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Investigation on Host Preference of *Sitophilus oryzae* (Rice Weevil) (Coleoptera: Curculionidae) on Different Grains

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ABSTRACT

Rice weevil, *Sitophilus oryzae* is one of the most devastating primary pests of stored grains. Adults feed mainly on endosperm, while larvae feed on germ, resulting in reduced germination and nutritional value. Rice product after wheat has special importance as the second agriculture strategic product. So in this research, the pest effect was studied with five different treatments viz, *Oryza sativa* (polished rice, unpolished (rough) rice), *Triticum aestivum* (wheat), *Zea mays* (maize), and *Hordeum vulgare* (barley), each replicated ten times.The assessed parameters were percent grain damage, percent weight loss, and number of F1 progeny produced in free choice conditions. Polished rice was the most preferred host in free-choice testing, with 18.75% grain damage, 14.11% grain weight loss, and 138.8 adult F1 progeny emergence. Rough rice was the least preferred host under free choice condition. *S. oryzae* thus, preferred polished rice.

Keywords: rice, weevil, host preference, grains, *Sitophilus oryzae*

INTRODUCTION

Storage grain losses of major cereal crops can be attributed primarily to attack by rice insect pests, diseases (Rana and K.C., 1977). It is generally believed that half of the storage losses are usually caused by insects. *Sitophilus oryzae L*. is the most cosmopolitan in nature, and causes severe losses in rice, maize, barley, wheat, and other crops (Bhatia et. al., 1975; Singh, et. al, 1980; Neupane, 1995). While the hot, humid climate of Southeast Asia is quite suitable for rice cultivation, it is equally suitable for rapid stored-product insect development which can result in explosive outbreaks, potentially causing devastating post-harvest rice grain damage.

Cereals are the dominant sources of nutrition for developing and underdeveloped nations. Among the cereals rice, wheat and maize constitute about 85% of total global production (Dayal et al. 2003). Among the cereals, wheat is the second most important staple food crop after rice. On the other hand, after rice and wheat, maize is an important cereal crop serving as source of food, feed and industrial raw material. With the increase of population more food grain production is needed in the country. Wheat and maize can play a vital role in food requirement in nation perspective (Bari 1997). In storage, insect pests

became important soon after men first learned to keep grains for seed and food purposes. Rice, wheat, maize and other cereals are stored in the government and public go down in developing countries.

The infestation starts in the field where, female weevil makes a small hole on the seed, deposits an egg and covers it with a gelatinous fluid. The apodus grub feeds inside the grain, pupates there itself and emerges through a hole made on the seed (David and Kumaraswami, 1975) and damage is multiplied by several folds under storage. This leads to significant increase of moisture during rainy seasons, thereby creating congeal conditions for weevil infestation.

Infested seed fetches lower market price due to reduced weight and also the seed viability of the damaged grain is drastically reduced and affects subsequent planting. Thus, the objectives of this study are to estimate relative losses in different host crops and to determine the relative rice weevil host preference in said crops under free-choice condition.

MATERIALS AND METHODS

The study was conducted for periods of two months (February & March) at 22°C. The design of the experiment was completely randomized with 5 treatment and 10 replications. The following grains were taken are *Oryza sativa* (T1 = polished rice and T2 = unpolished (rough) rice), *Triticum aestivum* (T3 = wheat), *Zea mays* (T4 = maize) and *Hordeum vulgare* (T5 = barley).

200 grains from each material sample were kept in hand-made small rectangle shaped box of (length 9cm, width 7cm and height 3.5cm) made from plastic sheets, with mouth open and were arranged in large rectangular plastic box. In each boxes 40 weevils were released with the help of forcep in the centre of the box. In order to proper aeration and to prevent escape of weevils , the mouth of the plastic boxes was covered with net with the help of rubber bands.

Weevil sex was determined by rostra length and rostra pit discrimination, as is described in Reddy (1951), and by abdominal tip shape, as is described in Qureshi (1963). Subsequent data were observed and recorded at 15 days interval, 15, 30,45 and 60 days (2 months).

Experimental setup based on 10 replication of Sitophilus oryzae

Subsequent data were recorded at 15 days interval and continued for the period of 2 months.Damaged and undamaged grains were independently weighed . Weighing was performed at 15, 30, 45 and 60 days.

