# VARIETAL PREFERENCE OF *SITOPHILUS ORYZAE* (L.) AND *TROGODERMA GRANARIUM* EVERTS ON SOME GRAIN VARIETIES OF WHEAT AND MAIZE

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***Abstract***

This work was done to clarify food preference of *S. oryzae* and *T. granarium* to different wheat and maize varieties. Non-choice and choice tests were followed. Results showed that giving, 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. Wheat varieties were generally more preferred to both insects either in non-choice or free choice methods. Also, wheat variety Sakha 8 followed by Sakha 93 and maize variety Tri-H 322 were the best preferred for both insects, while Giza 168 and Okrani were the least in this respect. The varietal differences had a significant effect on the biological parameters dealt in this research.

## INTRODUCTION

The agriculture production of cereal crops in Egypt is suffering from substantial losses which attributed to pest infestation. From an economic view point, maize is one of the most important crops and considered stable food for majority of the Egyptian farmers. In storage, wheat or maize is found to be attacked by several important pests causing variable losses depending upon the period of storage.

It is estimated that reduce of all cereal crops in the world is lost after harvest as a result of the degradation of stored grain pests including insects, fungi and birds. In Egypt, losses caused by insects infesting stored grains could amount to the equivalent of 12 million pounds yearly (Ezz, 1976). *S. oryzae* is the most serious insect pest of stored grains and their products all over the world resulting reduction in potential of grain and make them unfit for human consumption (Khare *et al.*, 1987) and several authors in different countries have studied it on a different varieties of

crops as Urrelo and Wright (1989) in USA on maize varieties; Kucerova and Stejskal (1994) In Czech Republic on wheat varieties; Joda (1998) in Nigeria on rice varieties; Ramputh *et al.*, (1999) in Canada on sorghum varieties; Grenier *et al.*,(2000) in France on a different cereals; White *et al.*, (2000) in Canada on red and white varieties of wheat and In Egypt, Youssef and Salama (2004) on maize grain varieties and Gharib(2004a & b) on thirteen wheat grain varieties.

## MATERIALS AND METHODS

The insects were collected from the survey studies and maintained under laboratory conditions until use. The study was carried out at the Economic Entomology Department, Faculty of Agriculture, and Mansoura University. Cultures were prepared by introducing batches of about 200 adults of each species to 150 g of grains in one liter glass jar (20 x 10 cm) then covered with muslin and permitted to lay eggs for two weeks and removed. The new emerged adults were removed every two days, to obtain new cultures under the same conditions to be used in the following tests. A stock culture of the two insects were reared on wheat (Giza 168) in an incubator at 27±2 °C and 35± 2 °C and 70± 5% R.H., for *S. oryzae* and *T. granarium*, respectively. Relative susceptibility of five varieties of both wheat and maize grains to *S. oryzae* (L.) and *T. granarium* were undertaken.

Wheat varieties were Sakha 8, Sakha 61, Sakha 93, Sakha 69 and Giza 168 from Crop Research Institute. Maize varieties were Tri-H 322 white, Tri-H 323 White and Tri-H 324 white from Crop Research Institute while Argentina maize and Okrani maize yellow were obtained from Damietta port. Enough samples of wheat and maize grains were firstly sieved to remove stones, dust and insects. The grains were then sterilized by sub-freezing (-18 °C to - 22 °C) for 2 days to kill any hidden insect stages (El- Sabaay, 1998). All grains were maintained in an incubator at 29± 1 °C and 65± 5% R.H. for two weeks to obtain equilibration moisture content with this R.H. (Ezz, 1976). Relative susceptibility of the tested wheat and maize varieties were done under a free choice and non-choice infestation methods as follows:

**1. Free- choice infestation method**

Petri-dishe 16 cm diameter, each was divided into five equal sectors or chambers by cartoon papers, as choice chambers (Ali *et al.*, 2001). Each crop was represented with ten dishes (as replicates) for each insect, five dishes were left for eggs count and the other five were left undisturbed for the progeny growth until adult

emergence. Each dish thus, contained all five tested grain varieties of each crop as 20.0 gm of each. Ten pairs of each insect (two weeks old) were gently introduced in the dish center and then kept under the experimental conditions of 27± 2°C and70± 5% R.H. and 35± 2°C and 70± 5% R.H. for S. *oryzae* and *T. granarium*, respectively.

One week later, the parent adults were removed and the grain of each chamber were transferred into glass jars and placed under the same mentioned conditions. In case of *S. oryzae*, the eggs were counted in both wheat and maize, by the acidic fuchsin staining technique mentioned by Frankenfeld, (1948) as mentioned below. For counting *S. oryzae* eggs, infested grains were stained with acidic fuchsin (0.5 gr. acidic fuchsin + 50 cm glacial acetic acid + 950 cm distilled water) for 2- 5 minutes. The staining solution aids in eggs counting which egg-plugs take up the stain, and appear as deep, cherry red spots and so are guides for presence of the eggs, while the adult feeding punctures and mechanical injuries appear light pink.

