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A study of toxicity of botanicals against two coleopteran stored grain pests

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Abstract
Stored grain pests *Sitophilus oryzae* and *Rhyzopertha Dominica* cause vast damage of stored grain and their products. Therefore an eco-friendly and safe means of control of these was by botanical insecticides. 7 plant extracts *viz*. Seeds of castor, custard apple, Soybean, sunflower and leaves of *Eucalyptus* and mint were prepared by solvent extraction method. Leaf powder of *Ocimum* was also used. The adulticidal effect was studied and LC_{50} Values calculated. All the six Botanical insecticides were effective. Eucalyptus seed extract was highly toxic and *Ocimum* leaf powder was least effective against the rice weevil and lesser grain borer.

Keywords: *Sitophilus oryzae*, *Rhyzopertha dominica*, adulticidal, botanicals

Introduction

Stored grain pests *S. oryzae* and *R. Dominica* belong to order Coleoptera and cause vast damage of grain as well as stored products (Singh *et al* 1996). Earlier these pests were controlled by chemical insecticides but with the increasing rate of resistance to these chemicals and also pollution hazards an alternate method was in demand. The botanical pesticides were one of the solutions as they are eco-friendly, biodegradable and less hazardous.

There is an inexhaustible range of botanicals and their use is gaining an increase due to higher safety and low residue hazards. The present investigation will evaluate the toxicity and protectant property of few plant products against two stored grain pests.

Material and Methods

Seven plant products *viz*. Seeds of *Ricinus communis, Annona squamosa, Glycine max* and *Helianthus annus* and leaves of *Eucalyptus* and *Mentha* were taken and extracts were prepared using petroleum Ether as solvent. Dry leaf powder of *Ocimum* was also used.

For adulticidal Test, 20 grams of wheat grain was taken in a culture tube and the botanical extract was mixed. 10 pairs of test insects were released and the tube was covered by muslin cloth using rubber bands. After 24 hours, mortality count was done. Tests were set in triplicates and Central experiment was also conducted. LC_{50} values were calculated by probit analysis (Finny, 1981) [3].

Result and Discussion

For all the botanical insecticides used the adults of *R.dominica* most susceptible to extract of leaves of *Eucalyptus* and least susceptible to dried leaf powder of *Ocimum sanctum*. The Lethal concentration (LC_{50}) of the botanicals for 50% mortality of adults of *R.dominica* were as follows (Table 1)-

Eucalyptus 5.98 µl, *Annona squamosa* 6.54µl, *Mentha* 6.68 µl, *Helianthus annus* 3.37µl, *Glycine Max* 25.51µl and *Ricinus communis* 37.13µl.

Eucalyptus, mint and custard apple extracts were 4 to 7 times more effective than extracts of sunflower, soybean and Castor.

Table 1: Relative toxicity of insecticides (botanical/chemical) to adults of *Rhyzopertha Dominica (Fab.)*

S. No.	Botanical/chemical insecticide	Heterogeneit X^2 (3)	Regression equation	LC_{50} (µl per 20g. wheat)	Sm	Fiducial limits
1	*Annona squamosa*	2.6803	Y=2.604x ± 4.937	6.542	0.0319	7.558-5.663
2	*Eucalyptus sp.*	5.2700	Y=3.139x ± 6.853	5.9759	0.0274	6.762-5.281
3	*Glycine max*	5.9903	Y=4.914x ± 16.653	25.510	0.0180	27.667-23.521
4	*Helianthus annus*	4.6408	Y=2.981x ± 8.023	23.373	0.0323	27.035-20.206
5	*Menth asp.*	2.7345	Y=2.6504x ± 5.1365	6.677	0.0308	7.674-5.809
6	*Ocimum sanctum*		Not Effective			
7	*Ricinus communis*	2.1919	Y=1.384x ± 1.325	37.125	0.0611	48.913-28.179

In none of the cases the data was found to be significantly heterogeneous at P=0.05, Y=Probit kill, x=log conc., Sm=standard error

Comparing the effect of some plant extracts on *S. oryzae* the results were almost similar, *Eucalyptus* was most toxic and castor was least effective. *Ocimum sanctum* had no toxic effect against *Sitophilus oryzae*. The toxicity of the plant extracts against the Rise weevil were as follows (table 2)-

Eucalyptus 13.89 µl, *Annona squamosa* 23.742µl, *Mentha* 16.99 µl, *Helianthus annus* 20.0702µl, *Glycine Max* 23.887µl and *Ricinus communis* 111.8µl.

Table 2: Relative toxicity of insecticides (Botanical/chemical) to the adults of *Sitophilus oryzae*

S. No.	Botanical/chemical insecticide	Heterogeneity χ^2 (3)	Regression equation	LC_{50} (µl per 20g. wheat)	Sm	Fiducial limits
1	*Annona squamosa*	1.16903	Y=3.068x + 0.7805	27.7423	0.02694	26.81195-21.02418
2	*Eucalyptus sp.*	2.51112	Y=10.838x + -7.3861	13.8936	0.00785	14.39483-13.40979
3	*Glycine max*	2.18406	Y=3.748x + -0.1649	23.8878	0.02277	26.47278-21.55520
4	*Helianthus annus*	1.32355	Y=3.173x + 0.8668	20.0702	0.02901	22.87746-17.60736
5	*Menth asp.*	2.98067	Y=24.5638x + -25.2218	16.9900	0.00379	17.29000-16.70000
6	*Ricinus communis*	1.57384	Y=1.384x ± 1.325	111.8000	0.01641	120.40000-103.90000

In none of the cases the data was found to be significantly heterogeneous at P=0.05, Y=Probit kill, Sm=Standard error, x=log conc.

Eucalyptus among other plant materials was effective against *R.dominica* when used by E. L. lakwah *et al* (1997) [2] and Gakuru and Fona (1995) [4].

Studies of Melkani *et al* (1989) [6] Patel and Veland (1994) [7] on the pesticidal activity of mint oil against *Sitophilus oryzae* showed 100% mortality within 48 hours of wheat treatment with 2% solution of oil in acetone.

Chinese cinnamon, *Cinnamonium cassa* was highly effective against both *S. oryzae* and *R.dominica* (Al Moajd, 2005) [1]. Similarly other spices like fenugreek (*Trigonella foenumgraceum*) and *Curcuma longa* were toxic against *R. Dominica* and *S. oryzae* (Matter *et al* 2008) [5].

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