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Assessment of different rice varieties for resistance to granary weevil *Sitophilus Granarium* L. under laboratory conditions

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Abstract
The study was conducted to determine the population fluctuation of granary weevil, *Sitophilus granarium* on different rice varieties under laboratory conditions. The particular study was conducted in Department of Entomology, Faculty of Crop Protection Sindh Agriculture University Tando jam during 2016. The Ten different rice varieties i.e., T^1 (Kainat Sela), T^2 (Super Basmati), T^3 (IRRI-6), T^4 (IRRI White Pearl), T^5 (Poona Basmati), T^6 (Kernel Kainat Basmati), T^7 (Punjab 86 Basmati), T^8 (Kernel Super), T^9 (Kernel Super Sela) and T^{10} (Sela 86 Tarazo) were tasted in the experiment. The observations were recorded at fortnight interval and the populations of alive *S. granarium* were counted. The results of the study revealed that the significant highest overall mean population of *S. granarium* was recorded in Super Basmati (28.43±15.3), however the lowest population was recorded in Sela 86 Tarazo (0.23±0.23). In accordance with the level of infestation, the highest percentage weight loss was recorded in Super basmati (3.74%) and the lowest weight loss was recorded in Sela 86 Tarazo (0.03%). The result would be useful for the IPM of storing the rice variety at different time interval.

Keywords: rice, *Sitophilus Granarium*, varieties, resistance, weight loss

1. Introduction
Rice (*Oryzae sativa* L.) is the one of the most important cereal crops in many countries of the world; the rice is also cultivated in all the continents of the world and considered as the staple food of half of the world's population. Because many people are using rice as food all over the world, therefore it has great influence on human diet and food safety. Rice is also a considered as the sign of cultural individuality and global unity. Rice has changed the culture, diets and economic of many people (Stejskal and Kucerova, 1993) [1]. Due to the great importance of the rice crop, the United Nation elected year 2004 as the "International Year of rice. It provides 20% of the per capita energy and 13% of the protein consumed worldwide (Corner, 2004) [2].
The Granary weevil *Sitophilus granarium* L. (Coleoptera: Curculionidae) has an economic impact as stored product pests all over the world and *Sitophilus* species cause severe damage to stored grains. The granary weevil mainly causes economic damage in middle Europe, Asia, Mediterranean area, temperate climates, North America, and Australia. The rice and maize weevils are mostly present in the warm, moist and the tropical areas, Due to the biological potential of the rice weevil allows, it also appear in more moderate climates (Longstaff, 1981) [3].
Granary weevil is considered as one of the important and destructive insect pests of stored food grains and lives in the stores all time because it does not possess the 2nd pair of wings and cannot fly (Germinara *et al.*, 2007) [4]. Eggs are laid by the female in wheat grains near embryo and usually one egg is deposited in each grain upon hatching the larva begins to feed inside the grain excavating a tunnel as it developed. The larva consumes about 55% of the interior of the wheat kernel and the body of weevil varies from brown to black with shiny upper surface (Kljajic, 2001) [5]. Pupation takes place within the grain and newly developed adult makes its way out leaving a large characteristic emergence hole (Shah and Saleem, 2002) [6]. The average life cycle completed within 40 days at 25°C and high relative humidity, but sometime lifespan ranges between several months to about one year due to environmental conditions and the weevils ingest food and cause damage to grain respectively (Naito *et al.*, 2006) [7].

However, the young weevil emerges, its color is reddish brown; therefore they are called "red" and later "black" granary weevils (Surtees, 1965) [8]. The weevils have three to five generations in a year under natural conditions of temperature and relative humidity of store houses. These a biotic factor have the great influence on granary weevil development rate and can increase population (Schwartz and Burkholder, 1991) [9].

Granary weevil has considerable economical importance and it is generally hetero-phagous stored product pests which feed on different variety of food, and mainly affects grains of wheat, oats, rye, barley, corn, rice, millet and occasionally manufactured products (Dobie and Kilminster, 1978) [10]. Granary weevil is one of the major important pests of stored grains, especially rice in tropical and subtropical regions of the world (Floyd and Newsom, 1959) [11]. Adults beetle has destroyed seed kernels mainly embryo, producing debris, and increasing grain temperature and humidity, these beetles also provide help to develop the secondary insect pests like mites, bacteria, and fungi among the stored foods. Larvae grow inside the seed and consume about 64% of the seed content (Campbell and Sinha, 1976) [12]. Very little work on the relative resistance of wheat varieties against *S. granarium* has been reported particularly in Sindh. Keeping the above points in view an experiment on the relative resistance of rice varieties against *S. granarium* was carried out in the laboratory. This basic information would be helpful in the management of granary weevil in wheat grains. The main objectives of the study were to investigate the resistance and susceptible varieties of rice and record the weight loss due to infestation of granary weevil.

