J. Plant Prot. and Path., Mansoura Univ., Vol. 4 (7): 661 - 668, 2013

PREFERABILITY OF DIFFERENT WHEAT AND RICE VARIETIES TO LESSER GRAIN BORER *Rhizopertha . dominica* F. INFESTATION:

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ABSTRACT

Choice and non-choice tests were carried out to determine the varietal preference of *Rhizopertha dominica* F. under laboratory conditions. Regarding to non-choice tests on different wheat varieties , data revealed that, Sakha 93, Sakha 94 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties. On the other hand, Sakha 105 was the most preferred rice variety, while Giza 181and Giza 177 were the least preferred rice varieties. In respect to free choice tests on different wheat varieties , the results indicated that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties. On the other hand, Sakha 105 was the most preferred rice variety, while Giza 181, Giza 177 and Egyptian jasmen were the least preferred rice varieties.

INTRODUCTION

The world population gets most of their daily energy needs from wheat and rice. The total grains produced (wheat and rice) in 2011 were 1.4 billion tonnes (Gt), and it is very important to store these grains without any losses to feed the ever growing global population (FAOSTAT, 2011).

The lesser grain borer, *R. dominica*, is a primary pest of stored grain in many regions of the world. The insect is injurious to cereals; breeds in corn, rice, wheat, and in other substrates containing starch. *R. dominica* is frequently captured in forest habitats and in grain storage environments. Recent studies suggest that the adults are likely to fly back and forth between agricultural and non-agricultural landscapes (Mahroof *et al.,* 2010).

Laboratory analysis of the main components of the different wheat and rice varieties suggested that the susceptibility of these varieties to S. *granarius* infestation may be attributed to the high content of protein and low content of carbohydrate compared to resistant varieties. Susceptibility and resistance of some stored grains to certain insects have been reported by several authors (Dick and Credland 1986 ; Dongre *et al.,* 1993 ; Kucerova and Stejskal, 1994; Ram and Singh, 1996 ; Ignacimuthu *et al.*, 2000 ; Ali *et al.*, 2004; Mebarkia *et al.* 2011 and Arthur *et al.*, 2012).

Therefore, the aim of the present work is to study the Preferability of different wheat and rice varieties to lesser grain borer *Rhizopertha . dominica* F. infestation

MATERIALS AND METHODS

Relative susceptibility of certain wheat varieties, broken wheat, rice varieties and broken rice to *Rhyzopertha dominica* F. were carried out under laboratory conditions at stored product pest laboratory, Sakha Agricultural Research Station. The insect pest was collected from the survey studies were maintained under laboratory conditions until use in the following investigation.

Stock culture of the insect was obtained by rearing each one on wheat (Giza 168) in an incubator maintained at 30+2°C and 70+5 % R.H. The technique used for obtained adults of the *R. dominica* with a same age was described by Sun (1987).

The varieties used of wheat were Sakha 93, Sakha 94 , Egypt 1, Egypt 2 , Gemeza 9, Gemeza 10 , Gemeza 11 , Gemeza 168, Shandwel 1 and Sedse 12 from Crop Research Institute. While, the varieties used of rice were Sakha 101, Sakha 102, Sakha 103, Sakha 104, Sakha 105, Giza 177, Giza 178, Giza 181, Giza 182 and Egyptian jasmen from Crop Research Institute.

Enough samples of wheat and rice grains of different used varieties were firstly sieved to remove stone, dust and insects. The grains were then sterilized by freezing for 24:48 hr at -18:-22°C to be assumed freedom from any insect infestation (El-Sabaay, 1998). All grains were maintained in an incubator at a constant temperature of 29 + 1°C and 65 + 5% RH for two weeks to obtain equilibration susceptibility of the tested wheat and rice varieties.

1. Non-choice infestation test:

The first experiment was conducted to study the resistant of wheat grain (crushed) and rice seeds under no choice conditions using 20 gm of each variety in glass jars (250 ml). Three replicates for each variety were used. Ten pairs of *R. dominica* adult beetles (10 day old) were introduced to each jar and allowed to mate and lay eggs on the seeds under the forementioned experimental conditions. After 10 days, the parents were removed, progeny as a number of adults, the percent of loss and damage for *R. dominica* were recorded after 60 days post-treatment. Seeds with the exist holes of insects were separated from the samples and conducted to estimate the percentage of infestation according to the following equation:

$$\% \text{ infestation} = \frac{\text{No. of infested kernels}}{\text{No. of total kernels (sound and infested)}} \times 100$$

The mean weight of 1000 grain before and after infestation was determined. The difference between initial weight and final weight was calculated .

