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## Antixenosis Test on Red Flour Beetle *Tribolium castaneum* Herbst. (Coleoptera; Tenebrionidae) Against Different Stored Product Commodities under Lab. Conditions

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**Abstract:** Research was conducted to determine the preference and non-preference behaviour of red flour beetle against wheat, rice, paddy and sunflower crushed grains under laboratory conditions in university of Arid Agriculture Rawalpindi, Pakistan during 2000. In the antixenosis experiment, the red flour beetles were observed at 24 h interval. Red flour beetle had shown highest preference to rice crushed grains with mean  $9.2500 \pm 1.8875$ , medium preference to paddy crushed grains with mean value  $5.2500 \pm 2.7500$  and least preference to wheat and sunflower with mean value  $1.5000 \pm 0.5000$  and  $1.5000 \pm 0.8660$  respectively.

**Key words:** Antixenosis, *Tribolium castaneum*, stored, commodities

### Introduction

Agriculture is the largest sector of Pakistan economy. It contributes more than 24% to Gross Domestic Product. The world's major agricultural commodities include wheat, rice, maize, cotton and sugarcane. Wheat is the most important crop as it is extensively grown all over the world, covering the largest acreage of land annually and fitting well with most crop rotations (Directorate of Agriculture Information, Punjab, 1980). It being a major cereal occupies an eminent place in the economy of our country (Chowdhry *et al.*, 1998). It constitutes about 80% of total intake (Baloch and Irshad, 1986).

Rice (*Oryza sativa* L.), is the second most important food staple of Pakistan after wheat. Rice is grown in all the provinces of Pakistan (Chaudhry, 1994). Sunflower is the oilseed crop. In Pakistan, sunflower was first introduced as an oilseed crop in 1960's. Extensive research work on the different aspects of this crop has continued since 1964 (Hatam and Abbasi, 1994).

Bulk of the harvested cereal crushed grains are stored in the godowns on large or small scales as storage of food crushed grains is inevitable both in times of deficit and surplus production (Lal, 1996). Grain is living entity, which is affected by biotic and a biotic factors resulting in qualitative and quantitative (Ahmed, 1995). According to Singh *et al.* (1997) food grains under storage conditions are damaged by several biotic and a biotic processes. Among the biotic factors insect pests are the major agents which cause considerable losses in terms of quantity and quality of food grains. Different commodities are attacked by different insect pests. They cause heavy losses each year due to which about 25-30% crop yields are damaged in the field and stores (Lal and Srivastavas, 1996). Wheat

during storage suffers about 4% weight loss due to insects that account for about 1000 million rupees loss per year (Hashmi, 2001).

Red flour beetle (Coleoptera; Tenebrionidae) is major secondary pest. It is a pest of cosmopolitan nature especially of tropical regions and has great impact on the economy of Pakistan, which should not be under estimated (Hamed and Khattak, 1985). Under optimum condition single pair of this pest can accelerate its progeny to one million in 150 days (Gray, 1948). Both the larva and adult cause damage (Atwal, 1976). Red flour beetles mix up their excreta, create offensive smell in products reducing their nutritive value (Anisa, 1971).

The main objective of research work was to determine the preference and non-preference of Red flour beetle against different stored product commodities crushed grains.

### Materials and Methods

Research was conducted on the Antixenosis test against red flour beetle among different stored product crushed grains under laboratory conditions in University of Arid Agriculture Rawalpindi, Pakistan. These stored crushed grains include wheat, rice, paddy and sunflower. 25 g of each commodity was placed inside the four wooden boxes at each corner randomly. The wooden box measure about 40 cm length and 30 cm wide in size. Each box represented single replication and each stored commodity represented a single treatment. In the experiment, there were four replications and treatments. These treatments were wheat crushed grains (Treatment 1), rice crushed grains (Treatment 2), paddy crushed grains (Treatment 3) and sunflower crushed seeds (Treatment 4). Each treatment was placed in complete randomized design (CRD). 25

adults of Red flour beetle were released in the center of the boxes. The boxes were immediately closed after the release to avoid the escape of red flour beetle. The data were recorded after 24 h interval. The data recorded for antixenosis test were subjected to the statistical analysis as one way ANOVA using Statistical Package for Social Sciences (SPSS, 10th version) program. Least Significant test was applied to analyze the significance of mean difference. The Duncan test was applied to make Homogeneous subset of mean and categorize the level of preference among stored crushed grains. The graphical representations were made in Microsoft Excel program.

### Results and Discussion

Number of *Tribolium castaneum* was recorded in all replications against different factors (Fig. 1). The minimum number of red flour beetle was 1 and maximum number was 3 attracted towards wheat crushed grains. The minimum number of beetle was 6 and maximum was 13 attracted towards rice crushed grains. The minimum number of the beetle was 0 and maximum number was 13 attracted towards paddy crushed grains. The minimum number of beetle was 1 and maximum number was 4 attracted towards sunflower crushed grains. Red flour beetle had shown non-responsive behaviour in two ways. First non-response behaviour of beetle to all crushed grains was by remaining in the center of the experimental wooden boxes shown by 4 beetles only. Second non-response behaviour of beetle was the escaped behaviour into corner and minute crevices of wooden box. Escaped behaviour was observed in 26 beetles in all replications. According to Miller and Miller (1986) and Kogan (1994), resistance can also be measured in term of the insects as food preference.

