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Bioactivity of different plant extracts against angoumois grain moth (*Sitotroga cerealella* Oliv.) in stored maize grain

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ABSTRACT

The insecticidal property of acetonic extracts of *Vitex negundo, Adathoda vasica, Catharanthus roseus* and *Lantana camera* @ 1% and 2% w/w was evaluated against *Sitotroga cerealella (Oliv.)* in stored maize grain. Among the acetonic extracts of *Adathada vasica, Catharanthus roseus* and *Vitex negundo* proved to have high efficacy for reducing the adult emergence, grain damage and grain weight loss while different extracts that of *Lantana camera* showed moderate effect compared to control. The % grain damage and weight loss showed positive correlation with number of moths emerged.

Keywords : *Adathoda vasica, Botanicals, Catharanthus roseus, Insecticidal activity, Sitotroga cerealella, Vitex negundo*

Angoumois grain moth (*Sitotroga cerealella* Oliv.) is one of the major storage insect pests of stored maize in the tropics and subtropics. Infestation of this moth starts in the field itself and immature stages from the field infestation complete their life cycle and emerge as adults in storage. Teotia and Singh (1976) reported that population of *Sitotroga cerealella* multiplies 112.27 times between two successive generations and usually found in the upper 40 cm layer of the grain. This leads to considerable quantitative and qualitative economic losses represented in weight loss, decrease in the nutritional value and reduction of germination. The exclusive reliance on insecticides for the control of insect pests leads to the development of insecticide resistance, resurgence, residues on grains and environmental pollution. Keeping in view of the above there is growing concern for the use of natural plant products as alternative to chemical pesticides for insect-pest management as they are safe, less hazardous, biodegradable and broad spectrum in their activity (Talukder and Howse, 1995). Many plants like *Annona squamosa, Lantana camera, Azadirachta indica* have been proved to be lethal for various stored grain pests and delayed the developmental stages by interfering with their apolytic and molting processes (Morya *et al.* 2010). The plant products like powder form of neem leaf and fruit (*Azadirachta indica*), curry leaf (*Murraya koenigii*), jute leaf (*Corchorus capsularis*), siam weed leaf (*Eupetorium odoratum*) and chick weed leaf (*Ageratum conyzoides*) could also be used as seed protectants to reduce the infestation of rice weevil and grain moth in stored wheat (Bora, 1982). The present study has been carried out with a view to study the insecticidal activity of plant extracts of *Vitex negundo, Adathoda vasica, Catharanthus roseus* and *Lantana camera*.

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MATERIALS AND METHODS

The mass culturing of *Sitotroga cerealella* was carried out by confining 10 - 20 freshly emerged moths of both sexes in 1l plastic jars with 500 g of maize grains maintained at 28 ± 2° C. The jars were covered with muslin cloth and tied with rubber band. Eggs of *Sitotroga cerealella* were obtained according to the technique of Stockel and Turtaut (1970). After the oviposition period clusters of eggs attached to black paper were counted under binocular microscope. Total number of eggs in each cluster was written on the black paper to simplify the recounting of hatched eggs after the incubation period.

Preparation of acetonic plant extracts

The powders of different plant products *viz., Vitex negundo, Adathada vasica, Catharanthus roseus* and *Lantana camera* were prepared by drying them in the shade and then grinding them in electronic grinder to get fine powder. For acetone extracts of plant products, 10 grams of ground leaves of plant powders were separately mixed with 50 ml acetone and stirred for 30 minute using stirrer and then left to stand for 2 weeks. The mixture was then filtered through whatmann grade 1 filter paper, and the solid were stirred again for 15 minutes with 30 ml acetone and filtered. The filtrates were evaporated. After complete evaporation, the final crude extract from the plant was then weighed, and preserved in sealed bottles in a refrigerator until required for bioassay.