2. Choice infestation test:

The second infestation experiment was carried out to study the *R. dominica* infestation levels under free-choice condition. In this experiment, glass jars accommodates ten varieties of rice seeds (with three replicates) and ten varieties of wheat grain (with three replicates) were used as choice chamber. Thirty Petri dishes (9 cm diameter) each contains 20 gm of a variety was used. Three hundreds adult of tested insect (150 pairs 10 day

old) were placed in the center part of each jar to give the insects a free choice to oviposit on any variety. The experiment was conducted at the conditions of (70 % R.H. and 27 °C). The parents were removed after ten days of treatment. After 60 days, the percent of damage and grain loss was estimated. Analysis of variance and Duncan (1995) were performed to rank the varieties according to their susceptibility to the insect.

RESULTS AND DISCUSSION

Choice and non-choice tests were carried out to determine the varietal preference of *R. dominica* under laboratory conditions. Four biological parameters were used as an indicator of the insect preference. These parameters were weight after damage, number of emerged progeny, the percentage of damage and the percentage of weight loss.

1. Non-choice test:

Data presented in Table (1) showed that the influence of different varieties of wheat on the weight after damage, number of emerged progeny, percentage of damage and percentage of weight loss caused by *R. dominica*. Regarding to the weight after damage, Seds 12 wheat variety was the highest weight after damage (9.4 ± 0.05 gm) followed by Egypt 2, Gemmeiza 10 and Gemmeiza 168 (9.2 ± 0.05 gm) and the lowest weight Sakha 93 (8.7 ± 0.19 gm). Meanwhile, Sakha 94 recorded the highest number of emerged progeny or the most preferred wheat variety (51.4 ± 7.92 indiv.) followed by Sakha 93 and Shandwell (27.3 ± 0.3 and 24.2 ± 0.11 indiv., respectively). Moreover, Sakha 93 recorded the higher percentage of damage (13.0 ± 0.2%) followed by Shandawel (12.0 ± 0.05 %). Also, Sakha 93 and Shandweel recorded the highest percentage of weight loss with 4.3 ±0.1 and 4.0 ± 0.50%, respectively. As a conclusion, data in Table (1) revealed that, Sakha 93, Sakha 94 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties. Statistical analysis revealed that, a high significant differences were obtained for each parameter according to the different wheat varieties in non-choice test.

These results are in agreement with those of El-Syrafi *et al.* (2005) and they found that, the insect a chance to choose the preferred food increased mean number of eggs/Female as well as mean number of the emerged individuals. Therefore, it could consider both Sakha 8 and Sakha 93 were the most susceptible wheat varieties.

Table (1): Influence of different wheat varieties on number of emerged progeny, the percentage of damage and the percentage of weight loss caused by *R. dominica* according to non-choice test.

Varieties	Mean ± SD			
	Weight after damage	No. emerged progeny/ F1	Damage (%)	Weight loss (%)
Sakha 93	8.7± 0.19 e	27.3 ± 0.30b	13.0 ± 0.20a	4.3 ± 0.10a
Sakha 94	9.1 ± 0.13bc	51.4± 7.92 a	10.2 ± 1.20b	3.5 ± 0.55abc
Egypt 1	9.0 ± 0.05cd	18.6± 0.11 bcd	10.0 ± 0.11b	3.3 ± 0.05bcd
Egypt 2	9.2 ± 0.05ab	13.0 ± 0.11d	8.0± 0.11 c	2.7± 0.05 de
Gemeza 9	9.1± 0.05 bc	15.1 ± 0.11cd	9.0 ± 0.05bc	3.0 ± 0.05cd
Gemeza 10	9.2 ± 0.05ab	13.1 ± 0.05d	8.0± 0.11 c	2.7± 0.05 de
Gemeza 11	9.1± 0.05 bc	15.1± 0.11 cd	9.0± 0.05 bc	3.0± 0.05 cd
Gemeza 168	9.2± 0.05 ab	13.1± 0.05 d	8.0± 0.11 c	2.7± 0.05 de
Shandwel	8.8 ± 0.05de	24.2 ± 0.11 bc	12.0 ± 0.05 a	4.0 ± 0.05 ab
Seds 12	9.4 ± 0.05 a	11.8 ± 0.11 d	6.0± 0.05 d	2.0± 0.05 e

Where weight before damage = 10 g
In the same column, means followed by the same letter are not significantly different according to DMRT at 0.05 level of probability.

