

## EFFECT OF TEMPERATURE ON THE DEVELOPMENT OF LESSER GRAIN BORER, *RHYZOPERTHA DOMINICA* FB. IN STORED WHEAT

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### ABSTRACT

Ten genotypes of stored wheat (00183, 01180, 01196, 01197, 00055, 00057, SH-2002, AS-2002, V-98059, and V-99022) were screened for resistance/susceptibility against *Rhyzopertha dominica* Fb. Under three temperature levels (25°C, 28°C, 30°C with RH 75%) and room conditions with 23 to 30 °C and 60-75 percent RH. The data regarding emergence of male female, number of damaged grains, weight of damaged grains and grain weight loss were recorded in various genotypes after three months storage period i.e March, April, and May, 2004. The genotype SH-2002 showed maximum emergence of females (27.58) and males (6.58), maximum number of damaged grains (53.75/50g) with maximum weight (1.68/50g) and maximum weight loss (3.36%). V-98059 showed minimum emergence of males (3.33), females (9.33) and minimum number of damaged grains (16.75), whereas weight of damaged grains (0.37%) and loss in grains weight (0.75%) was the lowest on AS-2002. The genotypes AS-2002 and V-98059 showed relatively resistance response to *R. dominica*. The emergence of female ( $r=0.820$ ) and male ( $r=0.712$ ), number of damaged grains ( $r=0.997$ ) and weight of damaged grains showed positive and highly significant correlation with grains weight loss. The temperature of 28 °C was found to be the most favourable for the development of pest.

**KEYWORDS:** *Triticum aestivum*; storage; *Rhyzopertha*; temperature; Pakistan.

### INTRODUCTION

A safe grains storage is necessary to meet the food requirements of ever-increasing population. In developing countries like Pakistan, it is essential to save even a single grain. A programme to reduce the storage losses can increase about 10-25 percent food availability for the nourishment of 150.6 million people of Pakistan (2). The most common insect pests of stored wheat

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in Pakistan are *Sitophilus oryzae* (L.), *Tribolium castaneum* (Hbst.), *Rhizopertha dominica* (Fb.), *Oryzaephilus surinamensis* (L.), *Trogoderma granarium* (Fb.) and *Sitotroga cerealella* (Oliv.) (3,5,6,8). These insects pests damage the stored wheat both quantitatively and qualitatively.

Saxena and Singh (7) studied the reproduction potential of *R. dominica* and the losses inflicted by it on 32 wheat varieties. Raj -911 with 4.92 percent weight loss was recorded to be the most resistant variety followed by HUW – 213, HW-147, HP-1498, WH-416, K- 800, HP- 1102, K- 8027 and HK-2285 with 6.74, 6.90, 7.54, 7.66, 7.75, 7.80, 8.3 and 85 percent weight loss, respectively. They also observed that the insect pest oviposited 151.64-300.74 eggs on different wheat varieties. Ishtiaq *et. al.* (4) recorded survival of larvae on advanced line 89053 which was significantly maximum (98.54%) followed by 88022 (95.82%) and 90204 (96.28%).

Anonymous (1) conducted two experiments on varietal resistance in wheat against *R. dominica*. In first experiment Kohistan-97, V- 99091, V-94195 and Parwaz-94 were exposed to two same aged adults of *R. dominica*. They found V-94195 as susceptible regarding grub population, whereas V-94091 showed maximum number and weight of damaged grains. Similarly, this genotype resulted in maximum loss in grain weight. In second set, Durum- 97, V-95153, V-95069, V-97088 were included. Genotype V-95069 was found to be susceptible showing maximum loss in grain weight (7.10%). Anonymous (2) studied nine genotypes of stored wheat viz. V-97603, V97024, Parwaz-94, V-97112, V-97046, Pb-96, V-97052, V-97005, and MH-97 against *R.dominica* under  $28^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and  $70 \pm 5$  percent relative humidity. Maximum weight loss was noted in Pb-96 which showed susceptible response, whereas minimum loss was recorded on V-97603 (0.41%).

The present research was conducted on ten genotypes of stored wheat to screen resistant/susceptible genotypes of stored wheat against *R. dominica* and also to find out the relative effect of various temperatures on insect development and grain loss.

## MATERIALS AND METHODS

The study was carried out in the laboratory of Entomological Research Institute, AARI, Faisalabad. The experiment was started on February 28, 2004 and observations were recorded after three months storage period. Ten

genotypes of stored wheat viz. 00183, 01180, 01196, 01197, 00055, 00057, SH-2002, AS-2002, V-98059 and V-99022 were tested for their resistance/susceptibility to *R. dominica* (Fb.) under various room temperatures. Fifty gram grains of each genotype were weighed and put into 120 petri dishes (15 cm dia ), comprising three petri dishes of each genotype and there were four sets in total. Thus the experiment was replicated thrice under completely randomized design. Three sets, each containing 30 petri dishes, were kept into three incubators at 25°C, 28°C and 30°C, respectively. The fourth set was kept under room temperature ranging from 23-30°C at 60-75 percent relative humidity. Five hundred gram grains of stored wheat (cv. SH-2000) were put into a glass jar (2 kg capacity) and ten pairs of adults of *R. dominica* were liberated. Five jars containing the same materials were maintained. These jars were fumigated with Agtoxin tablets @ six g per 300 cm<sup>3</sup> feet area before liberation of the pest to avoid prior infestation in grains. After ten days of liberation adults were taken out from each jar. The jars were observed daily and newly adults of *R. dominica* of same age were taken out, paired and then two pairs were released in each jar to get same aged adults. After ten days of release, adults were taken out from each jar. The jars were observed daily and newly emerged adults of *R. dominica* of same age were taken out, paired them and then two pairs were liberated into each petri dish containing various genotypes of stored wheat under variable temperatures. Number of male and female emerged, number of damaged grains, weight of damaged grains and loss in grains weight were determined after three months of pest liberation from each petri dish. The loss in grains weight was calculated by the following formula.

$$\text{Weight loss (\%)} = \frac{\text{Weight of damaged grains (g)}}{\text{Total weight of grains (g)}} \times 100$$

The data were analyzed statistically. The effect of biological parameters (female and male emergence) on non-biological parameters (number and weight of damaged grains and weight loss) were determined by calculating correlation coefficients.