2. Materials and Methods

2.1 Place of Work: The studies on the relative resistance of rice varieties were carried out in laboratory, Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tando jam during 2016.

2.3 Collection of Rice Varieties: Ten commercial rice varieties were tested and sample of varieties were obtained from the Rice Research Institute of Dokri, Larkana.

2.4 Collection of Insects: The original culture of *S. granarium*, were obtained from Grain Storage Research Laboratory, Tropical Agriculture Research Institute, Karachi University, Karachi, Pakistan.

2.5 Experimental Design: The standard weight of 150 grams of different rice varieties were kept in different plastic jars that covered with muslin cloth and banded with rubber strips. Ten pairs of male and female adult of *S. granarium* were released in each plastic jar with the help of a brush. The experimental designed was Complete Randomized Design (CRD) with three replications.

2.6 Collection of Data: Collection of data was started from 15th February 2016, after 15-days interval the alive weevils were counted. The seed weight was determined by sieving all the samples in each jar and residue was discarded afterward, the remaining samples weighed through electric balance machine to calculate the weight losses of each sample. The data were subjected to analyze statistically.

3. Results and Discussion

The results are determined in Table-1 that the population of granary weevil was not supported by seven varieties as the population declined continuously and become zero in Kainat Sela and Kernel Super Sela after third fortnight, in Poona Basmati and Punjab 86 Basmati after fifth fortnight and in IRRI-6, Kernel Super after sixth fortnight and in the IRRI White Pearl after seventh fortnight. No population dynamics of weevils were recorded in Sela 86 Tarazo after the first observation. But According to (Boniecki *et al*., 2014) [13] grain in storage is exposed by a number of adverse factors; including extensive damage to grain Rice caused by infestations of the granary weevil *S. granarium.* This pest causes a major decline in grain quality leading to a substantial drop in the value of the stored material, thus contributing to large financial losses, respectively. On the other hand, our results are generally agreed with (Odeyemi *et al.*, 2010) [14] whom recorded the 7 rice varieties viz, BR3, BR11, BR14, BR26, BRRI dhan28, BRRI dhan29 and Kalogira against rice weevil, *S. oryzae* (L). Resistance was tested. But the Mortality of weevil populations within 10 days of confinement was observed. The new adult emergence, development and grain weight losses were considered as an indicator of resistance. Among all the varieties showed some degree of resistance against rice weevil.

However, the remaining three rice varieties i.e. Super Basmati, IRRI-6 and Kernel Kainat Basmati favored the population growth of weevil observed a rapid growth in all varieties during fourth fortnight of observation. This investigation is well matching with (Schwartz and Burkholder, 1991) [9] who conducted the experiment on different grain varieties as wheat, rice, oats, corn and barley to examine the development of *S. granarium* L. from egg to adult. The results showed that developments of this insect pest recoded fastest on Rice and slowest on corn. Fecundity of females recorded maximum on wheat and barley followed by corn, rice and oats respectively. Furthermore the highest populations were noted in Super Basmati followed by Kernel Kainat Basmati and IRRI-6. Accordingly, the maximum population (126.66±28.7 weevils) was recorded in Super Basmati on 26.04.2016, followed by 111.66±23.3 in Super Basmati on 12.04.2016 and 43.00±10.5 weevils in a Kernel Kainat variety on 26.04.2016. During the study of (Bagheri and Baghari, 1985) [15] observed the fecundity of *S. granarium* in stored cereals (especially rye, rice and wheat) for periods of 15-90 days in the laboratory in Egypt. The main factors influencing fecundity were relative humidity, grain moisture content and grain hardness. About 12 oviposition periods, 18-20 adults from the 16th to the 60th day, and 4 adults from the 61st to the 90th day. In a population of 4164 weevils, 2427 females and 1737 males were identified which gave sexes-ratio of 58.4 to 41.6 of female and male. However, in the present results the maximum numbers of eggs and adults in small sized grains recorded on higher population densities of granary weevil. The Overall, highest population of granary weevils were examined in Super Basmati (28.43±15.3 weevils), while the lowest population were recorded in Sela 86 Tarazo (2.33±0.33), followed by Kainat Sela (0.56±0.43), respectively.

