

Comparative Susceptibility of Wheat and Rice Grains to Rice Weevil, *Sitophilus oryzae* (L.)

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Members of the grass family Poaceae (Gramineae), particularly cereals such as maize, rice, wheat, sorghum, pearl millet, and barley, serve as staple food crops in many parts of the world. However, a considerable portion of harvested grains is lost during storage due to biotic factors, especially insect pests, which cause both quantitative and qualitative deterioration of stored produce (Sharon *et al.*, 2014; Tripathi, 2018). In India, where food grain production reached 250 mT in 2010-2011, insect pests damage was also recorded around 20-25 percent of the grains (Nattudurai *et al.*, 2015). Among these pests, the rice weevil, *Sitophilus oryzae* is one of the most destructive storage pests in tropical and subtropical regions worldwide. *S. oryzae* is considered a primary pest of stored cereals, capable of infesting intact, undamaged grains. Once these grains are attacked, they become more prone to secondary insect infestations, which further intensify storage losses (Doherty *et al.*, 2023). Both growth stages of the weevil are destructive, adults feed mainly on the endosperm just beneath the husk, while larvae remain concealed within the kernel and consume the germ and inner tissues of the grain (Gvozdenac *et al.*, 2020). The use of resistant crop varieties is considered the first line of defense against insect pests, both in field and storage environments.

The level of infestation caused by *S. oryzae* largely depends on grain characteristics such as hardness, pericarp thickness and nutrient composition, which influence oviposition, larval development and adult emergence (Chen and Li, 2024; Arya *et al.*, 2025). Previous studies have reported host-dependent variation in susceptibility among different cereals (Soujanya *et al.*, 2020; Bhargude *et al.*, 2021), but comparative information on wheat and rice grains under uniform laboratory conditions remains limited. Therefore, the present study was undertaken to compare grain damage, weight loss and susceptibility index of wheat and rice to *S. oryzae* under laboratory conditions.

The study investigating host preference of *S. oryzae* to stored grains was conducted during 2021-2022 in the Department of Agricultural Entomology, Palli Siksha Bhavana, Visva-Bharati, Sriniketan, Birbhum, West Bengal under controlled laboratory conditions (27 ± 2 °C temperature and $70 \pm 5\%$ relative humidity). Fresh, uninfested grains of wheat and dehusked rice were sourced from the local market and prepared for the experiment by drying them in a hot air oven for four hours at 60 ± 2 °C. This process was essential to eliminate any pre-existing infestations in the grains. Although grain moisture was not directly measured, all samples were conditioned uniformly



under the same laboratory environment before use to maintain comparable moisture levels across treatments. After cooling, grains were stored in clean plastic containers (50 g capacity) covered with muslin cloth to allow aeration. The rice weevil was collected from infested wheat stocks obtained from local farmers and reared on sterilized wheat grains in 1 kg plastic jars covered with muslin cloth. Adults were allowed to oviposit for seven days and then removed using a No. 10 mesh sieve. Newly emerged adults (five days old) from this stock were used for experiments. Equal quantities of wheat and rice grains (25 g each) were placed in separate containers, and two pairs of adult weevils were released per container. The experiment was laid out in a completely randomized design (CRD) with ten replications per treatment. Observations were recorded on adult emergence, developmental period, grain damage, weight loss, and susceptibility index (Dobie, 1977). The Dobie Susceptibility Index categorizes susceptibility as follows: an index of 1 to 5 indicates resistance, 6 to 10 denotes intermediate or moderate resistance, 11 to 15 signifies susceptibility and an index of 16 to 21 reflects high susceptibility. Data was analyzed using analysis of variance (ANOVA) and paired t-test in GRAPES software

version 1.1.0 (Gopinath *et al.*, 2021). Mean separation was done at a 5 % level of significance.

Significant differences were observed between wheat and rice grains in their susceptibility to *S. oryzae* (Table 1; Figure 1). The number of adults emerged varied distinctly between the two grains. Rice recorded a higher mean adult emergence (13.2 ± 2.35) compared with wheat (6.6 ± 0.72), and the difference was statistically significant ($p < 0.05$). The greater adult emergence in rice indicates that the species can successfully complete its life cycle in both hosts, though reproductive success is somewhat higher in rice. In contrast, the mean developmental period of the weevil was distinctly shorter in wheat (31.17 ± 1.38 days) than in rice (39.05 ± 0.32 days), indicating faster insect development on wheat. The boxplots in Figure 1 illustrate these contrasting trends in adult emergence and developmental duration, highlighting the variability observed across replications. Grain damage and weight loss were also differed significantly between the two grains. Wheat recorded higher mean grain damage (0.95 ± 0.11 %) and weight loss (0.48 ± 0.08 %) compared to rice (0.53 ± 0.04 % and 0.23 ± 0.02 %, respectively). These findings show that even though adult emergence was greater in rice,

