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To evaluate the relative toxicity and residual toxicity of leaf extracts against stored grain pest

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Abstract
Sitophilus oryzae is one of the most destructive insects of stored grains. Various insecticides can be used to control the *Sitophilus oryzae*. But chemical pesticides are harmful for the humans and livestock. Use of Biopesticides reduces the health hazards and do not harm the environment. Plant products are easily available and are economic too. In the present investigation two commonly available leaves *viz Eucalyptus* and *Mentha* are used as Botanical.
In the present investigation petroleum ether extract of *Eucalyptus* sp. and *Mentha* sp. are used against *Sitophilus oryzae*. Both extracts provided promising results to control the *Sitophilus oryzae* in wheat.

Keywords: Relative toxicity, leaf extracts, *Sitophilus oryzae*, residual toxicity

Introduction
Rice weevil *Sitophilus oryzae* is one of the most destructive insects of stored grain. Various insecticides can be used to control the rice weevil. But chemical pesticides cause irreparable consequences on the environment, human health and livestock. Therefore an ecofriendly alternative to chemical pesticides is required. Biopesticides can reduce the pest population and provide sustainable solution against the damage caused by pests. The biodegradability, non-persistence and users safety are the main cause of their preference. The plant products are indigenous and abundantly available as well as they are economic too. The potential of leaf extracts as biopesticides is evaluated in the present investigation. In this study the relative toxicity and residual toxicity of leaves of *Eucalyptus* and *Mentha* sp was evaluated.

Materials and Methods
For conducting tests, insects were reared at 27±2ºC temperature and 65±5 relative humidity. Wheat grains were used as culture medium. Mass rearing of insects was carried out in glass bottles covered with muslin cloth. Extract of leaves of *Eucalyptus* sp. and *Mentha* sp. were evaluated for relative toxicity and residual toxicity. Fresh leaves were washed with water, dried in shade and then the dried leaves were powdered in a mixture cum grinder. Extract of leaves was prepared in Petroleum ether by *Soxhlet* extraction method. Several preliminary tests were performed to obtain the relative mortality between 5 to 90%. The mortality count for each botanical was recorded at five different concentrations replicated thrice, along with a set of control experiments. The mortality concentration was corrected by Abbot's (1925) [2] formula. Data was subjected to probit analysis (Finney 1952), So as to calculate relative toxicity.
For the assessment of residual toxicity wheat seeds and botanical were mixed thoroughly. The mortality count was recorded 3 DAT, 7 DAT, 15 DAT, 30 DAT, 60 DAT and 90 DAT. Then the residual toxicity was calculated. For the residual toxicity experiments only those concentrations of botanicals were taken, which were able to kill about 100% population of test insect.

Table 1: Relative toxicity of botanicals used.

S. No.	Common Name of Plant	Botanical Name of Plant	Plant part used	LC_{50}(µl)	Fiducial limits (µl)
1	*Eucalyptus*	*Eucalyptus* sp.	Leaves	13.8936	14.39483 13.40979
2	*Mint*	*Mentha* sp.	Leaves	16.9900	17.29000 16.70000

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Table 2: Residual toxicity of botanicals (in terms of percent mortality).

S. No.	Botanical used	Concentration (µl)	Percent mortality due to residue of deposits						
			1 DAT	3 DAT	7 DAT	15 DAT	30 DAT	60 DAT	90 DAT
1	*Eucalyptus*	17	91.67%	70.00%	30.00%	6.60%	-	-	-
2	*Mentha*	20	98.33%	50.87%	29.82%	5.00%	-	-	-

Result and Discussion

The relative toxicity of Botanicalwas calculated by taking *Eucalyptus* as a standard insecticide. *Eucalyptus* leaf extract was most toxic to *Sitophilus oryzae* having LC_{50} value 13.8936µl.*Mentha* leaf extract was also very toxic to *Sitophilus oryzae* with LC50 value 16.9900 µl. Both *Eucalyptus* and *Mentha* leaf extract application prooved to be significantly superior to control.

Central Potato research institute at Meerut reported *Eucalyptus* as a good grain protectant against *Sitophilus oryzae* in rice grain.

Byung-Lolee *et al*. (2004) [5] estimated the furmigant toxicity of essential oil from family myrtaceas against 3 major stored grain insects *Sitophilus oryzae*, *Tribolium castaneum* and *Rhyzopertha dominica*. Among these *Eucalyptus* oil also was found toxic to *Sitophilus oryzae*. The essential oil vapours distilled from anise, cinamine, *Eucalyptus* were reported fumigants and caused 100% mortality of eggs of *Tribolium confusum*.

Ashok Kumar *et al*. (2009) [4] used *Mentha* oil against *Aspergillus flavus* in chickpea seeds and reported that *Mentha* oil exhibited the broad fumigant toxicity against 14 storage fungi and showed insecticidal potential against *Callosobruchus chinensis*.

Derbalah and Ahmed (2011) [3] reported that oil and powder of *Menthaviridis* were effective against *S, oryzae* compared to the control treatment. Spearmint oil and powder do not significantly affect wheat grain germination relative to the control treatment.

Kumar *et al*. (2011) [9] reported that *Mentha* possess the insecticidal potential against the stored grain pests. Fumingant and repellent activity of *Mentha* essential oil has been studied against several stored grain pests including *S. oryzae*.

Abbas and Javed (2012) [1] reported that essential oil extracted from *Mentha longifolia* were tested in the laboratory for volatile toxicity against two stored product insects, *Tribolium castaneum* and *Callosobruchus maculatus*. The oil displayed the insecticidal activity against both the test insects.

Mishra *et al*. (2012) [8] evaluated the repellent action of *Eucalyptus* oil against Tribolium castaneum and *Sitophilus oryzae*. Their observations confirmed that *Eucalyptus* oil have repellency against both insects.

So the above findings support the results of present investigation. In residual toxicity experiments *Eucalyptus* oil was able to prevent the attack of rice weevil for about 15 days only. *Mentha* leaf extract was found effective for 7 to 15 days. After 15 days, residue of *Mentha* was not detectable.

Conclusion

From the above finding it is concluded that *Eucalyptus* leaf extract and *Mentha* leaf extract can be used for control of stored grain pest *Sitophilus oryzae*.

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