3.1. Weight Loss

The percentage weight loss of various rice varieties due to attack of granary weevil were recorded in at the end of experiment and the results are summarized in Table-2. The results shown a significant difference in % age weight loss of various rice varieties with the highest weight loss (5.62 grams or 3.74%) was recorded in Super Basmati rice, followed by

Kernel Kainat Basmati (2.86 grams or 1.60%). The results of (Lohar *et al*., 1995) [16] are conformity with ours that three wheat, rice and maize varieties; they investigated losses by *S. granarium*. The data showed the number of infested grains, progeny produced that during specific time intervals and weight loss in *S. granarium* varied with both time intervals of infestation and types of kernel provided as food and oviposition substrates. After 90 days the percentage weight loss was significantly higher in maize kernels followed by rice and wheat. Among rice varieties, Basmati-370 was significantly more susceptible to attack of *S. granarium* than IR-8 and IR-6. According to another researcher (Permaul, 1994) [17] carried out survey to determine the spectrum of storage pest species present in paddy and millet rice. The results showed that the following species could be regarded as economically important: *Rhyzopertha Dominica, Tribolium castaneum, S. oryzae, S. granarium, S. zeamais* and *Sitotroga cerealella*. May pose a threat in the future to stored rice of the several thousands of samples analyzed, one or more live stored-produce insect pest was found in 93% of paddy samples while the corresponding figure for rice was 35%. In present work further results revealed the lowest percentage weight loss (0.05 grams or 0.03%) due to an attack of granary weevil was recorded in Sela 86 Tarazo, followed by Kainat Sela (0.85 grams or 0.56%) and IRRI White Pearl (0.06 grams or 0.04%). The maximum and minimum weight losses in the above mentioned a rice variety corresponds to the level of infestation of granary weevils to the respective varieties and the loss was also positively and significantly correlated with progeny production.

Table 1: Mean population fluctuation of granary weevil on different rice varieties

Date	Treatments									
	Kainat Sela	**Super Basmati**	**IRRI-6**	**IRRI White Pearl**	**Poona Basmati**	**Kernel Kainat Basmati**	**Punjab 86 Basmati**	**Kernel Super**	**Kernel Super Sela**	**Sela 86 Tarazo**
01/03/16	4.33± 0.88	17.00± 0.57	15.33± 1.15	17.66± 0.66	18.00± 0.57	16.00± 0.57	18.00± 0.57	17.66± 0.66	4.00± 0.57	2.33± 0.33
15/03/16	1.00± 0.57	14.00± 1.00	14.00± 1.00	16.00± 1.00	15.33± 0.88	14.66± 0.66	16.00± 1.52	18.00± 0	1.33± 0.66	0
29/03/16	0.33± 0.33	13.00± 1.52	12.66± 0.88	13.66± 1.76	13.00± 1.00	15.00± 1.15	13.00± 2.30	15.66± 1.85	0.33± 0.33	0
12/04/16	0	111.6± 23.3	20.66± 1.76	7.66± 0.66	7.00± 2.08	29.00± 4.04	8.33± 1.20	7.33± 0.33	0	0
26/04/16	0	126.6± 28.7	22.33± 2.96	3.00± 1.15	4.33± 2.40	43.00± 10.5	3.33± 1.66	0.66± 0.33	0	0
10/05/16	0	2.00± 1.00	8.00± 2.08	0.66± 0.33	0	17.33± 7.21	0	0.33± 0.33	0	0
24/05/16	0	0	0	0.33± 0.33	0	0	0	0	0	0
Means	0.56± 0.43d	28.43± 15.3a	9.29± 2.82c	5.89± 2.29c	5.76± 2.26c	13.49± 4.55b	5.86± 2.32c	5.96± 2.53c	0.56± 0.40d	0.23± 0.23d

Table 2: Effect of *S. granarium* on weight loss of different rice varieties under laboratory condition

Treatments	Initial weight (grams)	Final Weight (grams)	Wight Loss (grams)	Percentage (%)
Kainat Sela	150	149.15	0.85	0.56
Super Basmati	150	144.38	5.62	3.74
IRRI-6	150	149.86	0.14	0.09
IRRI white pearl	150	149.94	0.06	0.04
Poona Basmati	150	149.39	0.61	0.40
Kernel Kainat Basmati	150	147.14	2.86	1.60
Punjab 86 Basmati	150	149.19	0.81	0.54
Kernel Kainat	150	149.02	0.98	0.65
Kernel Kainat Sela	150	149.01	0.99	0.66
Sela 86 Tarazo	150	149.95	0.05	0.03

