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Mortality effect of pesticides against *Tribolium castaneum*

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Abstract
Toxicity of pesticides *Acorus calamus* (AC), Eucalyptus oil (EO) was tested against *Tribolium castaneum* by Filter Paper Impregnation method (FPIM) after 24 hours treatment. The LC_{50} of AC and EO was observed that 24.68 µl/ cm2, 0.6510 µl/cm^2 respectively. The LC_{50} value of Deltamethrin (DM) was found to be 0.016 6µl/cm^2.

Keywords: Mortality effect, pesticides, *Tribolium castaneum,* Eucalyptus oil, *Acorus calamus*

Introduction
Collins (1990) [6] reported a new resistance to pyrethroids in *Tribolium castaneum* (Herbst). Zettler *et al.* (1990) [20] worked on pesticide resistance in *Tribolium castaneum* (Coleoptera: Tenebrionidae) and *Rhyzopertha dominica* (Coleoptera: Bostrichidae) in wheat. Samate *et al.* (1998) [17]. Worked on aromatic plants of tropical West Africa. VII. Chemical composition of the essential oils of two Eucalyptus species (Myrtaceae) from Burkina Faso: *Eucalyptus alba* Muell. and *Eucalyptus camaldulensis*. Dehnardt. Tunç *et al.* (2000) [18] worked on ovicidal activity of essential oils from five plants against two stored-product insects Park *et al.* (2002) [12] reported insecticidal activity of asarones identified in *Acorus gramineus* rhizome against three coleopteran stored-product insects. Tunç *et al.* (2000) [18] reported the ovicidal activity of essential oils from five plants against two stored-product insects. Mondal and Khalequzzaman (2006) [9] reported the toxicity of essential oils against red flour beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae). Mahfuz and Khanam (2007) [10] reported the toxicity of some indigenous plant extracts against *Tribolium confusum* Duval. Magdy and Samir (2008) [8] worked on chemical composition and insecticidal potential of essential oils from Egyptian plants against *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) and *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae) Kambouzia *et al.* (2009) [7] worked on fumigant Toxicity of *Eucalyptus Leucoxylon* against Stored Product Insects. Bachrouch *et al.* (2010) [2] reported fumigant toxicity of *Pistacia lentiscus* essential oil against *Tribolium castaneum* and Lsioderma serricorne. Bagheri *et al.* (2011) [3] worked on bioactivities of essential oil of Eucalyptus globolus L. against *Tribolium castaneum*. Caballero-Gallardo *et al.* (2012) [4] reported the repellency and toxicity of essential oils from Cymbopogon martinii, Cymbopogon flexuosus and Lippi origanoides cultivated in Colombia against *Tribolium castaneum*. Sehgal *et al.* (2013) [15] reported the variation in susceptibility of field three stored grain insect species to spinosad and chlorpyrifos-methyl plus deltamethrin on hard red winter wheat. Sehgal *et al.* (2014) [16] reported the variation in susceptibility of field strains of three stored grain insect species to spinosad and chlorpyrifos-methyl plus deltamethrin on wheat.

Material and Method
Rearing Procedure
The Initial culture of *Tribolium castaneum* was taken from the Laboratory of Department of Zoology Federal Urdu University of Karachi and reared at 30 ± 5.0 °C on Flour. The insects were kept in 1 liter glass jars. The Mouth of jars were covered with a piece of muslin cloth tied by means of rubber band. A humidities was placed into mountain humidity at 25 ± 5 °C. Flour were used as food and egg laying media. The egg were laid but the adults, died in about a week. New adults emerged in about 25 – 30 days. After emergence the new adults they were transfer to other jar containing fresh grains.