Percent grain damage was computed using the following formula:

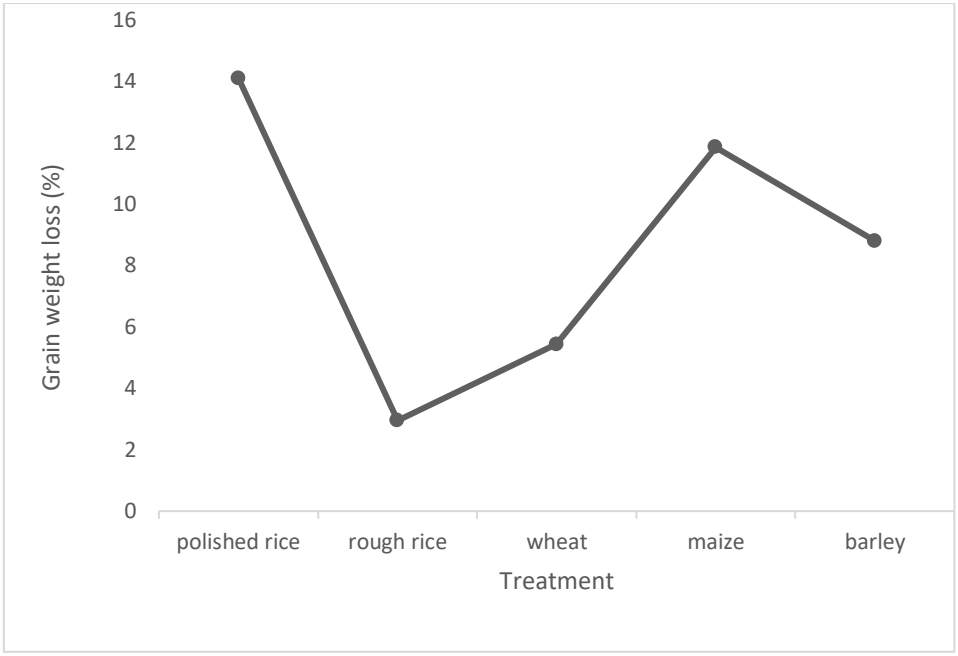
$$grain\ damage\ (\%) = \frac{\text{number of damaged grains}}{\text{total number of grains}} \times 100$$

Statistical Analysis- The data was projected for statistical analysis to find assessment parameters included: percent grain damage, percent weight loss, and number of F1 progeny. The analysis of variance by (ANOVA) was applied. the test significance level was P=0.05. The calculation were performed using IBM SPSS statistical software.

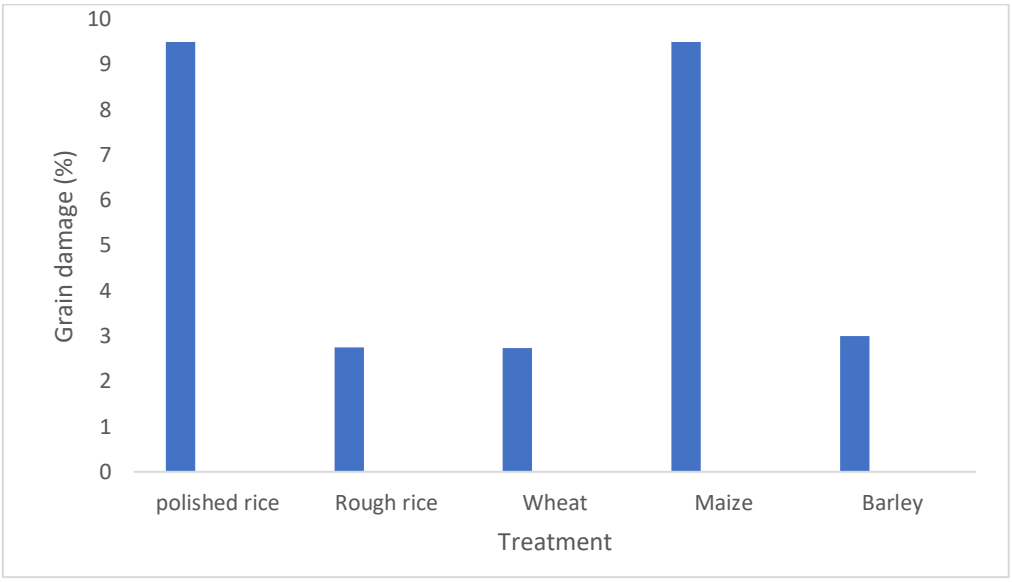
OBSERVATION

Table. The weight loss, F1 progeny and grain damage of different host crops due to *Sitophilus oryzae* infestation under free choice condition

