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Effect of *A. muricata* and *Cinnamomum verum* leaf powders on rice weevil (*S. ORYZAE*) in stored rice grains

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Abstract
In the present study, the leaf powder of two medicinal plants, *Annona muricata* and *Cinnamum verum* were tested against rice weevil *Sitophilus oryzae* for insecticidal properties and also for their biological grain protectant. Response varied with plant species. The leaf powders were tested in stored rice grain. In treatment, the sterilized rice grains were treated with five pairs of rice weevil. Adult insects were exposed to 5g of *A. muricata and C. verum* powder rice grains (20gms) for a time period of five weeks (35 days). The mortality was assessed after 1day, 7 days, 14 days, 21 days, 28 days and 35days.The mortality was increased in dose dependent manner. The mortality of adults increased with increasing dose concentrations. The results of the study showed that maximum mortality of *S. oryzae* was observed at 5g of grain protectant during fifth week of treatment. *A. muricata* leaf powder showed highest grain protectant efficacy when compared to *C. verum* leaf powder. It appeared that the leaf powder had some insecticidal activities against *S. oryzae* adult.

Keywords: *A. muricata, C. verum, S. oryzae,* mortality, insecticidal

1. Introduction
Rice (*Oryzae sativa)* is an important and nutritive food source consumed by more than half of the world's population. For the above reason rice is considered as a great economic importance and therefore it is very essential to control the pest inhabiting it. Pest can damage stored grain and their products. One of the important pests inhabiting stored rice grain is *S. oryzae* and it is distributed throughout the world. Rice weevil infected rice grains lead to losses of nutritional value and became unfit for marketing. Efforts are taken to control these insect pests, especially usage of chemical pesticides.
The usage of chemical pesticides increased the residence of pest against several classes of pesticides. Another drawback of utilization of chemical pesticides was its toxic side effects. To overcome these problems, bioactive molecules of plant origin were used as an alternative method for the chemical pesticide.
Plant based insecticides or Biological pesticides are cheaper lower than chemical pesticides and showed low toxicity to non-target organisms and are less harmful to the environmrnt. In the present experiment *A. muricata* and *C. verum were* studies for their grain protectant efficacy against *S. oryza.* These plant extracts exhibit a wide range of insecticidal property.


A. muricata leaf


C. verum leaf

2 Materials and Methods
Leaf powders of *A. muricata* and *C. verum* were the two-grain protectant used for the present study.

2.1 Insect Culture
Parent stock of *S. oryzae* was obtained from infested raw white rice brought from the local market of Coimbatore and Palakkad. 50grams of rice were taken in plastic containers and then ten pairs of adult rice weevils were introduced into it. The containers were covered tightly and pin holes were made on the lid for ventilation. After two weeks, the adult rice weevils were removed. The cultures were produced at 20.6ºC - 29ºC.

2.2 Preparation of Botanical powders
Fresh leaves of *A. muricata* and *C. verum were* collected from in and around Palakkad District, Kerala. They were washed in running water and kept in shade for air drying. The air dried in the oven at 60ºC to gain constant weight. The dried leaves were blended into fine powder and sieved through a 25-mesh sieve to obtain fine and uniform dust. The plant powders were preserved in airtight jars.


A. muricata leaf powder


C. verum leaf powder

2.3 Experimental set up

The grains were sterilized in an incubator, about 24 hours at 60ºC to disinfect them. About 20 gm of the fresh and un-infested rice grain was measured and transferred into transparent plastic bottle of 8×8 cm size. Thereafter five different doses of each plant power were thoroughly mixed with 20 gm of rice grain in each plastic bottle. Freshly emerged adult were starved for 4 hour and ten pairs of adult weevil were introduced into grain plastic bottle. The bottles were covered tightly with lid with holes for ventilation. The control was free from grain protectant. Rate of Mortality was recorded after every seven days for thirty-five days. Five replications were maintained in each treatment. The present study was conducted at 27ºC and 73% relative humidity under laboratory condition.

