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Insecticidal activity of seeds extracts of *Argemone mexicana* against *Tribolium castaneum* (Herbst, 1797) (Coleoptera: Tenebrionidae)

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ABSTRACT

Extracts from seeds of *Argemone mexicana* were tested against 6th instar larvae of the *Tribolium castaneum*.100% mortality was observed after treatment with acetone extract at 1.6ml/kg wheat while 56.6±4.16 larvicidal effect was observed after treatment with ethanol extract at the same dose 20.1±1.73 adult were emerged from those pupated having abnormalities. Only 50.6±4.35and 40.0±2.64larval mortality was recorded in chloroform and methanol extract respectively and from the remaining pupated, 23.3±2.08 and 16.6±1.52 adult emerge. Those treated at lower doses and having some adult emergence, most were having abnormalities. The acetone and ethanol extract can be used to control the infestation of the rust red flour beetle, *Tribolium castaneum.*

Key words-*Tribolium castaneum, Argemone mexicana*

INTRODUCTION

Infestation by stored-product pests causes serious losses in food and feed commodities (Ress,1996). Pest infestations are responsible for changes in the chemical composition of stored food, reductions in nutritional values and contamination by harmful compounds and allergens (Rajendran and Parveen 2005).Insects often cause extensive damage to stored grains and grain products, amounting to 5-10% loss in temperate regions and 20-30% in the tropical regions (Nakakita, 1998). In India, post-harvest losses caused exclusively by insect pests is 12% (Mohan, 2003).

The *Tribolium castaneum* is one of the most destructive pest throughout the world(Pronoto,*et. al.,*1991).The presence of this pest in stored products results in contamination and economic damage and also decreases their nutritive value as well (Barkholder and Faustini, 1991).Pesticide chemicals which are mostly used for crop protection could be environmentally pollutants and also have adverse effects on animals and human beings (Meena *et al.,* 2006, Hashim and Davi, 2003).

The plant kingdom can be a rich source ofa variety of chemicals with the potential for development as successful pest control agents (Rahaman *et al.*1999, Malik and Naqvi 1984). Secondary compounds from plants include

alkaloids, terpenoids, phenolics, flavonoids, and other minor chemicals can affect insects in several ways. The effects of plant products so far reported include insecticidal, repellent and anti-feedant activities (Huang *et al*., 1998).

In the present study *Argemone mexicana* has been selected as one of the safer substitutes to control the stored pest *Tribolium castaneum*.

MATERIAL AND METHODS

Initial stock of *Tribolium castaneum* was obtained from infested wheat grain bought from local market in Aurangabad and was reared in a plastic jar of 10kg capacity covered with muslin cloth to ensure ventilation in the laboratory. The grains were sterilized at 60˚C for24hours in an oven. A standard mixture of whole wheat grain with 5% powdered dry yeast was used as food medium throughout the experimental period with 70-75% relative humidity. Mature 6th instar larvae were selected for present study.

Preparation of plant extract

The seeds of *Argemone mexicana* were collected from the local market of Aurangabad and were washed with distilled water and dried in the shade and then oven for sterilization at 45^0c.The dried seeds were powdered with the help of the grinder. The powder of seeds was packed in the filter paper and extract was extracted in soxhlet apparatus in 1:10 ratio i.e.20gm of seed powder in 200ml solvent. After eight hours of continuous extraction the final extract was kept open to evaporate the solvent and remaining as a stock solution extract was stored in a refrigerator at 4^0c temperature with proper labeling. The extracts were extracted in chloroform, acetone, methanol and ethanol separately.

The seed extract of *Argemone mexicana* in each solvent was separately mixed with 25gm of crushed wheat grains at 0.4,0.8, 1.2 and 1.6ml/kg concentration and were placed into 250gms plastic bottles then five male and five female *Triboliumcastaneum*6^{th} instars larvae were placed into the plastic bottles and covered with a piece of muslin cloth, tied with rubber band to prevent escape. The experiment was conducted under the laboratory environment as mention above. The percentage of larval mortality, pupation, pupal mortality and number of adult emerged were recorded. The morphological abnormalities of the treated live larvae were recorded in each group. The abnormal individual was separated and the deformed character was studied.