In case of *T. granarium*, that laid eggs freely, the grains were gently sieved to separate the eggs and calculate number/ variety then kept for estimating its hatchability (%). Insect fertility of *S. oryzae* and *T. granarium* on the different grain varieties was calculated by measuring total number of emerged progeny/ variety. Insect fertility can be calculated by the total numbers of emerged adults/ variety.

**2. Non – Choice infestation test**

Ten replicates were done for each variety, each five glass jars, for each variety and each insect. Each jar contained twenty g of one variety, and received ten pairs of the insect adults. One week later, adults were removed and eggs number was counted as mentioned before. The jars were incubated again until adult emergence to count emerged progeny. Data were statistically analyzed by ANOVA and differences between means of the different treatments were statistically analyzed by Duncan multiple range test (Duncan, 1956).

## RESULTS AND DISCUSSION

Choice and non-choice tests were carried out to determine the varietal preference of *S. oryzae* and *T. granarium* under constant laboratory conditions. Three biological parameters were used as indicators of the preference; number of eggs, percentage of egg hatching and number of the emerged adults.

Data presented in Table (1) showed the influence of the different varieties of wheat and maize, by using non-choice test, on some biological parameters of *S. oryzae*. In respect to the number of eggs laid/ female, Sakha 8 was the most

preferred wheat variety, the female laid the highest number of eggs (71.8± 0.7) while Giza 168 was the lowest (37.0± 0.7 eggs/F.). AS for maize varieties, Tri-H 322 was the most preferred variety. Okrani showed the lowest average (11.0± 0.7 eggs/Female). These results indicated that, wheat or the maize varieties affected significantly the mean number of eggs/ female. Egg hatchability (%) ranged between 98.1 on Sakha 8 and 94.0 on Giza 168 with significant differences between the five wheat varieties. This percentage in case of maize varieties varied between 86.9 on Okrani and 96.9 on Tri-H 322 respectively, with significant differences between Okrani and each of the other varieties (Table 1).

In respect to adult emerged progeny, Sakha 8 was the most preferred wheat variety, gave the highest number of progeny (70.6± 0.7 individual/F). Giza 168 gave the lowest (34.8±0.7 individual/Female). Also, Tri-H 322 maize was the most preferred maize variety, *S. oryzae* gave the highest progeny (31.2± 0.9 individual/F), Okrani maize gave the lowest individuals (10.2± 0.4). These results indicated that, the wheat and maize varieties affected significantly the mean number of progeny.

Data in the same table revealed that the wheat varieties were generally more preferable to *S.oryzae* than maize varieties, gave more number of eggs (37.0- 71.8 eggs/F), more hatchability (94- 98%) and more progeny (34.8- 70.6/F).

Data presented in Table (2) showed the influence of the same previous varieties of wheat and maize under free- choice method, on the same biological aspects of *S.oryzae*. Results in this table showed that Sakha 8 wheat variety was the most successful diet for rearing *S.oryzae*, gave more eggs (82.2 eggs/ F) with higher percent of hatchability (97.8%) and in the same time gave the highest number of progeny (79.8/F). These values were significantly decreased according to wheat variety and reached a minimum of 42.0 eggs/ F, 97.2 % hatchability and 40.8 individuals/F when the insect was reared on Giza 168 grains.

Maize varieties were, in general, less successful as a diet for rearing this insect. The values were clearly low, the number of eggs ranged 17.0- 42.0/F only with 14- 41 individuals/ F. Tri-H 322 was relatively the most preferred variety, 42 eggs/ F, 97.6% egg hatchability and 41 individuals/ F. These values were also significantly decreased and reached their minimum as 17 eggs/F, 85.3% egg hatching and individuals 14.4/F individuals with rearing on Okrani maize variety (Table 2). Results of choice and non-choice experiments pointed to that, wheat varieties were more preferable to *S.oryzae* than maize ones. In the same time, Sakha 8 wheat variety and

Tri-H 322 maize variety were, relatively the most preferred to the insect. On the other hand, Giza 168 and Okrani were the least preferred under non- choice or free choice methods.

Data presented in Table (3) showed the influence of the different varieties of wheat or maize grains under non- choice test on some biological parameters of *T. granarium*. In respect to the number of eggs/ female, Sakha 8 was the most preferred wheat variety, the female laid the highest numbers of eggs (30.4± 0.5) while Giza 168 was the lowest preferred variety(11.8± 0.6 eggs/F).

Tri-H 322 was relatively the most preferred maize variety, in which *T. granarium* females laid the highest number of eggs (22.8± 0.9), Okrani maize showed the lowest average number of eggs/Female (11.5±0.6). Moreover, these results indicated that, the five wheat or maize varieties affected significantly the average number of eggs/ female.

