



BIOPESTICIDAL EFFICACY OF DEVIL'S TREE (*ALSTONIA SCHOLARIS*) ON *SITOPHILUS ORYZAE* (PEST OF RICE)

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ABSTRACT

Significant economic loss of stored grains is reported due to insect pests. Plants with medicinal properties are known to have biopesticidal effects. In the present study leaves and bark of *Alstonia scholaris* was tested for biopesticidal effects on *Sitophilus oryzae*, the pest of rice. The pest was exposed to crushed fresh leaves and bark tablets as a drug at concentrations of 0.5 gm, 1 gm, 1.5 gm and a tablet of rice powder for control. Each group contains 100 number of insect pests in 100 gm of grains placed in plastic boxes at room temperature and relative humidity. The results indicate 74.66% and 71.66% mortality of pests by leaves and bark tablets respectively at 96 hrs. The effects were dose and duration-dependent.

KEYWORDS: Biopesticide, *Alstonia scholaris*, *Sitophilus oryzae*, Stored Grain, Pests.

INTRODUCTION

Significant economic loss of stored grains is reported due to insect pests. A number of insect pests have been reported to damage stored grains and *Sitophilus oryzae* is one among them. It belongs to the family *Curculionidae* of the order *Coleoptera* and is commonly called as rice weevil. It is the most destructive insect pest of stored grains, feeding on rice, corn, wheat, and many other cereals (Cogburn, 1977; Padín et al., 2002; USDA, 2016; Vijay and Bhuvaneswari, 2018; Charles Kasozi et al., 2018). Hence, it is necessary to explore the effective method for control of *Sitophilus oryzae*. Although different methods of pest control are available, the use of biopesticides is more promising as they are naturally occurring substances from living organisms (natural enemies) or their products (microbial products, phytochemicals) or their by-products (semiochemicals) that can control pests by nontoxic mechanisms (Salma and Jogen, 2011). Many plants derived biopesticide (Botanicals) especially neem (*Azadirachta indica*), bach (*Acorus calamus*), phoolakri (*Lantana camara*), draik (*Melia azadarach*), kali mirch (*Piper nigrum*), Basuti (*Adhatoda zeylanica*), etc. have been reported to control agricultural insect pest in the field as well as stored grain pests without affecting the quality of grains or seeds and without harming ecosystem or environment (Lal, et. al., 2017). It is observed that, plants with medicinal properties showed biopesticidal effects and may be recommended alone or as a part of IPM to control insect pests.

In the present study, *Alstonia scholaris* (devil's tree) is investigated for its biopesticidal effects on *Sitophilus oryzae*. *Alstonia scholaris* belongs to the family *Apocyanaceae*. It is widely distributed in dried forests of India specially in Western Himalayas, Western Ghats and in the Southern region (Anonymous, 1985; Naik, 1998). It contains active principles and have been used in different systems of traditional medicine for the treatment of diseases. The phytochemical constituents of *Alstonia* sp. contains nearly 400 compounds. It is used as an anti-

irritation agent (Goyal and Shinde, 2019; Sharma, et. al., 2016). The extract of the plant showed anti-malarial and anticancer properties, while the bark is used solely for medicinal purposes for malaria, epilepsy, skin conditions and asthma. In Ayurveda, it is used as a bitter and an astringent herb for treating skin disorders, malarial fever, urticaria, chronic dysentery, diarrhea, in snake bites (Nadkarni, 1976; Sharma, et. al., 2016). Also, the dried leaf powder of *A. scholaris* showed a significant insecticidal effect against *Sitophilus oryzae* (Paramanik, 2018). In the present study, leaves and bark of *Alstonia scholaris* was tested for biopesticidal effects on *Sitophilus oryzae*, the pest of rice.

MATERIALS AND METHOD

Preparation of leaves and bark tablet

The plant *Alstonia scholaris* Linn. was identified in the Department of Botany of our institution. Fresh leaves and bark were collected, washed under tap water, and grinded in an electronic mixer. Tablets were made by mixing crushed leaves and bark with rice flour. First, rice flour was taken and its pulp was soaked, then freshly crushed leaves and bark were measured in given quantities, mixed with rice flour, and made into pellets by hand. Separate tablets were made containing 0.5 gm, 1 gm, and 1.5 gm of crushed leaves and bark.

Insect rearing

The *Sitophilus oryzae* collected from local grocery shops, and were used for the study. The pests were identified by using the user guide of Grains Research and Development Corporation (GRDC). The pests were reared in the plastic box, covered with muslin cloth held tightly with rubber to allow aeration in a laboratory condition at room temperature of $27 \pm 2^\circ \text{C}$ with 14-10 hours of light: dark photoperiod and $65 \pm 5\%$ relative humidity.

The insect pests were divided into four groups consisting of

100 insect pests in 100gm of rice grains. The pests in Group I, Group II, and Group III were exposed to tablets containing 0.5gm, 1gm, and 1.5gm of crushed fresh leaves and bark. Group IV served as vehicle control exposed to rice flour. The exposure was given to each group for 24, 48, 72, and 96 hrs.

Mean percent mortality was calculated using Abbott's.

RESULT AND DISCUSSION

The present study was undertaken to test the biopesticidal effect of crushed leaves and bark of *Alstonia scholaris* on *Sitophilus oryzae*.