Experiment for Toxicity

In each 90 mm 6 sets of perti dishes, six sets were prepared after preliminary tests the selected volume of pesticide was applied on the inner surface of 5 petri dishes, while 6th petri dish was not treated i. e control. Then 10 pairs of *Tribolium castaneum* were released for judging the toxicity level and later on egg laying. The dishes were placed at 30 °C ±5.0 °C mortality were noted daily. The procedure was followed for standard and candidate phytopesticide. Filter Paper Impregnation Method used.

$$\text{For mean mortality} = \frac{\text{Average mortality} \times 100}{\text{Total insects}}$$

$$\text{For } LC_{50} = \mu l/cm^2 = \frac{\text{Conc. of solution} \times \text{Volume} \times 1000 \times \frac{1}{9}}{100}$$

Formula for statistical analysis:

$$\text{Abbots formula} = \frac{\text{test mortality} - \%\ \text{control mortality}}{100 - \text{control mortality}} \times 100$$

$$\text{Standard deviation} = \frac{\sqrt{\sum x^2 - n\,(x)^2}}{n - 1}$$

$$\text{Standard Error} = \frac{S.D}{\sqrt{n}}$$

Table 1: Toxicity of *Acorus calamus* against *Tribolium castaneum* after 24 hours of treatment by Filter Paper Imprignation Method showing LC_{50} value as 24.68 µl/cm^2.

S. No.	Dose in ml	Dose in µl/cm^2	Mean Mortality %	S.D	S.E
0	Control %				
1	2	2.222	16.66 %	0.67	0.236
2	3	3.333	38.33%	1.36	0.965
3	4	4.444	45%	1.00	0.707
4	5	5.555	56.66%	0.68	0.240
5	6	6.666	81.65%	0.69	0.243

Table 2: Toxicity of *Eucalyptus oil* against *Tribolium castaneum* after 24 hours of treatment by Filter Paper Imprignation Method showing LC_{50} value as 0.6510 µl/cm^2.

S. No.	Dose in ml	Dose in µl/cm^2	Mean Mortality %	S.D	S.E
0	Control				
1	0.500	0.2777	23.33 %	6.76	4.7808
2	0.250	0.138	35%	1.00	0.707
3	0.125	0.0694	48.33%	2.26	1.598
4	0.625	0.3472	61.66%	3.565	2.51
5	0.312	1.56	81.66%	0.6	0.424

Table 3: Toxicity of Deltamethrin against *Tribolium castaneum* after 24 hours of treatment by Filter Paper Imprignation Method showing LC_{50} value as 0.0766 µl/cm^2.

S. No.	Dose in ml	Dose in µl/cm^2	Mean Mortality	S.D	S.E
0	Control				
1	0.00625	0.3472	21.5 %	0.9	0.318
2	0.0125	0.00694	36.66%	0.5	0.353
3	0.025	0.0138	45%	1.00	0.707
4	0.500	0.2777	68%	1.5	1.060
5	0.100	0.0555	83.3%	3.00	1.060

Result

Toxicity of *Acorus calamus* was observed when five doses applied 2.222, 3.333, 4.444, 5.555 and 6.666 µl/cm2 mortality was found 16.66, 38.33, 45, 56.66, 81%. The LC_{50} value calculated 24.68 µl/cm^2 (Shown in table 1). Similarly the toxicity of Eucalyptus oil observed different five doses 0.277, 0.138, 0.0694, 0.3472 and 1.56 µl/cm^2 mortality was found to be 23.33, 35, 48.33 61.66 and 81.66%. The LC_{50} value calculated as 0.6510 µl/cm^2 (Shown in table 2) The toxicity of Deltamethrin was observed after applied different doses 0.3472, 0.00694, 0.0138, 0.2777 and 0.0555 µl/cm2 mortality was found to be 21.5, 36.66, 45, 68, 83.3%. The LC_{50} value was calculated 0.0766 µl/cm^2 (Shown in table 3).

Discussion

Chander *et al.* (1990) [5] observed the high mortality was observed at both levels of *A. calamus* and only a few progeny adults could emerge from the 0.1% level. *T. castaneum* adults suffered negligible mortality at all storage intervals, however, more than 50% reduction was achieved at the 0.1% level. In the present study. Toxicity of *Acorus calamus* was observed when five doses applied 2.222, 3.333, 4.444, 5.555 and 6.666 µl/cm^2 mortality was found 16.66, 38.33, 45, 56.66, 81%. The result was comparable may be due to similar specie and pesticides.