The percentage of hatchability ranged between 87.9% on Giza 168 and 95.4% on Sakha 8 with significant differences between the five wheat varieties. On the other hand, the results of varieties indicated that, the percentage of hatching varied between 89.6% and 94.4% on Tri-H 322 and Okrani, respectively. Statistical analysis reveled, significant difference between Okrani maize and the other maize varieties.

Also, in respect to the emerged progeny, Sakha 8 was the most preferred variety, showed the highest average number of progeny (29.0± 0.3 individual/F) while Giza 168 was the lowest (10.6± 0.5 individual/F). Tri-H 322 was the most preferred maize variety, *T. granarium*, the female gave the highest progeny (24.2± 1.2) while Okrani gave the lowest average (10.5± 0.6 individual). Moreover, these results indicated that, the tested wheat and maize varieties significantly affected the average progeny number.

Data presented in Table (4) showed the influence of the same wheat and maize varieties on *T. granarium*. Sakha 8 was the most preferred wheat variety, the highest average number of eggs (39.6± 0.5 eggs/F) and Giza 168 was the lowest (17.0± 0.7 eggs/ F). In the same time, Tri-H 322 was also the most preferred maize variety; *T. granarium* female laid the highest average number of eggs (27.2± 1.3) while Okrani showed the lowest average number of eggs/Female (9.5±0.6). These results indicated that, wheat varieties and maize varieties affected significantly the average number of eggs laid / female.

The percentage of hatchability recorded 93.9% (the highest) on Sakha 8 and 89.2% on Giza 168 with significant differences among the tested wheat varieties. The results of maize varieties indicated that, percentage of hatching varied between 81.2n Okrani and 95.4 on Tri-H 322. Statistical analysis revealed significant differences between Okrani maize and each of the two Tri-hybrids 322 and 323.

In respect to the emerged progeny number, Sakha 8 was also the most preferred wheat variety, showed the highest average number of progeny (37.2± 0.6 individual/F) while Giza 168 was the lowest one(15.2± 0.9 individual/F). In the same time, which Tri-H 322 was the most preferred maize variety, *T. granarium* female gave the highest average of individuals (26.0± 1.6). Okrani gave the lowest average (7.8±0.7 individual/F). Moreover, these results indicated that, the wheat varieties and those of the maize affected significantly the progeny number.

As a conclusion, the obtained data in Tables (3 and 4) showed that, in respect to the number of eggs/ female, the percentage of hatching and the number of emerged progeny for *T. granarium*, Sakha 8 wheat and Tri-H 322 maize variety were the most preferred and diets either in the non- choice or free- choice methods.

These results are in agreement with those of Khare et al., 1987, Urrello and Wright, 1989; Joda, 1998, Grenier, 2000 Gharib, 2004 and Youssef, 2004. They studied the susceptibility of wheat and maize varieties and found that, the percentage of infestation or the number of emerged offspring varied according to the variety.

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Table 1. Influence of different wheat & maize varieties on certain biological aspects of *S. oryzae* under non- choice method.

| Progeny Number/F | Eggs Hatchability (%) | No. eggs/F | Varieties | Grains |
|---|---|---|---|---|
| 70.6±0.7a | 98.1a | 71.8 ± 0.7a | Sakha 8 | Wheat |
| 65.6±1.2d | 95.7abc | 65.4±1.3d | Sakha 61 | |
| 50.0±0.3c | 96.9ab | 51.6±0.5c | Sakha 69 | |
| 43.8±1.2b | 96.2c | 46.8± 0.9b | Sakha 93 | |
| 34.8±0.9e | 94.0c | 37.0±0.7e | Giza 168 | |
| 31.2±0.9a | 96.9a | 32.2±0.9a | Tri-H 322 | Maize |
| 24.2±1.4b | 94.3a | 25.6±1.3b | Tri-H 323 | |
| 20.0±0.3c | 93.5a | 21.4±0.5c | Tri-H 324 | |
| 15.8±0.7d | 92.9a | 17.0±0.7d | Argentina | |
| 10.2±0.4e | 86.9b | 11.0±0.7e | Okrani | |

Means with the same letter(s) within a row were not significantly different, H=hybrid and F=female.