RESULTS

The larvae were treated with the high dose of extracts had reduced body size and showed incomplete metamorphosis. No any mortality occurred in the larvae feed on controldiet. Larval mortality was increased with increased concentration of seed extract of *Argemone mexicana.* In seed extract of *Argemone mexicana* in acetone at 0.4mlconcentration not larval mortality was recorded whereas atthe 1.6ml concentration 100% mortality was recorded. With the increase in the concentration, a significant reduction in pupation and adult emergence was observed. Pupation was 76.7±1.52% at 0.4ml concentration which decreases to 33.4±4.04% at 1.2ml concentration of *Argemone mexicana*. At 1.6mlconcentration of extract 100% pupal mortality was observed. In ethanol extract at 0.4ml concentration larval mortality was recorded as 13.3±1.52% while 56.6±4.16% larval mortality was recorded at 1.6ml concentration of *Argemone mexicana*. As the concentration increased, a significant reduction in pupation and adult emergence was observed in ethanol extract. Pupation was 86.7±1.52%in 0.4ml concentration in ethanol which decreased to 43.4±3.51% at 1.6ml concentration of *Argemone mexicana.*so correspondingly only 20.1±1.73 adult emergences were recorded at 1.6ml concentration of *Argemone mexicana* because pupal mortality increased insignificantly with increase of the concentration. At 0.4ml concentration, 13.3±1.52% pupal mortality which increased to 23.3±2.51at 1.6ml concentration of *Argemone mexicana* in ethanol extracts.

The present investigation showed that the effect of different dose level of *Argemone mexicana* seed extract in acetone and ethanol on the larval, pupal and adult stages of the *Tribolium castaneum*. As the concentration increased a significant reduction in pupation and adult emergence was observed (Table 1) Body become paralyzed, black color, reduced body sized and shrinkage body segment. The treated larvae showed the curling up, vigorous body movement which are the characteristic of the neurotoxicity.

The Acetone and ethanol extract showed the highest mortality of larvae and pupa as compared with the methanol and chloroform extract.

Table 1 : Efficacy of seed extract of *Argemone mexicana* in chloroform, Acetone, Methanol and Ethanol solvents against larval to adult mortality of *Tribolium castaneum*

Solvent	Conc. of extract in ml/kg	Larval mortality (%)	Pupation (%)	Pupal mortality (%)	Adult emergence (%)
Chloroform	Control	0	100	0	100
	0.4	0	100	0	100
	0.8	23.3±1.15	76.7±1.52	13.3±1.15	63.4±2.51
	1.2	36.6±1.52	63.4±2.51	16.6±2.08	46.8±4.72
	1.6	50.6±4.35	49.4±4.16	23.3±1.52	26.1±2.30
Acetone	Control	0	100	0	100
	0.4	23.3±2.08	76.7±2.30	13.3±1.15	63.4±3.78
	0.8	40.0±1.73	60.0±3.00	16.6±1.52	43.4±3.51
	1.2	66.6±0.05	33.4±4.04	23.3±2.08	10.1±1.00
	1.6	100	0	0	0
Methanol	Control	0	100	0	100
	0.4	0	100	0	100
	0.8	3.33±1.52	96.6±4.99	6.00±2.64	90.6±1.00
	1.2	46.6±2.88	53.4±378	13.3±1.52	40.1±3.60
	1.6	40.0±2.64	60.0±4.00	16.6±1.52	36.6±2.51
Ethanol	Control	0	100	0	100
	0.4	13.3±1.52	86.7±1.52	13.3±1.52	73.4±3.78
	0.8	33.3±2.51	66.7±2.51	13.3±1.15	53.4±4.16
	1.2	46.6±3.05	53.4±4.16	16.6±2.08	36.8±3.05
	1.6	56.6±4.16	43.4±3.51	23.3±2.51	20.1±1.73

± indicates the standard Deviation of three observations.

