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PREFERABILITY OF DIFFERENT WHEAT AND RICE VARIETIES TO *Tribolium castaneum* (HERBST)INFESTATION

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ABSTRACT

Choice and non-choice tests were carried out to determine the varietal preference of the red flour beetle *Tribolium castaneum* (Herbst) under laboratory conditions. Regarding to non-choice tests on different wheat varieties , data revealed that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12 was 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 was 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 (FAO, 2011).

The red flour beetle *T. castaneum* (Herbst) is an important pest of harvested grain crops (including wheat, sorghum, maize, millets and rice) and grain-based products worldwide (Fedina and Lewis, 2007).

Laboratory analysis of the main components of the different wheat and rice varieties suggested that the susceptibility of these varieties to *T. castaneum* 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 to study the Preferability of different wheat and rice varieties to *T. castaneum* infestation.

MATERIALS AND METHODS

Relative susceptibility of broken wheat and broken rice varieties to The red flour beetle *T. castaneum* (Herbst) 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^{o}C and 70±5 % R.H. The technique used for obtained adults of the *T. castaneum* (Herbst) 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^{o}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^{o}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 *T. castaneum* 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 for *T. castaneum* were recorded after 60 days post-treatment.

2. Choice infestation test:

The second infestation experiment was carried out to study the *T. castaneum* 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 ^{o}C). The parents were removed after ten days of treatment. After 60 days, the percent of 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 *T. castaneum* 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 given in Table (1) showed that, the influence of different varieties of wheat on the weight after damage, number of emerged progeny/f1 and percentage of weight loss caused by *T. castaneum*. Regarding to the weight after damage, Seds 12 wheat variety was the highest weight after damage (8.7 ± 0.05 gm) followed by Egypt 2, Gemmeiza 10 and Gemmeiza 168 (9.2 ± 0.057 gm) and the lowest weight Sakha 93 (8.0± 0.057 gm). Meanwhile, Sakha 93 recorded the higher number of emerged progeny/f1 (31.1 ± 0.05%) followed by Shandawel (28.2 ± 0.11 %). Also, Sakha 93 and Shandweel recorded the highest percentage of weight loss with 6.6 ±0.05 and 6.3 ± 0.05%, respectively. As a conclusion, data in Table (1) revealed that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12 was 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.

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

Varieties	Mean ± SD		
	Weight after damage	No. emerged progeny/f1	Weight loss (%)
Sakha 93	8.0± 0.057 d	31.1± 0.05 a	6.6± 0.05 a
Sakha 94	8.4± 0.057 bc	18.7± 0.11 d	5.3± 0.05 d
Egypt 1	8.3 ± 0.057c	22.7 ± 0.17c	5.6 ± 0.05e
Egypt 2	8.5 ± 0.057b	15.6± 0.11 e	5.0± 0.05 e
Gemeza 9	8.4± 0.057 bc	18.7± 0.11 d	5.3 ± 0.05d
Gemeza 10	8.5± 0.057 b	15.6± 0.11 e	5.0± 0.05 e
Gemeza 11	8.4± 0.057 bc	18.7± 0.11 d	5.3± 0.05 d
Gemeza 168	8.5± 0.057 b	15.6± 0.11 e	5.0± 0.05 e
Shandwel	8.1± 0.057 d	28.2± 0.11 b	6.3± 0.05 b
Seds 12	8.7± 0.057 a	10.2± 0.11 f	4.3 ± 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.

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.

Data illustrated in Table (2) indicated that, the influence of different varieties of rice on the weight after damage, number of emerged progeny and percentage of weight loss caused by *T. castaneum*. Regarding to the weight after damage, Giza 181 rice variety was the highest weight after damage (9.2

± 0.11 gm) followed by Giza 177 (9.1 ± 0.05 gm) and the lowest weight was Sakha 105 (8.4 ± 0.11 gm). Moreover, Sakha 105 recorded the higher number of emerged progeny (18.7 ± 0.11%) followed by Sakha 102 (15.6 ± 0.17 %). Also, Sakha 105 recorded the highest percentage of weight loss with 5.3 ±0.11 . As a conclusion, data in Table (2) indicated that, Sakha 105 was the most preferred rice varieties, 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. These results in non-choice test were in agreement with Abo Arab *et al.,* (2006).