## RESULTS AND DISCUSSION

The results (Table 1) revealed significant differences among entries regarding all the parameters studied. The entry SH-2004 showed susceptible response

Table 1. Relative development of *R. dominica* on various genotypes in stored wheat.

| Genotypes | No. of females emerged/2 pairs | No. of males emerged/ 2 pairs | No. of damaged grains/50g grain | Weight of damaged grains per 50g grain (g) | Grain weight loss% |
|-----------|--------------------------------|-------------------------------|---------------------------------|--------------------------------------------|--------------------|
| 00183     | 12.25 cd                       | 4.75 bc                       | 26.83 d                         | 0.82 b                                     | 1.65 b             |
| 01180     | 18.42 b                        | 5.50 b                        | 29.25 c                         | 0.68 e                                     | 1.36 d             |
| 01196     | 11.42 cde                      | 4.67 cd                       | 40.00 b                         | 0.77 c                                     | 1.54 c             |
| 01197     | 11.92 cde                      | 5.58 d                        | 27.58 d                         | 0.59 f                                     | 1.18 e             |
| 00055     | 19.50 b                        | 5.42 b                        | 39.58 b                         | 0.74 d                                     | 1.41 d             |
| 00057     | 11.75cde                       | 5.0 d                         | 23.67 e                         | 0.54 g                                     | 1.07 f             |
| SH-2002   | 27.58 a                        | 6.58 a                        | 53.75 a                         | 1.68 a                                     | 3.36 a             |
| AS-2002   | 10.08 de                       | 4.17 cd                       | 17.25 g                         | 0.34 j                                     | 0.67 h             |
| V-98059   | 9.33 e                         | 3.33 d                        | 16.75 g                         | 0.37 i                                     | 0.75 h             |
| V-99022   | 13.33 c                        | 4.38 bc                       | 21.75 f                         | 0.44 h                                     | 0.87 g             |

Column-wise means sharing similar letters do not differ significantly ( $P = 0.05$ ).

with maximum emergences of female (27.58) and male (6.58), number of damaged grains (53.75/50g grain) and weight of damaged grains (1.68/50g grain) and maximum loss in grain weight (3.36%). The entry V- 98059 found comparatively resistant with minimum emergence of female (9.33) and male (3.33) and the lowest number of damaged grains (16.75/50g grain). There was, however, significant difference in entry AS-2002. Similarly, AS-2002 with minimum weight of damaged grains (0.34g/ 50 g grain) and the lowest loss in grain weight(0.67%) did not show significant difference with those recorded in V- 98059 (0.37g) damaged weight/50g grain and 0.75% weight loss). All other entries showed variable responses in all parameters. The results (Table 2) showed that temperature 28°C was the most suitable for the development of pest with maximum number of damaged grains (51.17/50g grain), weight of damaged grains (1.11g/50 g grain) and maximum loss in grain weight (2.23%). The temperature level of 25 and 30 °C did not show significant effect on the emergence of female. The temperature of 30 °C did not favour the pest development resulting in minimum loss in grain weight (0.40%). The effect of room temperature was found to be intermediate.

Table 2. Comparison of means showing the effect of various temperatures on the development of *R. dominica* in stored wheat.

| Temperature (C°)         | No. of females emerged/ 2 pairs | No. of males emerged/ 2 pairs | No. of damaged grains/50g grain | Weight of damaged grains/ 50g grains (g) | Grains weight loss (%) |
|--------------------------|---------------------------------|-------------------------------|---------------------------------|------------------------------------------|------------------------|
| 25                       | 20.13 a                         | 6.60 a                        | 35.13 b                         | 0.82 b                                   | 1.61 b                 |
| 28                       | 19.23 a                         | 4.87 b                        | 51.17 a                         | 1.11 a                                   | 2.23 a                 |
| 30                       | 7.20 c                          | 2.60 d                        | 8.70 d                          | 0.20 d                                   | 0.40 d                 |
| Room temperature (23-30) | 11.67 b                         | 4.10 c                        | 23.83 c                         | 0.65 c                                   | 130.00 c               |

The results (Table 3) further showed highly positive and significant correlation between loss in grain weight and all parameters. The present findings can not

Table 3. Impact of various biological parameters on the grains weight loss caused by *R. dominica*.

| Dependent factor       | Independent factors |                |                          |                          |
|------------------------|---------------------|----------------|--------------------------|--------------------------|
|                        | Female emergence    | Male emergence | Number of damaged grains | Weight of damaged grains |
| Grains weight loss (%) | 0.820 **            | 0.712 **       | 0.885 **                 | 0.997 **                 |

\*\* Highly significant ( $P \leq 0.01$ ).

be compared with those of earlier workers (1, 2, 4, 7) who studied different varieties/advanced lines of stored wheat under different ecological conditions.

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