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Comparative efficacy of botanical extracts and synthetic insecticides against *Tribolium castaneum* H. (Coleoptera: Tenebrionidae) in Peshawar

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Abstract
Comparative efficacy of two botanical extracts viz. *Melia azedarach, Polygonum hydropiper*, an insecticide Chlorpyrifos and a control check was studied under laboratory conditions. The main goal of the study was to examine the susceptibility in various populations of the red flour beetle, *Tribolium castaneum* (Herbst) to dissimilar insecticides. The adult stage of *Tribolium castaneum* was tested. The bioassays were conducted by offering treated wheat flour pellets in glass vials of 2cm in diameter. The mortality data were recorded for 12, 24, 48, 72 and 96 hours after providing food to the test insect. Food consumption data was recorded at the end of the experiment. Results regarding *T. castaneum* mortality rate in *Polygonum hydropiper* revealed 32%, *Melia azedarach* 37%, Chlorpyrifos 100% while in control check, it revealed 12%. While results regarding *T. castaneum* food consumption in *Polygonum hydropiper* revealed 0.4g, *Melia azedarach* 0.2g, Chlorpyrifos 0.1g while in control check it revealed 01g. Chlorpyrifos was found the most toxic among the tested chemicals. Both botanical extracts exerted much lesser mortality as compared to Chlorpyrifos but significantly affected the diet consumption rate. The control check also had a minor effect on adults of the *T. castaneum* although it was prepared from the distilled water.

Keywords: *Melia azedarach, Polygonum hydropiper,* Chlorpyrifos and *Tribolium castaneum*

1. Introduction
The red flour beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebroinidea) eat stored grain product(s) like cereals, beans, dried pet food, chocolate, seeds, etc. and importantly "The Wheat" [1]. These insects have chewing mouthparts but surprisingly they do not bite [7]. They generally produce an odor which is sensitive to different human responses [3]. They also work as parasitoids; feed on variety of storage fungi species and play a vital role in nutrition [19]. Their eggs are whitish or colorless where the food particles always are adhered to its sticky surface [19]. The length of its eggs is 0.61mm x 0.35mm [14]. Their larvae's posture is slender and cylindrical, and color becomes honey colored or cream to yellow, with brown heads. They have six legs and two separate, black, branched projections on their posterior body segment [15]. The color of the Pupae is white, going to be pale brown as they develop [15]. The size of the adult is approximately 3-4mm. Their adults have strong wings and are able to fly [19].
The subsistence rate of *T. castaneum* larvae and the re-generative potential of females evidently increase when they are fed on *Aspergillus candidus* [29] and it is simple to include brewer's yeast into culture media for its larvae. The population of red flour beetle is diminished by the number of parasites, parasitoids and predators which cause trouble to its lifecycle in every stage. The fungus *Beauveria bassiana* has proven efficacy for many insect pests of stored grain and grain products but after few other fungi and some bacteria.

2. Materials and Methods
The experiment was conducted at the Insecticide Toxicology Laboratory, Department of Plant Protection, The University of Agriculture, Peshawar. The experimental conditions were 25 ± 2 °C and 65 ± 5% RH and 08-hours photoperiod (Author 2000).

2.1 Insect rearing
The test insect (*T. castaneum*) was obtained from the insect rearing laboratory, Plant Protection Department, The University of Agriculture, Peshawar. As and when required, the *T. castaneum* culture was maintained in the laboratory under the fore-mentioned conditions for the last 10 years.

2.2 Candidate insecticide

Among the candidate insecticides the Chlorpyrifos, was obtained from the local market and used in the experiment. The botanical extracts were prepared in the Agricultural Chemistry Department, The University of Agriculture Peshawar, according to the below mentioned methods.

2.3 Plant extract

The plant material i.e., *Melia azedarach* L. (droops) and *Polygonum hydropiper* L. (stems and leaves) were used in the experiment. These plants were brought to the laboratory for drying. After shade drying, the material was grounded with a grinding machine. Then those were weighed and both the samples (*Melia azedarach* and *Polygonum hydropiper*) of 100gm were soaked in with 200ml Ethyl acetate for 24hours. After 24hours, the soaked samples were stirred with a magnetic stirrer and then filtered. After filtration the samples were taken to the rotatory evaporator for formation of crude extract concentration with Ethyl acetate to make it ready for use in experiment.