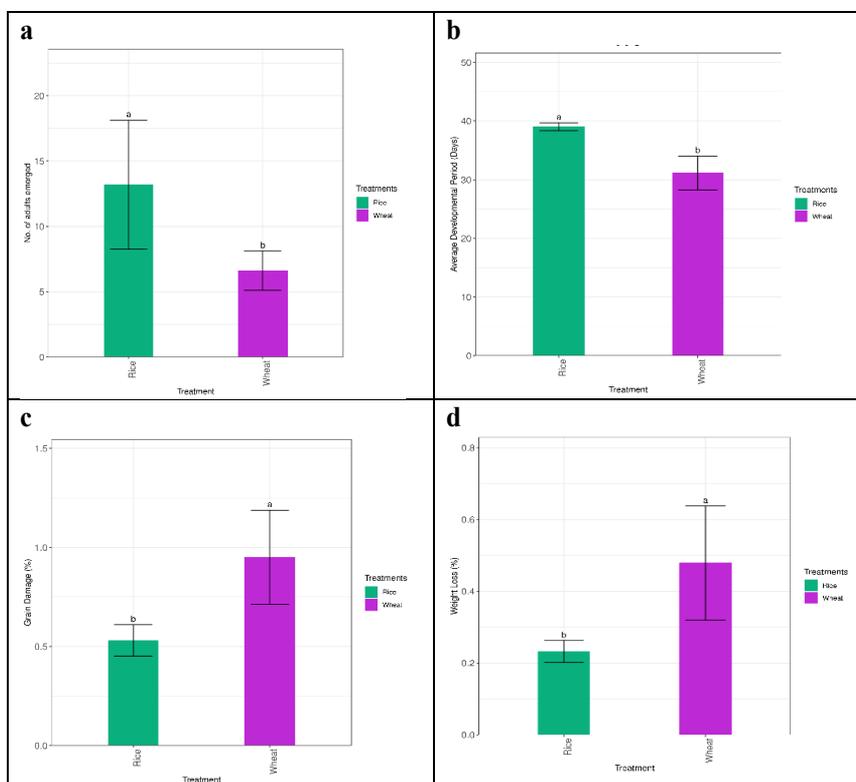


Fig. 1: Boxplots showing comparative biological and damage parameters of wheat and rice grains infested by *Sitophilus oryzae*. (a) Number of adults emerged, (b) developmental period (days), (c) grain damage (%), and (d) weight loss (%). Each box represents median, quartiles, and range for 10 replications per treatment.





Table 1: Biological response and susceptibility indices of wheat and rice grains infested by *S. oryzae* under laboratory conditions.

Parameter	Wheat (Mean±SE)	Rice (Mean±SE)	ANOVA F-value	p (ANOVA)	Paired tcal (df=9)	p (t-test)	Susceptibility Index (SI)	Category
No. of adults emerged	6.6 ± 0.72	13.2 ± 2.35	7.23	0.015	-2.65	0.027	13.44 (W) / 12.50 (R)	Susceptible
Mean developmental period (days)	31.17 ± 1.38	39.05 ± 0.32	30.93	< 0.001	-5.15	< 0.001	-	-
Grain damage (%)	0.95 ± 0.11	0.53 ± 0.04	12.31	0.003	3.5	0.007	-	-
Weight loss (%)	0.48 ± 0.08	0.23 ± 0.02	10.27	0.005	2.99	0.015	-	-

Values are means of 10 replications; W = Wheat; R = Rice

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the overall damage to wheat grains was more pronounced. According to the calculated susceptibility index values, both grains were classified as susceptible. However, wheat showed slightly higher susceptibility (SI = 13.44) than rice (SI = 12.50), reinforcing that while both grains can serve as hosts for *S. oryzae*, wheat offers more favorable conditions for its growth and multiplication.

Both wheat and rice grains were found to be susceptible to *S. oryzae*, though the extent of infestation differed markedly. Wheat showed higher grain damage and weight loss than rice, indicating its greater vulnerability. These findings agree with Bhargude *et al.* (2021) and Arya *et al.* (2025), who reported that physicochemical properties such as grain hardness, pericarp thickness, and nutrient composition strongly influence resistance to *S. oryzae*. The shorter developmental period of the weevil on wheat suggests that its softer grain structure facilitates easier larval penetration and faster growth, while the denser rice endosperm restricts infestation. Similar host-dependent variations in susceptibility have also been observed in maize and other cereals (Soujanya *et al.*, 2020; Chen and Li, 2024). The susceptibility indices in this study fall within Dobie's (1977) "susceptible" range, confirming that both grains support weevil development under storage conditions. These results highlight the importance of selecting harder or denser grain types as a practical and eco-friendly approach for minimizing postharvest losses due to *S. oryzae*.

In conclusion, this study highlights significant differences in the susceptibility of wheat and rice to *S. oryzae* infestations. Both wheat and rice grains were susceptible to *S. oryzae*, but the level of infestation varied. Wheat recorded higher grain damage and weight loss despite fewer adult emergences, while rice supported a greater adult population but exhibited lower damage rates. These findings indicate that grain physical properties and nutritional composition critically influence weevil development. Consequently, while both grains are susceptible, wheat is more vulnerable, underscoring the need for tailored storage protection strategies for each grain type.

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Author contribution

MK conceived and conducted the experiment, collected data, and prepared the manuscript. PM supervised the research work, guided data interpretation, and critically reviewed the manuscript. Both authors read and approved the final version of the paper.

Conflict of Interest

Authors declare that they have no conflict of interests

Ethical Approval

The article doesn't contain any study involving ethical approval.

Use of Generative AI or AI assisted technologies

Authors declare that no Generative AI or AI assisted technologies have been used in preparation of this manuscript.

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