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

Varieties	Mean ± SD		
	Weight after damage	No. emerged progeny/ F1	Weight loss (%)
Sakha 101	8.6± 0.10 cde	12.7± 0.10 c	4.7± 0.10 b
Sakha 102	8.5± 0.10 de	15.6± 0.17 b	5.0± 0.11 ab
Sakha 103	8.8± 0.11 bc	8.7± 0.05 b	4.0± 0.11 c
Sakha 104	8.7± 0.14 cd	10.2± 0.1 d1	4.3± 0.05 c
Sakha 105	8.4± 0.11 e	18.7± 0.11 a	5.3± 0.11 a
Giza 177	9.1± 0.05 a	6.8 ± 0.11g	3.0 ± 0.11de
Giza 178	8.8 ± 0.11abc	8.7 ± 0.05e	4.0 ± 0.11c
Giza 181	9.2± 0.11 a	5.2± 0.05 h	2.7± 0.11 e
Giza 182	8.8± 0.05 bc	8.7± 0.05 e	4.0± 0.11 c
Egyptian jasmen	9.0± 0.11 ab	7.5± 0.11 f	3.3± 0.17 d

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:

As shown in Table (3), the influence of different varieties of wheat on the weight after damage and percentage of weight loss caused by *T. castaneum*. Regarding to the weight after damage, Seds 12 wheat variety was the highest weight after damage (9.3 ± 0.05 gm) followed by Egypt 2, Gemmeiza 10 and Gemmeiza 168 (9.0 ± 0.05 gm) and the lowest weight Sakha 93 (8.5± 0.05 gm). Meanwhile, Shandweel and Sakha 93 recorded the highest percentage of weight loss with 5.6 % and 5%, respectively. As a conclusion, data in Table (3) cleared that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12 was 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 Mebarkia *et al.,* (2011).

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

Varieties	Mean ± SD	
	Weight after damage	Weight loss (%)
Sakha 93	8.5± 0.05 d	5.0
Sakha 94	8.9± 0.05 bc	3.6
Egypt 1	8.8± 0.05 c	4.0
Egypt 2	9.0± 0.05 b	3.3
Gemeza 9	8.9± 0.05 bc	3.6
Gemeza 10	9.0± 0.05 b	3.3
Gemeza 11	8.9± 0.05 bc	3.6
Gemeza 168	9.0± 0.05 b	3.3
Shandwel	8.3± 0.05 e	5.6
Seds 12	9.3± 0.05 a	2.3

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.

Data illustrated in Table (4) indicated that, the influence of different varieties of rice on the weight after damage and percentage of weight loss caused by *T. castaneum*. Regarding to the weight after damage, Giza 177 rice variety was the highest weight after damage (9.4 ± 0.17 gm) followed by Egyptian jasmen (9.3 ± 0.17 gm) and the lowest weight was Sakha 105 (8.5 ± 0.11 gm). Moreover, Sakha 105 recorded the higher number of emerged progeny (5.0 ± 0.057%) followed by Sakha 102 (4.3 ± 0.057 %). As a conclusion, data given in Table (4) indicated that, Sakha 105 was the most preferred rice varieties, while Giza 181, Giza 177 and Egyptian jasmen were the least preferred rice varieties.

Table (4): Influence of different rice varieties on the percentage of weight after damage and number of emerged progeny caused by *T. castaneum*. according to free choice test.

Varieties	Mean ± SD	
	Weight after damage	Weight loss (%)
Sakha 101	8.9 ± 0.10 cd	3.6± 0.057 c
Sakha 102	8.7± 0.05 de	4.3± 0.057 b
Sakha 103	9.1± 0.05 abc	3.0± 0.057 e
Sakha 104	9.0± 0.11 bcd	3.3± 0.057 d
Sakha 105	8.5± 0.11 e	5.0± 0.057 a
Giza 177	9.4± 0.17 a	2.0± 0.057 h
Giza 178	9.1± 0.05 abc	3.0± 0.057 e
Giza 181	9.2± 0.11 abc	2.6± 0.057 f
Giza 182	9.1 ± 0.05abc	3.0 ± 0.057e
Egyptian jasmen	9.3 ± 0.17ab	2.3 ± 0.057g

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.

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 were in agreement with Abo Arab *et al.,* (2006). 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 خنفساء الدقيق المتشابهه لأصناف مختلفة من حبوب القمح والأرز

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أجريت هذه الدراسة لمعرفة مدى تفضيل خنفساء الدقيق المتشابهه 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 للاختبارالثانى ، الأصناف سخا 93 و شندويل كانت أكثر أصناف القمح تفضيلا للحشرة ، بينما الأصناف سدس 12 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 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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