Different plant extracts at concenterations of 1 and 2% (w/w) were mixed with 50 g of maize grains placed in 500

Table 1. Mean number of *S. cerealella* adults emerged and grain damage in maize treated with plant extracts

Treatment	Number of adults emerged		% Grain Damage	
Dose	2% conc	1% conc	2% conc	1% conc
Vitex negundo	18±2.79(4.19)^{b}	20±2.12(4.45)^{a}	4.62±0.58(12.33)^{a}	5.11±0.55(13.0)^{e}
Adathoda vasica	12.25±1.10(3.48)^{a}	15.5±1.55(3.92)^{a}	3.06±0.27(10.04)^{a}	3.96±0.36(11.45)^{d}
Catharanthus roseus	13.75±1.10(3.69)^{ab}	19±1.73(4.34)^{a}	3.50±0.26(10.77)^{a}	4.92±0.47(12.77)^{de}
Lantana camera	24.75±2.05(4.96)^{c}	29±3.42(5.42)^{b}	6.28±0.50(14.48)^{b}	7.43±0.84(15.74)^{f}
Control	39±0.57(6.24)^{d}	37.75±1.03(6.13)^{c}	14.25±1.97(22.17)^{c}	16.00±1.92(23.57)^{g}
CV	9.29	9.18	9.86	10.15

Each value is mean of four replicates (mean ± SEm). Figures in parentheses are square root (number of adults emerged) and angular (% grain damage) transformed values. Means followed by the same letter are not significantly different (P> 0.05) from each other using Duncan's Multiple Range Test.

ml jar and 50 one day old eggs of *Sitotroga cerealella*, after separating under binocular, were seeded in each treatment. The experiment was designed in four replications with untreated control. After 4 weeks the adults were counted for 15 consecutive days. The data on number of adults emerged, per cent grain damage and weight loss were recorded.

Data obtained were converted to angular transform and square root transform values and analyzed in a completely randomized design. The mean values of the experiments were separated using Duncan's Multiple Range Test.

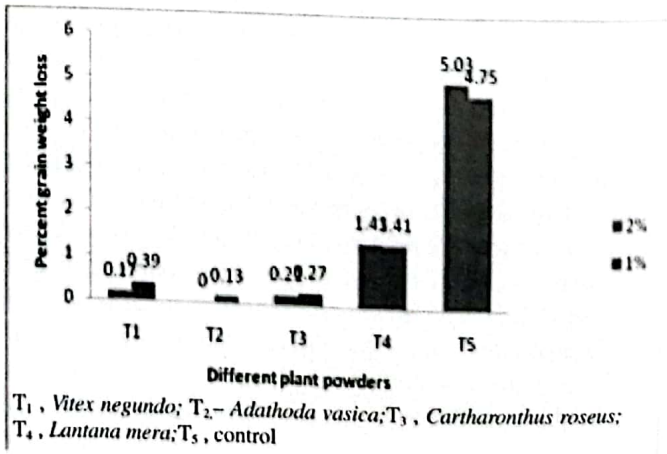
RESULTS AND DISCUSSION

The acetone extracts of four plant powders significantly affected the adult emergence compared to untreated grains (Table 1). Adult emergence of *Sitotroga cerealella* from grain treated with various plant extracts was influenced by the application rate of plant extracts. At 1% w/w of plant extracts minimum adult emergence was observed in *Adathoda vasica* (15.50), *Catharanthus roseus* (19) and *Vitex negundo* (20) while it was moderate in *Lantana camera* (24.75) compared to control (37.75). The same trend was followed at 2% w/w of plant extracts (12.25 to 18.0) resulting in significantly lower adult emergence compared to control (39). All levels of the acetone extracts of *Adathoda vasica, Catharanthus roseus* and *Vitex negundo* caused significant reduction in progeny emergence of *Sitotroga cerealella* which might be due to their ovicidal action. The present findings corroborate with Iqbal *et al.* (2010) who reported acetone extracts of sweet flag completely inhibited *Sitotroga cerealella* adult emergence. Similarly Prakash *et al.* (1990) reported fractionation of leaves of *Vitex negundo* acted as oviposition inhibitor against *Sitotroga cerealella*, lesser grain borer *Rhizopertha dominica* (Fab.) and rice weevil *Sitophilus oryzae*.

