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Integrated Pest Management of Major Storage Pests on Millets

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ABSTRACT

Millet grains like pearl millet (Bajra), finger millet (Ragi), foxtail millet, and sorghum (Jowar) play a critical role in India's agricultural landscape and are essential components of the diets of many people. Their ability to withstand extreme weather conditions and their nutritional value make them irreplaceable. However, post-harvest period has significant difficulties, as the stored grains become prone to infestation by various insect pests, leading to notable financial detriment. At the household, rural, and trader levels, these grains are targeted by many pest species such as Rhyzopertha dominica, Sitophilus oryzae, Sitotroga cerealella, and Ephestia cautella. These pests not only cause considerable loss in quantity but also degrade the quality of the stored millet, impacting food security and economic health. Insect damage to stored grains can lead to losses up to 50%. This study focuses on the major insect pests that affect stored millets in India, exploring their influence and the Integrated management practices to reduce their impact.

Keywords: Millet, essential components, nutritional value, pest

INTRODUCTION

Millet is especially popular in developing countries like India and Africa, where food security is a major concern. The global millet production is estimated at 27.8 million tons. India is the world's largest producer of millets, accounting for approximately 41% of global production, followed by Africa. **(Gowri and shivakumar, 2020)**. In terms of nutrition, millet is far ahead of rice and rice. In terms of mineral content, millet contains more fibre than rice and wheat. All types of millet contain more fibre than rice and wheat. Some millets have more than fifty times the fibre content of rice.

Wheat has thirty times more calcium, while other grains have at least twice as much calcium. Wheat and small grains are also more nutritious than wheat **(Amir Gull, et al, 2014).**

Recently, millet consumption has increased in developing countries due to its potential role in family food and food security. However, these processed millets are susceptible to pests, resulting in loss of quantity and quality. Although the effects of insects and physicochemical changes on major millets such as sorghum have been extensively studied, especially rice borers, there is little research on storage and pest control for other millets. Information about millet pests can help design appropriate protection strategies **(Swami and Wesley 2021)**.

MAJOR INSECT PEST OF MILLETS

1. *The Khapra Beetle (Trogoderma granarium)*

The Khapra Beetle

Capra bug is one of the most feared pests of rice and millet. It is known for its destructive larvae, which like to feed on rice pests and can survive almost anywhere in the storage area, making it particularly difficult to control. It is not resistant to many pesticides and persists for a long time, making it difficult to remove. Capra beetles cause 75% damage by directly eating stored products. Infected produce may also be contaminated with insects, larval lint, and feathers, which can pose a health hazard and be difficult to remove from storage and shipping containers. Quality control includes strict hygiene, use of closed containers and regular inspection of millet. **(Athanassiou *et al.*, 2019)**

2. *The Lesser Grain Borer (Rhyzopertha dominica)*

The Lesser Grain Borer

This pest is notorious for its ability to bore into grains, causing internal damage that is often undetectable from the outside. The Lesser Grain Borer thrives in warm conditions, making the climatic conditions of many parts of India ideal for its proliferation. Integrated Pest Management (IPM) approaches, including the use of pheromone traps for monitoring and biological control methods, have shown promise in managing its populations. **(Demis and Yenewa 2022)**

3. *The Rice Weevil (Sitophilus oryzae)*

The Rice Weevil

Despite its name, the Rice Weevil does not limit its infestation to rice and is a common pest of millets stored in households and granaries. The adult weevils bore into the grains to lay eggs, and the emerging larvae feed from the inside, rendering the grains hollow. Control measures include thorough cleaning of storage facilities, using insect-proof containers, and temperature control, as exposing infested grains to sunlight or freezing temperatures can kill the weevils. **(Demis and Yenewa 2022)**

4. *The Angoumois Grain Moth (Sitotroga cerealella)*

The Angoumois Grain Moth

This pest targets the stored grains directly, with the larvae feeding on the interior, leading to significant losses. The Angoumois Grain Moth is particularly problematic because the damage is often not apparent until it is too late. Early detection through regular monitoring and maintaining dry conditions in storage areas are crucial in managing this pest. Hermetic storage, which creates an oxygen-depleted environment, is also effective in controlling moth populations **(Chitra and Subramanian 2016)**.

5. *The Indian Meal Moth (Plodia interpunctella)*

The Indian Meal Moth

The Indian Meal Moth is an extensive pest in stored food products, including millets. Majorly larvae that feed on the grain and leaving behind webbing that contaminates the grain mass. Prevention includes proper sanitation practices, such as cleaning storage areas thoroughly to remove any larvae or pupae and storing **(Sharma *et al*.,2007).**

MANAGEMENT STRATEGIES

Integrated Pest Management (IPM) Approach

Management of insect pests in stored millets requires a integrated approach that minimizes the dependency on chemical pesticides, thereby preserving grain quality and ensuring environmental safety. The IPM strategy combines cultural, physical, biological, and chemical methods to achieve effective and sustainable pest control.

Cultural and Hygienic Practices

- Regular cleaning of storage facilities to remove insect-infested residues.
- Proper drying of millet grains before storage to reduce moisture content, making it less attractive to pests.
- Use of resistant millet varieties, where available, can reduce pest infestations.

Physical and Mechanical Controls

- Hermetic storage options, such as using sealed containers or bags, can create an oxygen-deprived environment, inhibiting pest survival.
- Temperature control, either through cooling or heating, can effectively manage pest populations.
- Solarization, for instance, heats grains to lethal temperatures for pests.

Biological Controls

- Utilization of natural predators or parasites of the pests can help in reducing their populations. For example, releasing *Trichogramma* wasps to control moth populations.
- Biopesticides derived from natural sources, such as neem oil, can offer a safer alternative to chemical pesticides.

Chemical Control

- Should be considered as a last resort and used judiciously, focusing on products with lower toxicity and minimal residual effects. Phosphine fumigation is widely used for bulk grain treatments but requires careful handling.

Community-Based Approaches

- Engaging communities in awareness and training programs on pest management practices can amplify the impact of IPM strategies, fostering collaborative efforts towards pest-free storage.

CONCLUSION

Given the importance of millets as a staple food and its dual use, grain-rich, resilient and low-input intensive crops, it has the potential to combat malnutrition and climate change and increase export income. Millet is not only nutritious but also rich in health-promoting phytochemicals, making it one of the best foods to fight age-related diseases. Keeping millet pests at bay is a major concern for farmers worldwide, especially farmers in developing countries. They cause serious losses directly or indirectly by eating seeds or crops or by collecting feathers, carcasses and webs in grains and crops. Therefore, understanding the signs of damage, life cycle and biological characteristics of the large stored organisms will help to reduce them. Damage caused by storage pests includes the weight, quality, value and total loss of stored products, and the loss continues. Management strategies that do not include synthetic pesticides require integrated pest management (IPM). Only the IPM method is effective in controlling the quantity and nutritional quality of stored rice and making it economically viable. Therefore, Xiaomi's good management needs to be strengthened and supported.

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