Athanassiou *et al.* (2005) [1] reported the contrast, at rates ≥100 ppm, azadirachtin was equally effective against S. oryzae on whole rye and oats, where mortality was 100% after 7 and 14 d of exposure, respectively. NeemAzal was not very effective against *T. confusum* where adult mortality was low, even after 14 d of exposure at the highest rate. In the present study Phytopesticides used and the mortality was observed 24 hours of treatment. Toxicity of *Acorus calamus* was observed when five doses applied 2.222, 3.333, 4.444, 5.555 and 6.666 µl/cm^2 mortality was found 16.66, 38.33, 45, 56.66, 81%. And Eucalyptus oil observed different five doses 0.277, 0.138, 0.0694, 0.3472 and 1.56 µl/cm2 mortality was found to be 23.33, 35, 48.33 61.66 and 81.66%. The result showed that the phytopesticides are effective against stored grain.

Negahban. M., Moharramipour (2007) [11] worked on the essential oils from Eucalyptus intertexta R.T. Baker, Eucalyptus sargentii Maiden and Eucalyptus camaldulensis Dehnh. The mortality of 1- to 7-day-old adults of the insect pests increased with concentration from 37 to 926 µl/l air and with exposure time from 3 to 24 h. The LC_{50} values to the selected essential oils were between 2.55 and 3.97 µl/l air for *Callosobruchus maculatus*, 6.93 and 12.91 µl/l for *S. oryzae* and 11.59 and 33.50 µl/l air for *T. castaneum*. In the present study the toxicity of Eucalyptus oil observed different five doses 0.277, 0.138, 0.0694, 0.3472 and 1.56 µl/cm2 mortality was found to be 23.33, 35, 48.33 61.66 and 81.66%. The LC_{50} value calculated as 0.6510 µl/cm^2. By Filter paper Imprignation method The result was not similar may be due to different method.

Sahaf *et al.* (2008) [14] reported the chemical composition of the essential oil was assessed via GC and GC-MS. 1, 8-Cineol (18.23%), α-Pinene (16.20%) and Sabinene (5.67%) were determined to be the major constituents of the oil. The fumigant toxicity of the essential oil was tested against 1–7 day-old adults of *Tribolium castaneum* (Herbst) and *Sitophilus oryzae* (L.) at 27 ± 1 °C and 60 ± 5% r.h. in darkness. The mortality of adults was tested at different concentrations ranging from 37.0 to 925.9 µL/L air and different exposure times (1–30 h) At concentrations higher

than 185.2 µL/L air, the mortality was recorded at more than 50% after 10 h, and reached 100% after 12–16 h. Data probit analysis demonstrated that *S. oryzae* (LC_{50} = 31.96 µL/L air) was more susceptible than *T. castaneum* (LC_{50} = 47.27 µL/L air. In the present study two phytopesticides *A. calamus* and Eucalyptus oil the LC_{50} calculated 24.68 µl/cm^2 and 0.6510 µl/cm^2 respectively. The deltamethrin LC_{50} calculated 0.0766 µl/cm^2. After 24 hours treatment of *Tribolium castaneum* by Filter paper impregnation method. The result was not similar may be due to different methodology.

Velki *et al*. (2014) [19] The results showed that according to the LC_{50} values, toxicity of the investigated insecticides could be arranged in the following order: pirimiphos-methyl > dimethoate > deltamethrin. The results of the present study clearly indicate that there is an influence of substrate on the susceptibility of *T. castaneum* to insecticides and that the efficacy of different insecticides is affected by exposure substrate. In the present study deltamethrin used against *T. castaneum*. The result showed that deltamethrin is highly toxic as compare to phytopesticides.

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