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Host Preference and Damage potential of Rice Weevil, (*Sitophilus oryzae* L.) on Different Stored Millets

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

The study was carried out at the Department of Entomology, SHUATS, Prayagraj during 2023-2024 to study the host preference and damage potential of rice weevil *Sitophilus oryzae* (L.) on different stored millets. The laboratory experiment was conducted to study host preference and seed damage of rice weevil *Sitophilus oryzae* (L.) on different millets (sorghum, pearl millet, foxtail millet, finger millet, kodo millet). Among different millets, sorghum was found as most preferred host with 30.44 number of weevils after 15 days of release. Maximum and minimum seed damage (%) was recorded on sorghum and foxtail millet after 30 days of release. It was observed that sorghum's high nutritional content, suitable grain structure, optimal moisture levels, and favorable storage conditions make it an ideal environment for rice weevils' development and reproduction.

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Keywords: Millets; seed damage; Sitophilus oryzae; sorghum.

1. INTRODUCTION

Millets are small-grained, warm-weather cereals from the grass family. In India, important types include Jowar (Sorghum), Bajra (Pearl Millet), and Ragi (Finger Millet). Additionally, Small Millets like Proso, Kodo, Foxtail, Barnyard, and Little Millet are cultivated. Millets thrive in semiarid tropics, offering staple crops where other food crops struggle due to low rainfall and poor soil fertility. They boast higher nutrient content compared to major cereals, ensuring food and nutrition security [1].

India is the top millet producer globally [2]. Two main types, Pearl Millet (Bajra) and Sorghum (Jowar), make up about 19% of the world's production in 2020. Pearl Millet leads with 40.51%, followed by Sorghum at 8.09%. The key millet-producing states are Rajasthan, Karnataka, Maharashtra, Uttar Pradesh, Haryana, Gujarat, Madhya Pradesh, Tamil Nadu, Andhra Pradesh, and Uttarakhand [3-5]. These states together contribute around 98% of India's millet production. Six states, including Rajasthan, Karnataka, Maharashtra, Uttar Pradesh, Haryana, and Gujarat, account for over 83% of total production, with Rajasthan alone contributing 28.61%. India grows various millet types like Pearl Millets, Sorghum, Finger Millet, Foxtail, Kodo, Barnyard, Proso, Little Millet, and Pseudo Millets such as Buckwheat and Amaranths. Pearl Millet, Sorghum, and Finger Millet make up the majority of India's millet production [6].

Stored sorghum faces damage from various agents like insects, rodents, fungi, birds, mites, and moisture, resulting in both quantitative (reduced weight) and qualitative loss (quality deterioration through direct feeding and chemical changes). Sorghum, whether stored or processed, is consistently vulnerable to insect invasion, leading to progressive degradation in quality and quantity, affecting both weight and germination capacity [7,8].

The rice weevil (*Sitophilus oryzae* Linnaeus) is a significant storage pest in tropical and subtropical regions worldwide. Both the larvae and adults of this pest feed internally on grains, leading to significant damage to both the quality and quantity of the grains. Their voracious feeding renders the grains unsuitable for human consumption and seeding purposes. Studies have shown that infestations of rice weevils alone can cause up to 83.5% damage to sorghum grains over a six-month period [9].

Keeping the above points in view, the present study was carried out with the following objective:

- To study the host preference and damage potential of rice weevil on different millets

2. MATERIALS AND METHODS

The study was carried out at the Department of Entomology, SHUATS, Prayagraj, Uttar Pradesh during 2023-2024.

Experimental details to study the host preference and damage potential of rice weevil on different stored millets:

a) Seed

Five hundred grams seed of each millets that is sorghum, pearl millet, foxtail millet, finger millet and kodo millet was cleaned of straw, chaff, light seeds and other impurities before testing. All the seeds were disinfected by keeping in the oven at 60℃ for 5 hours before keeping it for host preference and percent seed infestation.

b) Host Preference and Percent seed damage under free choice condition

The study was carried out under free choice condition to investigate the host, feeding preference and damage potential of the test insect. The experiment was carried out in completely Randomized Design with three replications of each treatment. Insects for the culture were collected from local stores at Prayagraj and later it were acclimatized under laboratory conditions. Seed samples were collected from Prayagraj market.