The mean number of red flour beetle adults was analyzed on different stored crushed grains including wheat, rice, paddy and sunflower (Table 1, Fig. 2). Minimum mean numbers of red flour beetle were recorded on wheat crushed grains  $1.5000 \pm 0.5000$  and sunflower crushed grains  $1.5000 \pm 0.8660$ . Mean number of adult beetles on paddy crushed grains was  $5.25 \pm 2.7500$ . Maximum mean number of beetles was recorded on rice crushed grains  $9.2500 \pm 1.8875$ . Total mean population of adult red flour beetles on all sixteen treatments was  $4.3750 \pm 1.1361$ . Daniels (1956) reported that red flour beetle preferred the finer milling products of corn and wheat.

Analysis of Variance of recorded data had shown the significance of research treatments with F value 4.515 and probability value 0.024 (Table 2). Least significance difference (LSD) test was applied to evaluate significance

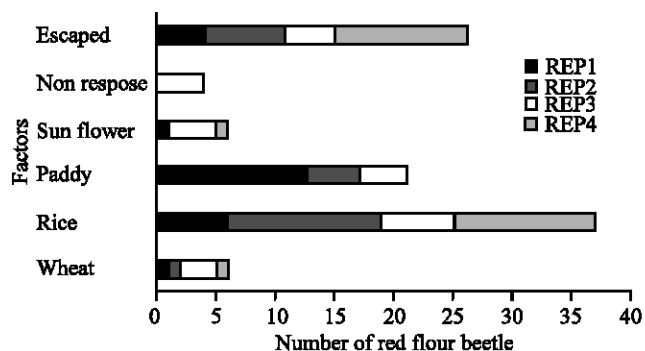


Fig. 1: Response shown by red flour beetle under different factors in the laboratory during 2000

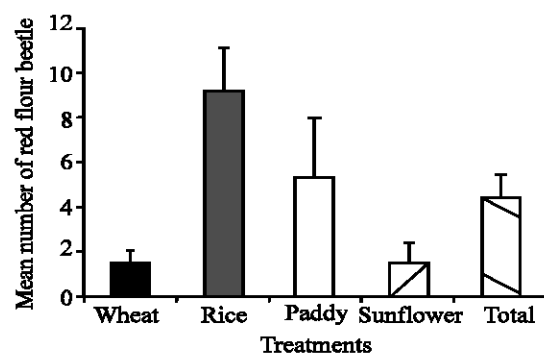


Fig. 2: Mean number of red flour beetle on different stored product crushed grains  $\pm$  S.E.

Table 1: Mean number of red flour beetle on different stored products  $\pm$  S.E

Treatments	Mean $\pm$ S.E
Wheat Crushed Grains	1.5000a $\pm$ 0.5000
Rice Crushed Grains	9.2500b $\pm$ 1.8875
Paddy Crushed Grains	5.2500ab $\pm$ 2.7500
Sunflower Crushed Seeds	1.5000a $\pm$ 0.8660
Total	4.3750 $\pm$ 1.1361

Table 2: Analysis of variance for red flour beetle

	Sum of Square	df	Mean square	F value	Sig. Value
Between Groups	164.250	3	54.750	4.515	0.024*
Within Groups	145.500	12	12.125		
Total	15.000				

mean difference among different treatments (Table 3). Significant mean difference at 0.05 significance level was recorded between treatment 1 (wheat crushed grains), treatment 2 (rice crushed grains) and treatment 4 (sunflower crushed grains)  $\pm 2.4622$  S.E. and probability value 0.008. Results had shown different level of preference towards these treatments.

Duncan test was applied on means to make different homogeneous subsets to categorize the level of preference of red flour beetle against stored crushed grains. All means of one homogeneous subset belonged to same level of preference (Table 1). Wheat crushed

Table 3: Least significance test applied on means of red flour beetle

Significance test	Treatment (I)	Treatment (J)	Mean difference(I-J)	S.E.	Significance
LSD Test	Wheat	Rice	-7.7500*	2.4622	0.0080
		Paddy	-3.7500	2.4622	0.1540
		Sunflower	0.000	2.4622	1.0000
	Rice	Wheat	7.7500*	2.4622	0.0080
		Paddy	4.0000	2.4622	0.1300
		Sunflower	7.7500*	2.4622	0.0080
	Paddy	Wheat	3.7500	2.4622	0.1540
		Rice	-4.0000	2.4622	0.1300
		Sunflower	3.7500	2.4622	0.1540
	Sunflower	Wheat	0.0000	2.4622	1.0000
		Rice	-7.7500*	2.4622	0.0080
		Paddy	-3.7500	2.4622	0.1540

grains and sunflower seeds were least preferred by red flour beetle. Paddy crushed grain was included in both homogeneous subsets had shown intermediate preference towards red flour beetle and rice crushed grains was highly preferred by red flour beetle as food source. In the experiments it was concluded that the red flour beetle least preferred the wheat crushed grains which is against the result that it mostly preferred the wheat flour (Lecato, 1975; Khattak *et al.*, 1994; Sattigi *et al.*, 1996). The main reason was that red flour beetle was secondary pest and mostly preferred the flour form of stored commodities. According to Daniels (1956) the survival and reproduction of red flour beetle was more on wheat flour.

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