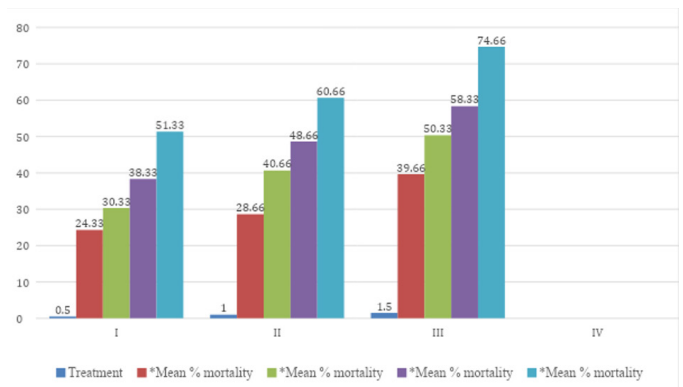
The percent mortality of *Sitophilus oryzae* in Group I, Group II, and Group III was 51.33%, 60.66%, and 74.66% respectively and the control group was 00.00% at 96 hrs of crushed leaves tablet exposure. This indicates that there is the highest percent mortality of *Sitophilus oryzae* in all three treatment groups at 96 hrs as compared to the control group. Also, it is observed that the percent mortality increased with the increase in the concentration of crushed leaves in the tablet (Table 1., Graph 1). Similar effects were recorded previously using leaves of different plants such as *Lantana camara* (Verbenaceae) (Ogendo et al. 2003; Dua et al. 2010), *Azadiracta indica* (Govindachari et al., 1999; Bina et al., 2004), *Annona squamosa* (L.), *Moringa oleifera* (Lam.), *Eucalyptus globulus* (Labill.) and *datura* (Nenaah et al 2011) against a serious pest such as *Tribolium castaneum*, *Trogoderma granarium*, *Rhyzopertha dominica*, and *Sitophilus oryzae*.

The percent mortality of *Sitophilus oryzae* in Group I, Group II, and Group III was 47.33%, 55.33%, and 71.66% respectively and the control group was 00.00% at 96 hrs of bark tablet exposure. This indicates that there is the highest percent mortality of *Sitophilus oryzae* in all three treatment groups at 96 hrs as compared to the control group. Also, it is observed that the percent mortality increased with the increase in the concentration of crushed bark in the tablet (Table 2, Graph 2). The bark of *Moringa oleifera* was reported to be effective against *T. castaneum* and *Scirpophaga incertulus* (Ajayi 2007, Deka et al 2006). Thus, it is clear that the biopesticidal effect of crushed leaves as well as bark tablet was increased with the time period of drug exposure and also with the concentration of the drug.

Group	Treatment (gm/100 gm grains)	*Mean % mortality			
		24 hrs.	48 hrs.	72 hrs.	96 hrs.
I	0.5	24.33	30.33	38.33	51.33
II	1	28.66	40.66	48.66	60.66
III	1.5	39.66	50.33	58.33	74.66
IV (Control)	Tablet of rice flour	00.00	00.00	00.00	00.00

*Mean of three sets with 100 insect pests in each set

Table 1: Biopesticidal effect of leaves tablet of *Alstonia scholaris* on *Sitophilus oryzae*

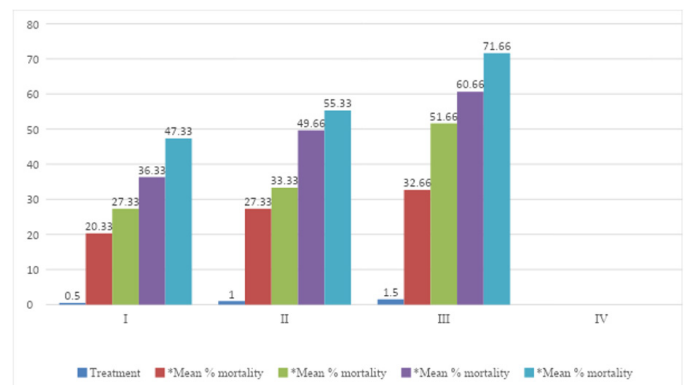


Graph 1: Graph for Determination of the biopesticidal effect of leaves tablet of *Alstonia scholaris* on *Sitophilus oryzae*.

Group	Treatment (gm/100 gm grains)	*Mean % mortality			
		24 hrs.	48 hrs.	72 hrs.	96 hrs.
I	0.5	20.33	27.33	36.33	47.33
II	1	27.33	33.33	49.66	55.33
III	1.5	32.66	51.66	60.66	71.66
IV (Control)	Tablet of rice flour	00.00	00.00	00.00	00.00

*Mean of three sets having 100 insect pests in each set

Table 2: Biopesticidal effect of bark tablet of *Alstonia scholaris* on *Sitophilus oryzae*



Graph 2: Graph for Determination of the biopesticidal effect of bark tablet of *Alstonia scholaris* on *Sitophilus oryzae*.

CONCLUSION

Dose-dependent biopesticidal effect of *Alstonia scholaris* was observed on *Sitophilus oryzae*, as the percentage of mortality was increased with the concentration of leaves and bark in tablets. The effects were duration-dependent as the activity was highest at 96 hrs. of exposure. Further studies are required with a combination of leaves and bark, modification in dose regimen, and duration of exposure to intensify the biopesticidal effects.

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