Under Free Choice Test, 100g seed of each millet was kept in a round plastic container which is equally partitioned in trough equidistance from centre. Approximately 50 pair of rice weevil were released in the centre of container giving free choice to the adult for orientation and then container covered with muslin cloth. The Experiment was replicated 3 times.

Plate 1. Layout for Host preference

c) Observations

For the study of host preference, the number of weevils present in each millets was counted on 3, 5, 7, 9, 12 and 15 days. Host preference was determined by taking the average number of weevil present on each above mentioned days on each millets.

The Observations as percent seed damage were recorded at 10, 20 and 30 days after released of rice weevil. The amount of damage was converted into percentage with help of the following formula:

$$\text{Seed damage \%} = \frac{Number\ of\ seed\ damage}{Total\ number\ of\ seed} \times 100$$

d) Statistical analysis

The data obtained from different treatments were subjected to statistical analysis as per the statistical guidelines by Gomez and Gomez [10]. Data were tabulated and statistically analyzed as per the standard procedure for analysis of variance. The comparison in the treatment means was tested by critical difference (CD) at a 5 percent level of significance. Statistical analysis was done through WASP (version 1.0).

3. RESULTS AND DISCUSSION

3.1 Host Preference of Rice Weevil (*S. oryzae*) in Major Millets

The host preference and damage potential of rice weevil were evaluated on sorghum, pearl millet, kodo millet, foxtail millet and finger millet. Host preference were evaluated based on orientation of weevils towards each millets. Among different millets, sorghum was found as the most preferred host with (30.44) number of weevils (mean number of weevils attracted towards millets after 15 days of release). This was followed by pearl millet (26.17), kodo millet (22.50) and finger millet (11.61), respectively. Foxtail millet was observed as the least preferred host with (8.17) number of weevils presented in Table 1 and depicted in Fig. 1.

The damage potential was determined in free choice condition based on percentage seed damage. Under free choice condition maximum percentage seed damage was recorded in sorghum (6.56%), this was followed by pearl millet, kodo millet, finger millet and foxtail millet, which encountered minimum percentage seed damage (1.61%) presented in Table 1 and depicted in Fig. 1.

Similar results imputed by Swamy and Wesley [11], who observed that sorghum was the most preferred host followed by pearl millet.

In contrary Bhargude et al., [12] the maximum seed damage was recorded in pearl millet followed by sorghum.

The physical characteristics of groundnut pods, such as pod size, shell thickness, and reticulations, influence their susceptibility or tolerance to bruchids Rekha et al. [13].

Table 1. Host preference and percent seed damage by rice weevil on different millets

Tr. No.	Treatments	Number of weevil Present/Millet sample						Mean	Percent seed damage			Mean
		3rd DAR	5th DAR	7th DAR	9th DAR	12th DAR	15th DAR		10th DAR	20th DAR	30th DAR	
T_1	Sorghum	30.67	29.33	30.00	29.67	31.33	31.67	30.44	5.36	6.69	7.63	6.56
T_2	Pearl Millet	25.67	26.00	26.33	26.67	25.00	27.33	26.17	3.24	4.53	5.40	4.39
T_3	Foxtail Millet	8.00	7.33	7.67	8.67	9.00	8.33	8.17	1.18	1.40	2.27	1.61
T_4	Finger Millet	10.33	11.00	11.33	12.00	12.67	12.33	11.61	1.53	2.37	3.03	2.31
T_5	Kodo Millet	22.00	23.33	23.67	22.67	22.33	21.00	22.50	2.94	3.71	4.73	3.79
S.Em (±)		1.73	1.69	2.27	1.66	1.89	1.35	0.34	0.19	0.24	0.36	0.52
C.D. (p=0.05)		5.45	5.33	7.15	5.23	5.97	4.25	1.01	0.62	0.76	1.14	1.66
C.V. (%)		15.51	15.11	19.86	14.24	16.37	11.61	4.30	11.99	11.26	13.65	24.50