2.4 Procedure for the Test

The *Tribolium castaneum* were collected from the wheat flour in laboratory conditions. The vials (of about 2cm in diameter) were used for this purpose. These vials were first cleaned and then made free of the micro-organisms by keeping them in autoclave for 120 °C for 10 minutes. After 10 minutes, they were then cooled at room temperature and were brought into use. The adults of *T. castaneum* were then reared in those glass vials for 12hours. The pellets were then prepared from wheat flour (2gm each) and for each replication the pellets were then mixed with 2ml of stock solution of the four test chemicals which were, *Polygonum hydropiper*, *Melia azedarach*, Chlorpyrifos and distilled water (Control check). After the pellets were mixed with chemicals, they were then offered to adults of *T. castaneum* after 12hours. The data was dependent on completely randomized design (CRD) and is of 12, 24, 48, 72 and 96 hours' time period. After 96 hours, the feeding activity of the *T. castaneum* was noted.

2.5 Data collection and Analysis

The experimental data was collected for the time period of 12hrs, 24hrs, 48hrs, 72hrs and 96hrs. The experiment was repeated four times with four chemicals along with check control. The experiment was laid out in completely randomized design (CRD). The data was converted into percentage and then analyzed by using computer based software Statistix 8.1 and LSD (Least significant difference) test was used for mean comparison.

3. Results and Discussion

The data was collected after 12hrs, 24hrs, 48hrs, 72hrs and 96hrs from providing food (pellets) to the *T. castaneum* into the vials. Total number of *T. castaneum* were 160 in 16 vials (10 *T. castaneum* each) with three different pesticides, *Polygonum hydropiper*, *Melia azedarach*, Chlorpyrifos and distilled water (Control check). On each pesticide, 40 *T. castaneum* were tested by making the pellets.

The results (Table 1) revealed that among the tested chemicals, Chlorpyrifos appeared to be the most toxic by causing 100% mortality even within 12hrs after insect release. *Melia azedarach* caused much lower level of toxicity (37%) as compared to the Chlorpyrifos but it was slightly more virulent than the *Polygonum hydropiper*. It could be concluded that the botanical extracts were comparative less toxic as compared to the Chlorpyrifos but significantly more toxic as compared to the control check.

The results (Table 2) showed that the insects were observed to have consumed minimal amount (0.1gm) of diet treated with Chlorpyrifos. The botanical insecticides also caused significant feeding deterrence as compared to the control check (1.0gm).

The findings of our study regarding Chlorpyrifos toxicity towards *Tribolium castaneum* are not inline to the findings of Larry J. Z. *et al*., (1990), in which eight strains of *T. castaneum* were tested for Chlorpyrifos. Results of selective dose tests of the red flour beetle clearly mentioned that 1 strain was resistant to phosphine, all strains were resistant to Malathion and no strain was resistant to Chlorpyrifos.

Our results are also in agreement with Larry J. Z. (1991), who tested different doses of chemicals on *T. castaneum* to find out the resistance in the test insect. Results indicated that out of 28 total strains of the test insect, 93% were resistant to malathion, 64% to dichlorvos and 36% strains of *T. castaneum* were resistant to that of Chlorpyrifos.

The results of our study are also in line with Andric G. *et al*., (2010), who examined the susceptibility of red flour beetle *Tribolium castaneum* (Herbst) in several populations from Serbia and proved that the most toxic insecticide for adults was deltamethrin followed by malathion and Chlorpyrifos among the tested contact insecticides.

Furthermore, our study showed somehow similarity with Khalequzzaman M *et al*., (2001), who tested nine insecticides against the mortality test of *T. castaneum* by applying different doses of insecticides by residual film method. The results revealed that Lambda cyhalothrin showed greatest toxicity followed by Malathion, then Carbosulfan and least toxicity by Chlorpyrifos.

Result, obtained from acute toxicity assays of different insecticides showed that Chlorpyrifos had the highest toxicity against red flour beetle. Our results agree with those found by Uddin and Ara (2006), who reported that Chlorpyrifos had the most efficacies against red flour beetle compared with Malathion, Carbosulfan, Dicofol, Cypermethrin and Lambda cyhalothrine.