Treatments	Grain weight (gm) Mean±S.E	Weight loss of weevil (%) Mean±S.E	F1 progeny(No.) Mean±S.E	Grain damage (%) Mean±S.E			
				15day	30day	45day	60day
Polished Rice (*Oryza sativa*)	85.89	14.1±.12	138.8	9.50±.29	11.50±.29	13.50±.87	18.75±.75
Rough Rice (*Oryza sativa*)	97.06	2.95±.17	16.25	2.75±.48	2.75±.25	3.25±.48	4.50±.29
Wheat (*Triticum sativum*)	94.57	5.43±.50	30.00	2.74±.25	4.25±.48	5.50±.29	6.25±.48
Maize (*Zea mays*)	88.14	11.86±.44	130.3	9.50±.96	10.00±1.47	12.00±1.08	16.25±.63
Barley (*Hordeum vulgare*)	91.21	8.80±.39	27.25	3.00±.41	4.00±.41	6.25±.25	8.50±.29
P value	0.05	0.05	0.05	0.05	0.05	0.05	0.05



Graph 1: Grain weight loss due to *Sitophilus oryzae* in different host crops



Graph 2: Showing Grain damage due to *Sitophilus oryzae* in different host crop

RESULT

On the basis of Table 1 and graph 1 & 2), *S. oryzae* caused weight loss percentage of polished rice (14.11%), maize (11.86%), barley (8.80%), and wheat (5.43). The number of F1 progeny produced in polished rice (138.8 adults), maize (130.3 adults) wheat (30.0 adults) and barley (27.25 adults). On the 15-day inspection, polished rice exhibited grain damage at 9.50%, a value shared by maize, barley (3.0%), rough rice (2.75%), and wheat (2.75%). At 30 days, the maximum grain damage was observed in polished rice (11.50%), and was numerically followed by maize (10.00%). At 45 days, polished rice grain loss of (13.50%), maize (12.0%). Barley (6.25%) and wheat (5.50%), while the lowest level of grain damage occurred in rough rice (3.25%). The highest grain loss level (18.75%) was evident in polished rice at 60

days. Rough rice incurred 4.50% damage while maize, barley, and wheat incurred (16.25%), (8.50%), and (6.25%) grain loss, respectively.

Thus, of the five treatments, *S. oryzae* caused the greatest weight loss to polished rice (14.11%), showed relatively high level of F1 Progeny (138.8 adults) and the highest grain loss level (18.75%) was recorded in polished rice at 60 days. The lowest number of F1 Progeny, weight loss, and grain damage was recorded in rough rice respectively. The test significance level was P=0.05 (polished rice> maize> wheat> barley> rough rice)

DISCUSSION

S. oryzae is universally regarded as one of the most destructive primary pests of stored cereals such as barley, maize, rice, and wheat (Atwal and Dhaliwal, 2002). Annual grain loss in storage due to these insects approaches 15% (Joshi et al., 1991). It is estimated that 20% of the total maize harvest is lost annually due to insect pest attack (Upadhyay et al., 2001). In one study, the maximum grain loss in wheat attributable to a single weevil was measured at 19%, and it was nearly 57% in rice (Banerjee and Nazimuddin, 1985), he also observed that five host crops (polished rice, rough rice, wheat, maize, and barley) were tested to determine the host preference of *S. oryzae* under free- and no-choice conditions. Grain weight decrease, number of F1 progeny, and percent grain damage differed significantly among the various selected host grains. Grain weight loss was found to be the greatest in polished rice (14.11%) in the free-choice scenario, and it was the least in rough rice (2.95%). The greatest percentage of weight loss was observed in wheat in the no choice test.

A similar finding was reported by Banerjee and Nazimuddin (1985), where the maximum single kernel weight decrease attributable to an individual larva was 57 and 19 percent in rice and wheat, respectively. A similar result was also reported by Ansari (2003). Regarding individual insect consumption, it has been reported that *Sitophilus oryzae* and *Rizopertha domonica* can consume 0.49 mg and 1.5 mg (respectively) of grain daily and produce 11-12 mg and 54 mg (again, respectively) of waste products throughout their lives (Golebiowska, 1969 cited by Shivakoti and Manandhar, 2000).

Percent grain damage was assessed at 15, 30, 45, and 60 days following experiment inception. The greatest grain damage was observed in polished rice (18.75%) and was followed by wheat (16.25%). These values are not unexpected, considering that an exceedingly high level of damage (67.78%) was reported by Ansari (2003) in wheat, while the level was 40.97% in maize.

Teotia and Tewari (1977) studied the ovipositional behavior and development of *Sitophilus oryzae*. on various natural foods, and observed that oviposition was higher in rice and wheat grains and lower in un-husked barley and maize. In fact, previous studies have revealed that rice (followed by wheat, jowar, barley, and maize) is the most preferred host in terms of oviposition (Ansari, 2003; Teotia and Tewari, 1977).

CONCLUSION

Findings of this study reveals that weevils prefer polished rice over other grains when conditions favor infestation. Damage in polished rice was measured at approximately 20%. Therefore, this study suggested that barley and rough rice are relatively less preferred to rice weevil and they can be stored for long time. In summary, the research give idea about proximity of storage for storage crops during stored inside the hose.

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