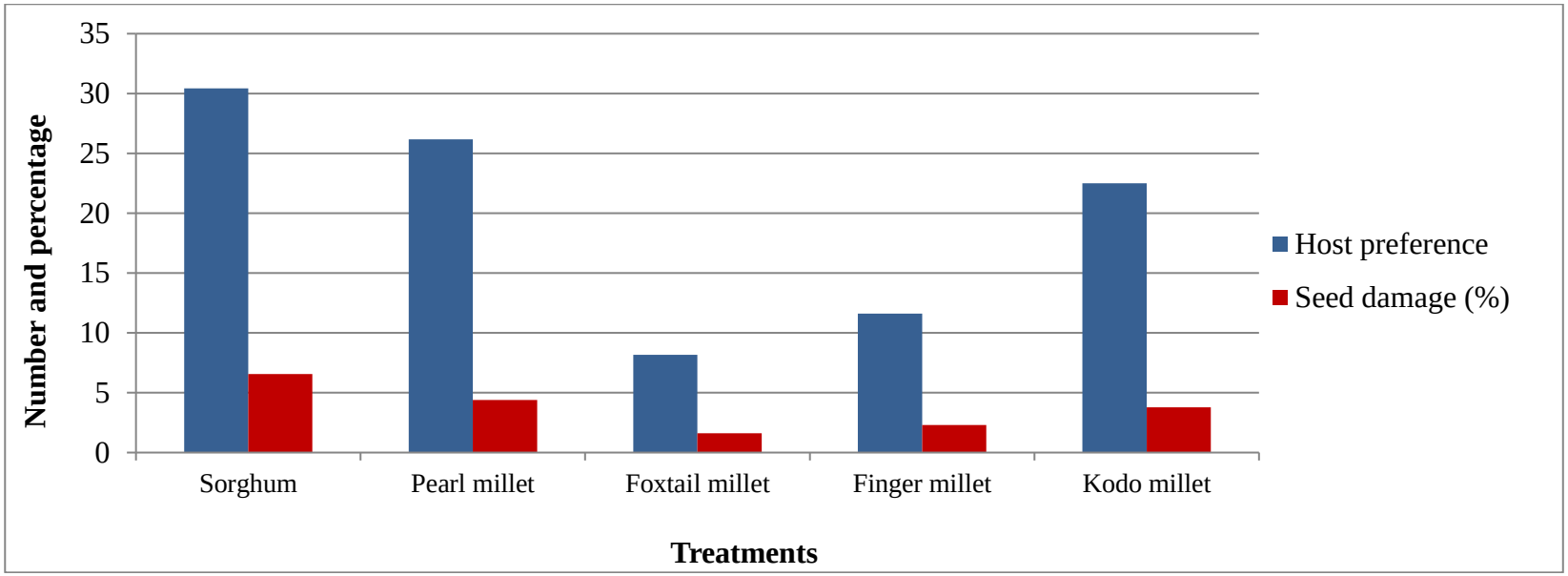

Fig. 1. Host preference and percent seed damage by rice weevil on different millets

Murad and Batool [14] demonstrated that wheat varieties with higher protein and carbohydrate content, higher grain weight, and lower grain hardness are more susceptible to grain moth.

4. CONCLUSION

The study revealed that among the millets tested, sorghum was the most preferred host for the rice weevil, *Sitophilus oryzae* (L.), with the highest number of weevils and greatest seed damage observed. Sorghum's high nutritional content, suitable grain structure, optimal moisture levels, and favorable storage conditions contribute to its susceptibility to rice weevil infestation. Effective management of rice weevils and protection of stored grains require a holistic strategy involving sanitation, proper storage, monitoring, biological and chemical controls, integrated pest management and education for sustainability and efficacy.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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