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SUSCEPTIBILITY OF SOME WHEAT GRAIN VARIETIES TO *SITOPHILUS ORYZAE* (L.) INFESTATION

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Abstract

Thirteen wheat grain varieties were screened for its susceptibility/resistance against lab. insect infestation by the rice weevil, *Sitophilus oryzae* (L.) under non-choice method. The parameters used for evaluating of the susceptibility were the growth index, weight loss (%), percentage of damaged grains, as well as the germination of the infested samples. The results showed significant differences among the tested varieties. No variety was completely resistant or immune. Gemmiza 7 and Giza 168 were the most relatively susceptible since both produced higher values of the growth index. Sohag Durum 1and Giza 164 were the least relatively resistant varieties. The rest varieties were intermediate. Other complementary methods for safe storage are needed.

INTRODUCTION

The infestation of stored cereals by insects in tropical, subtropical or temperate granaries is common. The stored cereals are vulnerable to damage by adults and immature stages of the graminivorous insects. The infested grains are largely reduced in their qualities and weight. Despite recent improvement in grain storage practices, the relative compatibility of some varieties of wheat for the postembryonic development of the rice weevil is still unknown. Wheat is almost continually subject to attack by *S.oryzae*, between harvest and consumption. Varieties of wheat are expected to influence the rates of reproduction and multiplication of the rice weevil (Koura and EL-Halafawy, 1967). Losses to wheat grains caused by *Sitophilus spp.* have been investigated in the laboratory (Golebiowska, 1969; Howe, 1963; Hurlock, 1965; Richard, 1947 and White, 1953).

Sitophilus oryzae L., which is the most serious insect of stored grain all over the world, leading to a reduction in viability potential of the grains and make them unfit for human consumption. Insecticidal chemicals are usually the method of choice for insect control, but concern over lack of environmental compatibility of the insecticides has

stimulated the search for alternative control measures. One possible and desirable approach of reducing wheat infestation by this insect is developing of resistant varieties. This article therefore, attempts to determine and describe relative compatibility of 13 wheat varieties for postembryonic development of this cosmopolitan species.

MATERIALS AND METHODS

1.1. Stock culture of the used insect: A stock culture of *S.oryzae* was reared and multiplicated for five generations in division of stored grain insects, Plant Protection Research Institute, on a mixture of different tested wheat varieties. The used wheat were previously sterilized by subjecting the grains to a constant temperature of 55 °C for 4- 6 hours according to the method described by Mookheerje *et al.*, 1968. To obtain the test insects of approx. the same age, the subculture was maintained on 400 g of wheat grains at 28 ± 1°C in 1-lb glass jars, each infested with 150 pairs of adult insects, which were removed after 7 days.

1. 2. Source of the tested wheat varieties: Thirteen varieties of the wheat grains were obtained from the wheat breeding section of the Field Crop Research Institute, ARC. All the varieties were washed with tape water and left to dry under lab. Conditions. Samples required for testing were incubated at 28 ± 1 °C and 60±5 % RH for two weeks to equilibrate their moisture content.

1. 3. Method of testing: To test the susceptibility of wheat varieties against infestation by the rice weevil, *six* replicates of ten grams were made from each variety. Each replicate was infested with 30 unsexed adults of one week old. The adults were allowed to oviposit for one week and then removed. The replicates were incubated at constant conditions of 28 ± 1°C and 60 ± 5 % RH until adult emergence. The first emergence date was recorded in order to estimate the duration of the insect development. To investigate the number of emerged adult progeny produced from each replicate, the newly emerged adults were daily removed and counted. The replicates were sieved and re-weighed to determine the loss in weight (%). The percent damaged grain was also recorded for each replicate by separating and counting damaged grains in a randomly selected sample of one hundred kernels according to the method described by Teotia and Pandey (1977). A sample of one hundred grain sample of each variety

was germinated in two Petri dishes of 9-cm diameter lined with water– moistened cotton pad and left under open lab. coditions. One week later, germination percentage was calculated. To determine the susceptibility/resistance of the different varieties, a growth index was calculated according to Howe (1971) as follows:

$$\text{Growth Index (SI)} = \frac{\text{Log F1} \cdot 100}{D}$$

Where: F1 =Total number of the emerging adults

D = The mean developmental period.

1. 4. The statistical analysis: The data were statistically analyzed using a computer program of SAS and the standard error of the means was calculated.

RESULTS AND DISCUSSION

The data obtained concerning the average number of adult progeny, mean developmental periods, and weight losses (%), growth index and germination (%) were presented in Table 1. The results revealed significant differences among the values of the determined characters. The varieties were arranged ascedingly concerning their growth index. Data in this Table reveals that the varieties Gemmiza 7 and Giza 168 are the most relatively susceptible since they showed the largest values of the growth indices (6.17 and 5.97) with insignificant differences. This result is assured and confirmed by high values of grain damage (%) and weight loss (%). Sohag Durum1 and Giza 164 are the most relatively resistant varieties since they showed lowest values of the growth indices and lowest grain damage (%) as well as weight loss (%). The percentage of damaged grains and germination (%) has variable values ranging from 38.5 to 68 % and from 61 to 88 % for both characters respectively. From the foregoing results, it is evident that Gemmiza 7 and Giza 168 were more easily vulnerable to infestation and damage than other varieties and considered the most susceptible varieties.