Our results are also exactly parallel to the findings of the Samad V *et al*., (2012), who tested the efficacy of three insecticides viz. Chlorpyrifos, Abamentin and Deltamethrin against the adults of *T. castaneum* (Herbst). The toxicity of insecticides tested was significantly different. The results showed that Chlorpyrifos had the most toxicity, followed by Deltamethrin which had the least toxicity against *T. castaneum* adults.

4. Conclusion and Recommendations

Chlorpyrifos was found the most toxic among the tested chemicals. Both botanical extracts exerted much lesser mortality as compared to the Chlorpyrifos but significantly affected the diet consumption rate. The control check also has a minor effect on the adults of the *T. castaneum* although it was prepared from the distilled water. Whatever the toxic level of the Chlorpyrifos was, the feeding on the pellets was similar to those of the less toxic treatments. It is recommended that the higher dose of *Melia azedarach* and *Polygonum hydropiper* might be used against the pests in stores for effective control, if the extract taken into the organic solvents.

Table 1: Mortality rate of *Tribolium castaneum* adults as affected by the different chemicals under laboratory conditions**.**

Treatments	12hours	24hours	48hours	72hours	96hours	Mean	% Mortality
Polygonum hydropiper	1.5	1.7	2.2	03	3.2	2.32 b	32%
Melia azedarach	2.2	2.5	03	3.7	3.7	3.02 b	37%
Chlorpyrifos	10	10	10	10	10	10 a	100%
Control Check	0.2	0.5	0.5	01	1.2	0.68 b	12%
Mean	3.48 c	3.68 c	3.93 bc	4.43 ab	4.53 a	-	-

* Mean followed by same letters (row wise) is non-significantly different = * significance at $p \leq 0.05$
LSD (0.05) for chemicals = 4.51, LSD (0.05) for Time period= 0.580

Table 2: Diet consumption rate of *Tribolium castaneum* as affected by the different chemicals under laboratory conditions

Treatments	Pre-feeding diet weight	Post-feeding diet weight	Mean	Diet consumed
Polygonum hydropiper	3g	2.6g	2.8 a	0.4g
Melia azedarach	3g	2.8g	2.9 a	0.2g
Chlorpyrifos	3g	2.9g	2.95 a	0.1g
Control Check	3g	2.0g	2.5 b	1.0g

* Mean followed by same letters (row wise) is non-significantly different = * significance at $p \leq 0.05$
LSD (0.05) for chemicals = 0.21