4. Conclusions

Among all the treatments highest overall mean populations of the granary weevil were recorded in Super Basmati and the minimum in Sela 86 Tarazo. Whereas, the maximum weight loss % age was noted in Super Basmati and minimum in Sela 86 Tarazo which shows the Super Basmati is the susceptible variety while the Sela 86 Tarazo is the resistant variety.

5. Recommendations

The granary weevil caused the variable infestation to all the rice varieties. Therefore, it is recommended that all the varieties should be stored separately with proper management tactics to minimize the damage.

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7. References

1. Stejskal V, Kucerova Z. Survey of stored- product pests in rice imported from Vietnam. Journal of Agriculture Sciences. 1993; 29(3):187-191.
2. Corner DJ. Cropping system. Encyclopedia of plant and crop science. Marcel Dekker Inc. New York. 2004; (3):355-357.
3. Longstaff BC. Biology of the grain pest species of the genus *Sitophilus* (Coleoptera: Curculionidae): a critical review. Journal of Protection Ecology. 1981; 3(2):83-130.
4. Germinara GS, Rotundo G, Cristofaro DA. Repellence and fumigant toxicity of prop ionic acid against adults of *Sitophilus granarium*. Journal of Stored Products Research. 2007; 4(3):229-233.
5. Kljajic P. Susceptibility of granary weevil, *Sitophilus granarium* populations to contact insecticides and

interaction with effects of temperature extremes and starvation. Journal of Agriculture. 2001; 5(6):166.
6. Shah HA, Saleem MA. Applied Entomology University Agriculture Faisalabad, Pakistan. 2002, 267-268.
7. Naito HN, Ogawa N, Tanigawa M, Goto T, Misum Y. Soma T, *et al*. Effects of gas mixtures of phosphine and sulfuryl fluoride on mortality of the granary weevil: *Sitophilus granarium* L. and the maize weevil: *S. zeamais* Motsculsky (Coleoptera: Rhynchophoridae). Journal of Plant Protection. 2006; 42(18):1-5.
8. Surtees G. Effect of grain size on development of the weevil *Sitophilus granarium* (L.) (Coleoptera: Curculionidae). Research Entomology Society London. 1965; 40(1-3):38-40.
9. Schwartz BE, Burkholder WE. Development of the granary weevil (Coleoptera: Curculionidae) on barley, corn, oats, rice, and wheat. Journal of Economic Entomology. 1991; 84(3):1047-1052.
10. Dobie P, Kilminster AM. The susceptibility of triticale to post-harvest infestation by *Sitophilus zeamais* Motschulsky, *Sitophilus oryzae* (L.) and *Sitophilus granarium* (L.). Journal of stored products research. 1978; 14(2):87-93.
11. Floyd EH, Newsom LD. Biological study of the rice weevil complex. Annals of the Entomological Society of America. 1959; 52(6):687-695.
12. Campbell A, Sinha RN. Damage of wheat by feeding of some stored product beetle. Journal of Economic Entomology. 1976; 69(1):11-13.
13. Boniecki P, Boniecka HP, Swierczynski K, Koszela K, Zaborowicz M, Przybyl J. Detection of the granary weevil based on X-ray images of damaged wheat kernels. Journal of Stored Products Research. 2014; 56:38-42.
14. Odeyemi OM, Ashamo RO, Akinkurolerem, Olatunji AA. Resistance of strains of rice weevil, *Sitophilus oryzae* to pirimiphos methyl. Julius-Kuhn-Archived. 2010; (425):167.
15. Bagheri ZE, Beghari S. Study of the fecundity of *Sitophilus granarium* on different rice varieties. Journal of Entomology Sciences. 1985; 49(39):759-761.
16. Lohar MK, Kahar HU, Juno GM, Ahmed M. Shakoori AR. Quantitative losses of stored wheat, rice and maize caused by *Sitophilus granarius* L. Fifteenth Pakistan Congress of zoology. 1995; 15:241-154.
17. Permaul D. Insect storage pests and arthropods of paddy and milled rice in Guyana. Annual Conference 1992 proceeding. 1994; 54-62.