhatoda</i> (Adathodai)	5.0c	10.0d	13.4d	15.0d	18.4e	23.3e
<i>Azadirachta indica</i> (Neem)	18.4b	35.0c	36.6c	43.3c	61.7c	65.0c
<i>Carica papaya</i> (Papaya)	15.0b	15.0d	16.7d	23.3d	30.0d	35.0d
<i>Ocimum tenuiflorum</i> (Tulsi)	31.7a	51.6b	71.6b	81.7b	86.6b	91.7b
<i>Annona squamosa</i> (Annona)	28.3a	65.0a	83.3a	98.3a	100.0a	100.0a
Control	0.0c	0.0e	8.3d	16.7d	18.4e	28.3e

Means followed by same letter in a column do not statistically differ ($p < 0.05$)

Conclusions

The results revealed that the efficacy of ground leaves *Annona squamosa* (Annona) was the highest among the botanicals tested in the present study and it was followed by *Ocimum tenuiflorum* (Tulsi) to control the rice weevil. *Justicia adhatoda* (Adathodai) had no significant control on the weevil. Therefore, the resource poor farmers can use ground botanicals namely, Annona and Tulsi in controlling rice weevils as they may not afford to buy chemical pesticides due to high cost. Furthermore, the use of botanical pesticides to control rice weevil is an appropriate strategy to avoid environmental pollution and other hazards, since the chemical pesticides are used by farmers and in agro industries currently.

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