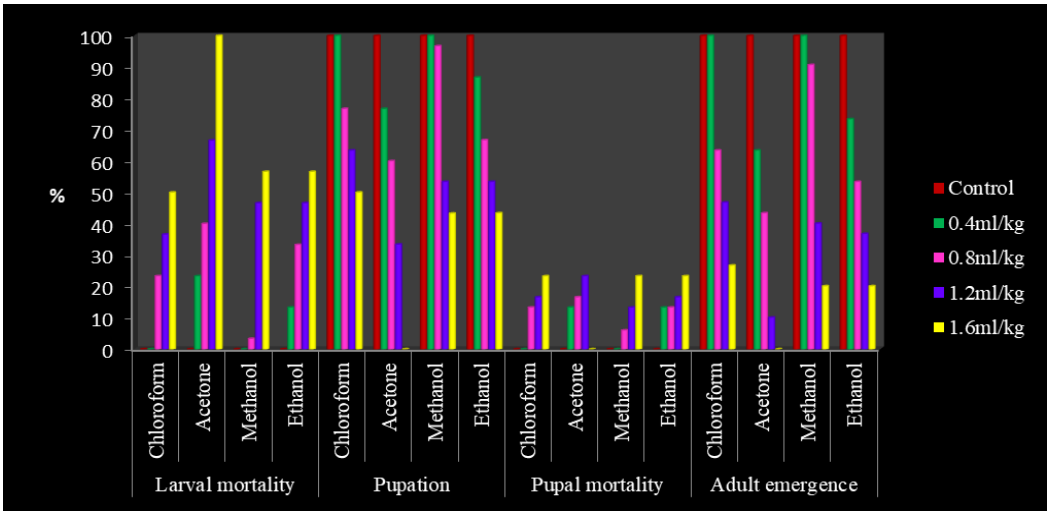

Figure 2: Efficacy of seed extract of *Argemone mexicana* in chloroform, Acetone, Methanol and Ethanol solvents against larval to adult mortality of *Tribolium castaneum.*

DISCUSSION

The *Argemone mexicana* showed the insecticidal activity on *Tribolium castaneum* and might have a potential role as an alternative pest control. Chemical investigations of this plant have revealed the presenceof alkaloids (Hussain *et al.,* 1983; Nakkady *et al.,*1988), amino acids (Dinda *et al.,* 1986), phenolics (Harborne *et al.,* 1983) and fatty acids (Gunstone*et al.,*1977). The plant is used mostly for the treatment of HIV (YuChwen *et al., 2003*). The plant contains many alkaloids (YuChwen *et al.,* 2003, Sangwan and Malik,1998) and was found to possess larvicidal and growth inhibiting activity against the second instar larvae of *Aedes aegypti* (Sakthivadivel and Thilagavathy, 2003). *A. mexicana* was found to be the

most efficient deterrent agent against *A. aegypti.* Ranvir and Chaterjee, (1989) studied the toxicity of *A. mexicana*seeds to rats and observed significant reduction in body weight, significant increase in blood glucose.

Petroleum ether extract and acetone extract of *Argemone mexicana* leaves possess maximum ovicidal effect against *T. granarium* (Dwivedi and Kumar,1998). Three iso quinoline alkaloids have been isolated as dihydropalmitine hydroxide; berberine and protopine, from the seeds. Oil contain up to 40% free glycerides of fatty acids (Anonymous, 2004). Protopine and sanguinarine in seed of *A. mexicana* was identified as the active moiety causing snail death by co-migration of active agent with seed powder (Singh and Singh, 1999).

CONCLUSION

The seed extract of *Argemone Mexicana* have potential as grain protectants. Their extract in acetone has strong insecticidal effect against *Tribolium castaneum.* These plants have a range of chemicals which can be isolated and used for pest control.

In the investigation it may be conclude that seed extract of *Argemone mexicana* in acetone can be used to control the Infestation of *Tribolium castaneum* in wheat.

Conflicts of interest: The authors stated that no conflicts of interest.

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