The minimum % of damage to grain caused by *Sitotroga cerealella* was recorded in *Adathhoda vasica* (3.06 to 3.96) which was on par with *Cartharanthus roseus* (3.50 to 4.92) and *Vitex negundo* (4.62 to 5.11) (Table 1). While *Lantana camera* (6.28 to 7.43) was moderately effective compared to untreated grains (14.25 to 16 %) at different application rates. This indicated that the active ingredients of botanicals which are responsible for the toxicity kill the insects gradually. The present findings are in agreement with Yadu *et al.* (2000) who reported minimum grain damage by *Sitotroga cerealella* when mixed with neem kernel powder.

The data on % grain weight loss of maize grains treated with 1% and 2% w/w acetone extracts of *Vitex negundo, Adathoda vasica, Catharanthus roseus* and *Lantana camera* indicated that all the treatments significantly reduced weight loss compared to the untreated check (Fig. 1). At 2% concenteration no weight loss was observed in maize grains treated with *Adathoda vasica.* However, some levels of grain weight loss, recorded for the remaining plant extracts were significantly low compared to untreated maize grains (4.75 to 5.03). Rahman *et al.* (2003) observed crude plant extracts of eucalyptus showed minimum grain weight loss by *Sitophilus granarious* (L.) in stored maize. With increasing number of adult emergence there was an increase in grain damage and grain weight loss (Fig. 2 and 3). The correlation coefficient between moth progeny and grain damage (r = 0.9653) and between moth progeny and weight loss (r = 0.9624) were positive and highly significant.

The effect of plant extracts on *Sitotroga cerealella* clearly indicated that *Adathoda vasica, Catharanthus roseus* and *Vitex negundo* have insecticidal property against



T_1, *Vitex negundo;* T_2– *Adathoda vasica;* T_3, *Cartharonthus roseus;* T_4, *Lantana mera;* T_5, control

Fig 1. Effect of various plant extracts on % grain weight loss in maize

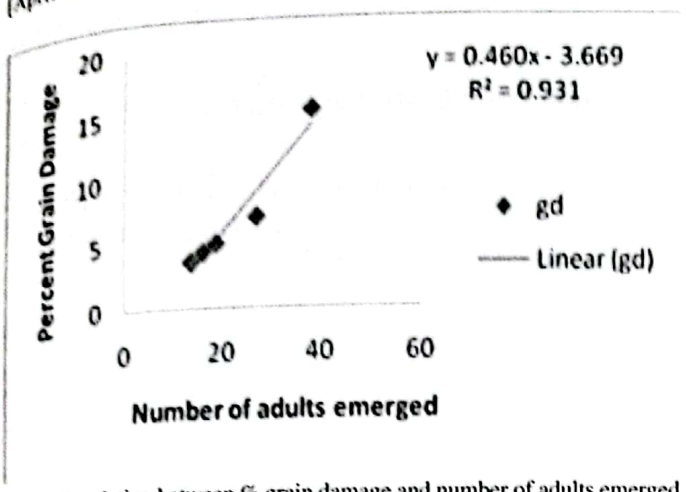


Fig. 2. Correlation between % grain damage and number of adults emerged

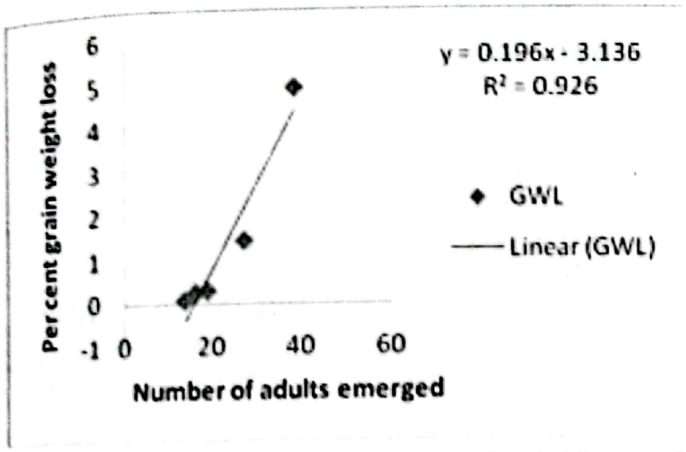


Fig. 3. Correlation between % grain weight loss and number of adults emerged

storage pests. Such studies on botanical derivatives as insecticides will benefit farmers as these substances are not only cheaper but also environment friendly.

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