5. References

1. Ahmed H. Losses incurred in stored food grain by insect pest. Pak. J Agric. Res. 1983; 4:198-207.
2. Ashfaq M, Khan AR, Khan MA, Rasheed F, Shahid H. Insect orientation to various colour lights in the agricultural biomes of Faisalabad. Pak. J. Entomol. 2005; 27:49-52.
3. Alanko K, Tuomi T, Vanhanen M, Pajari BM, Kanerva L, Havu K, *et al*. Occupational IgE-mediated allergy to *Tribolium confusum* (Confused flour beetle). J. Agric. Sci. 2000; 55:879-882.
4. Andric G, Kljajic P, Peric I, Prazic G M. Susceptibility of red flour beetle *Tribolium castaneum* (Herbst) populations from Serbia to contact insecticides. Julius-Kuhn-Archiv. 2010; 420-425.
5. Barrer TM. A field demonstration of odour based, host food finding behaviour in several species of stored grain insects. J stored prod. 1983; 19:105-111.
6. Dowdy AK. Mortality of red flour beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebroinidea) exposed to high temperature and diatomaceous earth combinations. J stored prod. 1999; 35:175-182.
7. Hayashi N. A contribution to the knowledge of the larvae of Tenebrioindae occurring in Japan (Coleoptera: Cucujoidea). Crop Protection. 1966; 3:44-50.
8. Jilani G, Saxena RC, Rueda BP. Repellent and growth inhibiting effects of Turmeric oil, Sweet flag oil, Neem oil and “Margosan-O” on the red flour beetle, *Tribolium castaneum* (Coleoptera: Tenebroinidea). J econ. Entomol. 1988; 81:1226-1230.
9. Khalequzzaman M, Jesmun N. Toxicity of nine insecticides to adult *Tribolium castaneum* (Herbst). J Biol. Sci. 2001; 1(11):1043-1045.
10. Khan AA, Rath S, Shankar U. Effect of coloured light on larval growth of rust red flour beetle, *Tribolium castaneum* (Herbst). California J Eco. Entomol. 1998; 5: 181-184.
11. Khattak SUK, Shafique M. Varietal susceptibility of ten wheat cultivars flour to red flour beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebroinidea). Pakistan J Zool. 1986; 18:257-261.
12. Larry JZ, Gerrit WC. Pesticide resistance in *Tribolium castaneum* (Coleoptera: Tenebrionidae) and *Rhyzopertha dominica* (Coleoptera: Bostrichidae) in Wheat. J Econo. Entomol. 1990, 1677-1681.
13. Larry JZ. Pesticide resistance in *Tribolium castaneum* and *T. confusum* (Coleoptera: Tenebrionidae) from flour mills in the United States. J Econo. Entomol. 1991, 763-767.
14. Leelaja BC, Rajashekar Y, Rajendran S. Detection of eggs of stored-product insects in flour with staining techniques. J stored product res. 2007; 43(3):206-210.
15. Lyon WF. Confused and Red Flour Beetles. Ohio State University Extension Fact Sheet. 2000; 4:2087-2097.
16. Levinson HZ, Levinson AR. Storage and insect species of stored grains and tombs in ancient Egypt. J Entomol. and Zool. 1985; 100:321-330.
17. Li L, Arbogast RT. The effect of grain breakage on fecundity, development, survival and population increase in maize of *Tribolium castaneum* (Herbst) (Coleoptera: Tenebroinidea). J Stored Prod. Res. 1991; 27:87-94.
18. Maqsood K, Khalil SU, Hussain N, Hamed M. Combined infestation and losses caused by three storage insects in Pak-81 wheat variety. Crop Protection. 1988; 25:23-26.
19. Mason LJ. Grain Insect Fact Sheet E-224-W: Red and Confused Flour Beetles, *Tribolium castaneum* and *Tribolium cunfusum*. Annual review of Entomol. 2003; 2:44-57.
20. Narayanan ES, Lal R, Rahlkar GW, Sethi GR, Saxena PN. Studies on the effects of beta radiations on insects: The effects of beta radiation (irrigation of egg stage and first instar larvae) on the life history of *Corcyra cephalonica*. J. stored prod. 1959; 12:186-191.
21. Ramos E, De Conconi J, Conconi J, Elorduy C, Oxley T, Barry S. Laser light as a new potential method for pest control in preserved foods; Bio deterioration. Environ. Entomol. 1983; 2:33-88.
22. Samad V, Moosa S, Vahid M, Hediyeh G, Zahra A. Efficacy of some insecticides against red flour beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae) adults exposed on glass, ceramic tile, plastic and paper disc surfaces. J Life Sci. 2012; 6:405-410.
23. Sokoloff A, Hoy MA, Johnson GR. Linkage studies in *Tribolium castaneum* (Herbst). J. stored prod. res. 1966; 1:255-260.
24. Shafique M, Ahmed M. Susceptibility of milled rice genotypes to Angoumois grain moth, *Sitotroga cerealella* (Olive) (Lepidoptera: Gelechiidae). SAARC J Agric. 2003; 1:193-197.
25. Uddin MA, Ara N. Temperature effect on the toxicity of six insecticides against red flour Beetle, *Tribolium castaneum* (Herbst). J Life Earth Sci. 2006; 1:49-52.
26. Vaidya VG, Kothari RM, Gedhole NN, Patil SP. Effect

of gamma irradiation on the protein metabolism in Drosophilidae (Diptera). Crop Protection. 1974; 57:545-550.

27. Viswanathan G, Rao SJ, Chakravarthy C. Response of *Tribolium castaneum* to different colours of light during night and change in their intensities. Insect Environ. 1996; 2:90-94.
28. White NDG, Leesch JG. Chemical control in Integrated management of insects in stored products. J stored products. 1992, 287-330.
29. Wright VF, Burroughs R. Mold-damaged grain sorghum as a diet for three stored-grain beetles (Coleoptera). Environmental Entomol. 1983; 12:558-560.