The obtained results in Table (2) revealed that, the influence of different varieties of rice on the weight after damage, number of emerged progeny, percentage of damage and percentage of weight loss caused by *R. dominica*. Regarding to the weight after damage, Giza 181and Giza 177 rice varieties was the highest weight after damage (9.9 ± 0.05 gm) followed by Egyptian jasmen (9.8 ± 0.05 gm) and the lowest weight was Sakha 105 (9.2 ± 0.05 gm). On the other hand, Sakha 105 recorded the highest number of emerged progeny or the most preferred rice variety (8.9 ± 0.05 indiv.) followed by Sakha 102 (7.2 ± 0.05 indiv.). Moreover, Sakha 105 recorded the higher percentage of damage (8.0 ± 0.05%) followed by Shandawel (7.0 ± 0.05 %). Also, Sakha 105 recorded the highest percentage of weight loss with 2.6±0.05 . As a conclusion, data in Table (2) indicated that, Sakha 105 was the most preferred rice variety, while Giza 181and Giza 177 were the least preferred rice varieties. Statistical analysis revealed that, a high significant differences were obtained for each parameter according to the different rice varieties in non-choice test. These results in non-choice test are in agreement with those of Abo Arab *et al.*, (2006).

Table(2): Influence of different rice varieties on number of emerged progeny, the percentage of damage and the percentage of weight loss caused by *R. dominica* according to non-choice test.

Varieties	Mean + SD			
	Weight after damage	No. emerged progeny/ F1	Damage (%)	Weight loss (%)
Sakha 101	9.4 ± 0.05 cd	5.0 ± 0.1 c	6.0 ± 0.05 c	2.0 ± 0.10 c
Sakha 102	9.3 ± 0.05 de	7.2 ± 0.11 b	7.0 ± 0.05b	2.3± 0.05 b
Sakha 103	9.6± 0.05 b	3.5± 0.28 e	4.0± 0.05 e	1.3± 0.05 e
Sakha 104	9.5± 0.05 bc	4.2± 0.28 d	5.0± 0.05 d	1.6± 0.05 d
Sakha 105	9.2 ±0.05e	8.9± 0.05 a	8.0± 0.05 a	2.6± 0.05 a
Giza 177	9.9 ± 0.05a	1.2 ± 0.05f	1.0 ± 0.05g	0.3 ± 0.05g
Giza 178	9.6 ± 0.05b	3.5 ± 0.05e	4.0± 0.05 e	1.3 ± 0.05e
Giza 181	9.9 ± 0.05a	1.2 ± 0.05f	1.0 ± 0.05g	0.3 ± 0.05g
Giza 182	9.6 ± 0.05b	3.5 ± 0.05e	4.0 ± 0.05e	1.3 ± 0.05e
Egyptian jasmen	9.8 ± 0.05a	2.1 ± 0.11f	2.0 ± 0.05f	0.6 ± 0.05f

Where weight before damage = 10 g
In the same column, means followed by the same letter are not significantly different according to DMRT at 0.05 level of probability.

2. Free choice test:

Data given in Table (3) indicated that, the influence of different varieties of wheat on the weight after damage, percentage of damage and percentage of weight loss caused by *R. dominica*. Regarding to the weight after damage, Seds 12 wheat variety was the highest weight after damage (9.6 ± 0.05 gm) followed by Egypt 2, Gemmeiza 9, Gemmeiza 10, Gemmeiza 11 and Gemmeiza 168 (9.5 ± 0.057 gm) and the lowest weight Shandwell (8.9 ± 0.08 gm). Meanwhile, Sakha 93 recorded the higher percentage of damage (11.0 ± 0.57%) followed by Shandawel (10.0 ± 0.57 %). Also, Sakha 93 and Shandweel recorded the highest percentage of weight loss with 3.6 ±0.11 and 3.3 ± 0.05%, respectively. As a conclusion, data in Table (3) cleared that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties. Statistical analysis revealed that, a high significant differences were obtained for each parameter according to the different wheat varieties in non-choice test. These results were agreement with El- Syrafi *et al.*, (2005).

Table (3): Influence of different wheat varieties on the percentage of weight after damage, the percentage of damage and the percentage of weight loss caused by *R. dominica* according to free choice test.

Varieties	Mean + SD		
	Weight after damage	Damage (%)	Weight loss (%)
Sakha 93	8.9± 0.08 c	11.0± 0.57 a	3.6± 0.11 a
Sakha 94	9.4± 0.057 ab	6.0± 0.57 bc	2.0± 0.11 d
Egypt 1	9.3± 0.057 b	7.0± 0.57 b	2.3± 0.11 c
Egypt 2	9.5± 0.057 ab	5.0± 0.57 cd	1.6± 0.05 e
Gemeza 9	9.5± 0.057 ab	7.0± 0.57 b	2.3± 0.11 c
Gemeza 10	9.5± 0.057 ab	5.0± 0.57 cd	1.6± 0.05 e
Gemeza 11	9.5± 0.057 ab	5.0± 0.57 cd	1.6± 0.05 e
Gemeza 168	9.5± 0.057 ab	5.0± 0.57 cd	1.6± 0.05 e
Shandwel	8.9± 0.08 c	10.0± 0.57 a	3.3± 0.05 b
Seds 12	9.6± 0.11 a	4.0± 0.57 d	1.3± 0.05 f

Where weight before damage = 10 g
In the same column, means followed by the same letter are not significantly different according to DMRT at 0.05 level of probability.