Many authors explained the grain resistance to differences in grain size and mentioned that the larger sized grains could supply more food and space for growth (Ewer, 1945; Russell, 1962 and Khare and Agrawal 1963 and Singh *et al.* 1974). We conclude that, although there is a wide range of susceptibility in the tested varieties to *S.oryzae* L., some varieties retarded insect development (Sohag Durum1 and Giza 164) while

Table 1.Growth and damage of *S.oryzae* on grains of thirteen varieties of wheat *Tritcum aestivum* at 28±1°C and 60±5%RH.

Wheat Variety	Progeny number	MDP (days)	Growth index	Weight loss (%)	Grain damage (%)	Germination (%)
Sohag Durum 1	48.8±6.1 f	37.8±1.0 ab	4.45±0.1 f	12±1.1 e	39.5±4.7 d	80.5±0.5 ab
Giza 164	64.8±4 def	38±0.0 a	4.76±0.1 ef	12.8±1.5 de	43±2.4 cd	74.5±4.5 abc
Beni Swaif 3	66.3±11.8 def	37.8±1.1 ab	4.79±0.3 def	17.9±2.2 bcd	55.5±7.2 bcd	74±9.0 abc
Sakha 69	60.8±6.8 ef	35.8±0.5 abcd	4.96±0.1 cdef	16.6+1.8 bcde	41±4 cd	74.5±5.5 abc
Sakha 93	68.3±6.7 cdef	34.3±0.9 d	5.35±0.2 bcde	15.6±0.6 cde	38.5±7.6 d	88±5.0 a
Beni Swaif 1	85±7.2 bcde	35.8±0.5 abcd	5.39±0.2 abcd	26± 1.6 a	75.5±8.2 a	70.5±6.5 abc
Sohag 2	85.5±2.1 bcde	35.5±0.3 bcd	5.4±0.1 abc	16.3±1.3 bcde	57±3.1 abcd	61.5±5.1 bc
Sids 1	92.3±9.5 bcd	35.8±0.8 abcd	5.49±0.2 abc	14±0.4 de	50±5.1 bcd	78±3.0abc
Giza 163	108.8±7.7 ab	36.8±0.3 abc	5.53±0.1 abc	21±1.1 b	65.5±4.9 ab	69±6.0 bc
Sohag 3	99.8±13.8 ab	34.5±1.0 cd	5.78±0.3 ab	20.5±2.3 bc	63.5±8.7 ab	62.5±4.5 bc
Giza 167	114.8±9.8 ab	35.5±0.3 bcd	5.79±0.2 ab	15.8±1.9 cde	68±5.4 ab	61±3.0 c
Giza 168	126.8±8.8 a	35±0.4 cd	5.97±0.3 ab	26.4±2.3 a	64.5±7.9 ab	66±9.3 bc
Gemmiza 7	97±5.0 abc	32.3±1.0 e	6.17±0.2 a	26±1.6 a	60±3.5 abc	70±5.0 abc

- Data was analyzed statistically by analysis of variance and means separated by Duncans multiple range test.
- Different symbols after standard error indicates a significant difference.

other varieties provide shorter developmental periods (Gemmiza 7 and Giza 168). The study concludes that no variety of the tested varieties was completely resistant or immune and the Egyptian wheat varieties in general are relatively susceptible to *S.oryzae* infestation. Hence, other complementary methods for a safe storage are needed.

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حساسية حبوب بعض أصناف القمح المصرية للإصابة بحشرة سوسة الأرز

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يعتبر القمح محصولاً إستراتيجياً هاماً نتيجة الزيادة السكانية الكبيرة ، ويتم إستيراد بعضه بالعملة الأجنبية الصعبة ، لأن كمية المنتج المحلى لا تكفى كمية المستهلك . وتتعرض حبوب القمح للإصابة بحشرة سوسة الأرز ، حيث يمثل القمح عائلاً أساسياً لها محدثة به خسائر كبيرة . ونتيجة لذلك تم تنفيذ الدراسة الحالية لتقدير حساسية ١٣ صنفا من القمح المصري للإصابة بهذه الحشرة عن طريق تقدير تفاعل الحشرة مع هذه الأصناف وتحديد المتغيرات البيولوجية للحشرة على هذه الأصناف، ومنها دليل نمو الحشرة (دليل الحساسية) ونسبة الفاقد فى الوزن ,ونسبة التلف بجانب تقدير درجة الإنبات للبذور المصابة فى نهاية التجربة. وأظهرت النتائج المتحصل عليها وجود إختلافات معنوية واضحة بين هذة الأصناف ,حيث كان الصنف جميزة ٧ وجيزة ١٦٨ من أكثر الأصناف حساسية للإصابة بالحشرة بينما كانت الأصناف ديورم سوهاج ١ وجيزة ١٦٤ من أكثر الأصناف المقاومة نسبيا للحشرة. ولم تظهر الدراسة الحالية وجود أصناف منيعة أو عالية المقاومة تماما للإصابة بهذه الحشرة ، وتوصى الدراسة الحالية بضرورة استخدام طرق تكميلية أخرى لعمل مكافحة متكاملة لحماية الحبوب من هذه الحشرة أثناء التخزين.