Experimental Setup

2.4 Mortality rate Assessment

To estimate mortality, the number of dead insects in each vial was counted at 7,14,21,28 and 35 days after treatment. Rice weevil mortality was assessed as number of dead insect/Total number of insects x 100. Data on percentage adult weevil were corrected using Abbott's [1925] formula,

$$\text{Percentage of corrected mortality} = \frac{(\text{Observed mortality} - \text{Control mortality})}{100 - \text{Control mortality}} \times 100$$

3. Results and Discussion

The result of the percentage mortality of *S. oryzae were* recorded at every seven days for five weeks at exposure to different concentrations of the two experimental plant leaf extracts. It was seen that the mortality rate was maximum at higher concentration in both the plants (Table 1 and 2)

Table 1: Effect of *A. muricata* leaf powder against *S. oryzae* on rice grain

Does of *A. Muricata*	Mean mortality after 7 – 35 days treatment				
	7	4	21	28	35
1	00.00 ±00.0	00.00 ±00.0	10.12±2.08	13.33±1.54	18.00±1.24
2	00.00 ±00.0	00.00 ±00.0	10.33±2.10	19.6±3.00	20.33±3.14
3	00.00 ±00.0	00.00 ±00.0	16.61±3.28	29.33±2.58	40.66±2.31
4	00.00 ±00.0	27.12±2.23	38.05±1.52	56.33±2.33	61.33±3.47
5	28.33±4.35	43.63±2.59	62.63±2.62	86.64±2.35	92.60±3.87
Control	00.00 ±00.0	00.00 ±00.0	00.00 ±00.0	00.00 ±00.0	00.00 ±00.0

Mean ±SD values of five replicates

Table 1 shows the effect of *A. muricata* leaf powder treated against *S. oryzae* on stored rice grain. The maximum mortality was observed in the fifth week at 5 g of *A. muricata* leaf powder treated rice grains and the least mortality was observed for first week of treatment at 1 g of *A. muricata* leaf powder treated rice grains. The rate of mortality was directly proportional to the concentration of doses, ie as the concentration of grain protectant increases the rate of mortality also increases.

Table 2: Effect of *C. verum* leaf powder against *S. oryzae*

Does of *C. Verum* (gm)	Mean mortality after 7days post treatment				
	7	14	21	28	35
1	00.00 ±00.0	00.00 ±00.0	10.10±1.22	15.13±1.25	19.31±2.1
2	00.00 ±00.0	00.00 ±00.0	14.33±2.54	23.05±2.32	304.3±2.33
3	00.00 ±00.0	00.00 ±00.0	19.60±2.56	32.65±2.11	45.64±1.05
4	00.00 ±00.0	00.00 ±00.0	29.12±2.08	38.15±1.22	49.13±2.44
5	00.00 ±00.0	00.00 ±00.0	32.00±2.31	48.33±2.08	62.33±2.14
Control	00.00 ±00.0	00.00 ±00.0	00.00 ±00.0	00.00 ±00.0	00.00 ±00.0

Mean ±SD values of five replicates

Table 2 shows the effect of *C. verum* leaf powder extract against *S. oryzae*. The mortality rate was zero for the first two weeks of treatment. The maximum mortality was observed after fifth week of treatment at 5 g concentration of *C. verum* leaf powder treated rice grains and the least mortality was observed after 21, 28 and 35 days of treatment at 1 g of C. *verum* leaf powder treated rice grains. This proves that the efficacy of *C. verum* leaf powder is lower when compared to *A. muricata* leaf powder in controlling the stored pest *S. oryzae*

Many studies had been conducted to study the efficacy of grain protectant against *S. oryzae* and produces similar results. Rahman *et al*. (2007) [2] tested the ethanol extract of melgota, *Macaranga postulata* at different concentrations for their repellent activity against *S. oryzae* and showed that concentration of doses was directly proportional to repellent activity of pesticides. Mervat *et al*., (2016) [3] conducted experiment to protect grains from *S. oryzae* using oils of basil, fennel, and geranium. Ujjwal SahooI *et al*., (2018) [4] studied the efficacy of *Cinnamomum verum* against *S. oryzae* and found to be a potent repellent. Asawalam *et al*., (2012) [5] reported that powder of the *A. squamosa* leaves extract lead to suffocation and finally death of the stored grain pests, *Oryzae sativa*. Tariq Javed *et al*., (2018) [6] carried out experiment using *Guaiacum officinale* and *A. squamosal* against *S. oryzae* and observed 19.00% mortality against *Guaiacum officinale* and 100% mortality by *A. squamosa*.

Yoon *et al*., (2007) [7] Studied the repellent efficacy of six essential oils extracted from caraway, clary sage, grapefruit, strawberry and thyme white, their related volatile constituents against the adult of *S. oryzae* and found that the mixture of caraway and grapefruit was potent repellents for controlling *S. oryzae*. Pascual-Villalobos *et al*., (2003) [8] observed the insecticidal effects of a group of plant essential oils which are caraway, coriander (*Coriandrum sativum*), sweet basil (*Ocimum basilicum*) garland chrysanthemum and were tested against the cereal storage pests *Collosobruchus maculatus* and *Sitophilus granarius*. The

caraway oil was most effective in controlling pest causing 60% to 100% mortality in *Callosobruchus maculatus.*

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