Table 2. Influence of different wheat & maize varieties on certain biological aspects of *S. oryzae* (free choice method).

| Crop | Varieties | No. eggs/F | Eggs Hatchability(%) | Progeny/F |
|---|---|---|---|---|
| Wheat | Sakha 8 | 82.2±0.9a | 97.8ab | 79.8±0.7a |
| | Sakha 93 | 66.8±0.8b | 95.2a | 63.6±0.5b |
| | Sakha 69 | 55.8±1.4c | 95.8bc | 53.4±1.1c |
| | Sakha 61 | 72.2±0.9d | 97.8c | 71.0±1.0d |
| | Giza 168 | 42.0±0.7e | 97.2ab | 40.8±0.7e |
| Maize | Tri-H 322 | 42.0±0.7a | 97.6a | 41.0±0.7a |
| | Tri-H 323 | 37.2±0.7b | 94.1a | 35.0±1.2b |
| | Tri-H 324 | 28.4±1.3c | 91.4ab | 26.0±1.6c |
| | Argentina | 22.4±0.9d | 95.5a | 21.4±0.9d |
| | Okrani | 17.0±0.7e | 85.3b | 14.4±0.6e |

Means with the same letter(s) within a row were not significantly different, H=hybrid and F=female.

Table 3. Influence of different wheat & maize varieties on certain biological characters of *T. granarium* ( non-choice method).

| Crop | Varieties | No. eggs/F | Egg Hatchability(%) | No. emerged progeny/F |
|---|---|---|---|---|
| Wheat | Sakha 8 | 30.4 ±0.5a | 95.4b | 29.0±0.3a |
| | Sakha 93 | 16.0±0.7b | 90.9c | 14.6±0.9b |
| | Sakha 69 | 21.0±0.7c | 94.3a | 19.8±0.7c |
| | Sakha 61 | 26.0±0.7d | 94.5a | 24.6±0.9d |
| | Giza 168 | 11.8±0.6e | 87.9d | 10.6±0.5e |
| Maize | Tri-H 322 | 22.8±0.9b | 94.4a | 24.2±1.2a |
| | Tri-H 323 | 25.6±1.0a | 92.2b | 21.0±0.7b |
| | Tri-H 324 | 19.0±0.7c | 93.5a | 17.8±0.9c |
| | Argentina | 14.0±0.7d | 91.2c | 12.6±0.9d |
| | Okrani | 11.5±0.6e | 89.6c | 10.5±0.6d |

Means with the same letter(s) within a row were not significantly different, H=hybrid and F=female.

Table 4. Influence of different wheat & maize varieties on certain biological characters of *T. granarium* (free- choice method).

| Crop | Varieties | No. eggs/F | Eggs | No. emerged |
|---|---|---|---|---|
| Wheat | Sakha 8 | 39.6±0.5a | 93.9a | 37.2±0.6a |
| | Sakha 93 | 26.0±0.7b | 93.1a | 24.2±0.6b |
| | Sakha 69 | 21.2±0.4c | 90.6ab | 19.2±0.4c |
| | Sakha 61 | 33.0±0.9d | 93.8a | 31.0±0.9d |
| | Giza 168 | 17.0±0.7e | 89.2b | 15.2±0.9e |
| Maize | Tri-H 322 | 27.2±1.3a | 95.4a | 26.0±1.6a |
| | Tri-H 323 | 22.0±0.7b | 90.9a | 20.0±0.7b |
| | Tri-H 324 | 17.0±0.7c | 84.5b | 14.4±0.9c |
| | Argentina | 12.0±0.7d | 83.1b | 10.0±0.7d |
| | Okrani | 9.5±0.6d | 81.2b | 7.8±0.7d |

Means with the same letter(s) within a row were not significantly different, H=hybrid and F=female.

# التفضيل الغذائي لحشرتي سوسة الأرز وخنفساء الصعيد لأصناف مختلفة من حبوب القمح والذرة

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أجريت هذه الدراسة لمعرفة مدي تفضيل كل من سوسة الأرز وخنفساء الصعيد لخمسة أصناف من القمح وخمسة أخرى من الذرة الشامية وذلك بإجراء اختبارين، الأول يوفر للحشرة حرية اختيار الغذاء المفضل ، والثاني لا يوفر لها هذه الحرية. وقد أتضح من الدراسة مايلي:

توفير حرية اختيار الغذاء للحشرتين أدي لزيادة متوسط عدد البيض لكل أنثي وبالتالي زيادة متوسط عدد الأفراد لكل أنثى من الصنف. كانت أصناف القمح بصفة عامة اكثر تفضيلا كل من الحشرتين عن أصناف الذرة المختبرة، كما كان الصنف سخا ٨ هو أفضل أصناف القمح لهما في كلا الاختبارين، وكذلك كان صنف الذرة هجين ثلاثي٣٢٢ ذو الحبوب البيضاء علي الجانب المقابل وجد كذلك أن الصنف جيزة١٦٨ (قمح ) وأوكرانيا (ذرة) هما أقل الأصناف تفضيلا من القمح والذرة علي التوالي. كان للأصناف المختلفة من القمح أو الذرة تأثيرا معنويا علي كل من متوسط عدد البيض/أنثي والنسبة المئوية لفقس البيض وكذلك عدد أفراد كل حشرة الخارجة من أي صنف.