Table (4): Influence of different rice varieties on the percentage of weight after damage, the percentage of damage and the percentage of weight loss caused by *R. dominica* according to free choice test.

Varieties	Mean + SD		
	Weight after damage	Damage (%)	Weight loss (%)
Sakha 101	9.6± 0.05 cd	4.0± 0.50 bc	1.3± 0.05 c
Sakha 102	9.5± 0.05 de	5.0 ± 0.57ab	1.6± 0.05 b
Sakha 103	9.8± 0.05 ab	2.0 ± 0.57de	0.6± 0.05 e
Sakha 104	9.7 ± 0.05bc	3.0 ± 0.28cd	1.0 ± 0.11d
Sakha 105	9.4 ± 0.05e	6.0 ± 0.57a	2.0± 0.11 a
Giza 177	9.9± 0.05 a	1.0± 0.05 e	0.3± 0.05 f
Giza 178	9.8± 0.05 ab	2.0± 0.57 de	0.6± 0.05 e
Giza 181	9.9± 0.05 a	1.0± 0.28 e	0.3± 0.05 f
Giza 182	9.8± 0.05 ab	2. ± 0.570 de	0.6± 0.05 e
Egyptian jasmen	9.9± 0.05 a	1.0± 0.17 e	0.3± 0.05 f

Where weight before damage = 10 g
In the same column, means followed by the same letter are not significantly different according to DMRT at 0.05 level of probability.

The results represented in Table (4) showed that, the influence of different varieties of rice on the weight after damage, percentage of damage and percentage of weight loss caused by *R. dominica*. Regarding to the weight after damage, Giza 181and Giza 177 rice varieties was the highest weight after damage (9.9 ± 0.05 gm) followed by Giza 178, Giza 182 and Sakha 103 (9.8 ± 0.05 gm) and the lowest weight was Sakha 105 (9.4 ± 0.05

gm). Moreover, Sakha 105 recorded the higher percentage of damage (6.0 ± 0.05%) followed by Sakha 102 (5.0 ± 0.05 %). Also, Sakha 105 recorded the highest percentage of weight loss with 2.0 ±0.05 . As a conclusion, data in Table (4) indicated that, Sakha 105 was the most preferred rice variety, while Giza 181, Giza 177 and Egyptian jasmen were the least preferred rice varieties. Statistical analysis revealed that, a high significant differences were obtained for each parameter according to the different rice varieties in non-choice test. Susceptibility and resistance of some stored grains to certain insects have been reported by several authors (Dick and Credland 1986 ; Dongre *et al.,* 1993 ; Ram and Singh, 1996 ; Su *et al.*, 1996 ; Ignacimuthu *et al.*, 2000 and Ali *et al.*, 2004).

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التفضيل الغذائى لحشرة ثاقبة الحبوب الصغرى لأصناف مختلفة من حبوب القمح والأرز

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أجريت هذه الدراسة لمعرفة مدى تفضيل ثاقبة الحبوب الصغرى لأصناف مختلفة من حبوب القمح والأرز تحت ظروف المعمل ، وذلك بإجراء اختبارين الأول يوفر للحشرة حرية اختيار الغذاء المفضل ، والثانى لا يوفر لها هذه الحرية . والنتائج أشارت إلى انه بالنسبة للاختبار الثانى ، الأصناف سخا 93 ، سخا 94 و شندويل كانت أكثر أصناف القمح تفضيلا للحشرة ، بينما الأصناف سدس 12، جميزة 11 و مصر 2 كانت اقل أصناف القمح تفضيلا للحشرة . على الجانب الأخر ، الصنف سخا 105 كان أكثر أصناف الأرز تفضيلا للحشرة ، بينما أصناف جيزة 181 و جيزة 177 كانت اقل أصناف الأرز تفضيلا للحشرة . أما بالنسبة للاختبار الأول ، فالنتائج أشارت إلى أن الأصناف سخا 93 و شندويل كانت أكثر أصناف القمح تفضيلا للحشرة ، بينما الأصناف سدس 12، جميزة 11 و مصر 2 كانت اقل أصناف القمح تفضيلا للحشرة . من ناحية أخرى ، الصنف سخا 105 أكثر أصناف الأرز تفضيلا للحشرة ، بينما أصناف جيزة 181 ، جيزة 177 و الياسمين المصرى اقل أصناف الأرز تفضيلا للحشرة.

قام بتحكيم البحث

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