

# *Proso Millet (*Panicum miliaceum* L.): A Resilient Grain and Its Management Challenges with Focus on Shoot Fly*

**Reshma M.<sup>1\*</sup> and Suddapalli Anka Pujitha<sup>2</sup>**

<sup>1</sup>Department of Entomology, School of Agricultural Sciences,  
Malla Reddy University, Hyderabad, India.

<sup>2</sup>Department of Entomology, Acharya N.G. Ranga Agricultural University,  
Bapatla-522101, Andhra Pradesh, India.

**Corresponding Author**

Reshma M.

Email: reshma@mallareddyuniversity.ac.in



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## **ABSTRACT**

Proso millet (*Panicum miliaceum* L.), known as an ancient, drought-resistant grain, excels in marginal lands with short growth cycles of 60-90 days and low water needs (300-500 mm rainfall). Rich in protein (11-14g/100g), fiber, iron, and gluten-free properties, it supports nutrition amid climate challenges and India's Shree Anna promotion. The article highlights shoot fly (*Atherigona* spp.) as a key pest causing "dead heart" damage, recommending IPM strategies like timely sowing, neem biopesticides, and seed treatments for sustainable yields.

## **INTRODUCTION**

**P**roso millet (*Panicum miliaceum* L.), also called common millet, broomcorn millet, or "cheena" in parts of India, is an ancient cereal grain known for its short growth duration, drought resistance, and adaptability to marginal lands. Cultivated for thousands of years, Proso millet remains a valuable crop in traditional farming systems

and is increasingly being recognized for its nutritional benefits and role in sustainable agriculture (Mathanghi *et al.*, 2020).

In recent years, the growing need for climate-resilient and low-input crops has revived interest in millets, especially in countries like India, where the government is actively

promoting “Shree Anna” (nutri-cereals). Among millets, Proso millet stands out due to its ability to grow in less fertile soils with minimal water and fertilizer inputs. However, despite its adaptability, the crop is not immune to biotic stresses. One of the major threats to its productivity is the shoot fly, a common pest in millet cultivation.

## Importance of Proso Millet

### 1. Agro-Climatic Adaptability

Proso millet thrives in dryland ecosystems and is highly adaptable to diverse climates. It requires only 300–500 mm of rainfall and grows well in sandy or loamy soils with minimal nutrient requirements. It matures in 60 to 90 days, making it ideal for short-season rotations and as a catch crop during delayed monsoons.

### 2. Nutritional Profile

Proso millet is rich in carbohydrates, protein (12–14%), dietary fiber, and essential micronutrients such as iron, magnesium, and B-vitamins. It is gluten-free and has a low glycemic index, making it suitable for individuals with gluten intolerance or diabetes. (Saleh *et al.*, 2013)

#### Nutritional comparison (per 100g of grain):

- **Protein:** 11–14 g
- **Iron:** 2.9 mg
- **Fiber:** 7–9 g
- **Fat:** 2–3 g

Its nutrient density helps address “hidden hunger” and lifestyle diseases, positioning it as a smart food for the 21st century.

### Pests of Proso Millet

Although Proso millet is generally more tolerant to pests compared to other cereals, it is

still vulnerable to several insect pests that can significantly affect yield. The most common insect pests include:

#### Major Pests:

1. Shoot fly (*Atherigona spp.*)
2. Stem borers (*Chilo partellus*)
3. Aphids (*Rhopalosiphum maidis*)
4. Grasshoppers
5. Cutworms

Among these, the shoot fly is the most economically important pest affecting Proso millet, particularly during the seedling stage.

### Shoot Fly: A Major Pest in Proso Millet

#### 1. Identification and Biology

Shoot fly, primarily *Atherigona pulla* and *Atherigona soccata*, is a significant pest of millets. (Sathish *et al.*, 2017). The adult is a small, dark gray fly resembling a housefly. Females lay eggs singly on the lower surface of the leaves, particularly at the seedling stage.

#### Life cycle overview:

- **Egg stage:** 1–2 days
- **Larval stage:** 5–7 days (boring into the central shoot)
- **Pupal stage:** 7–10 days (in the soil or plant base)
- **Adult lifespan:** 3–7 days

The entire life cycle completes in about 15–20 days depending on temperature and humidity, allowing for multiple generations during a single cropping season.

#### 2. Nature of Damage

Shoot fly maggots bore into the central growing shoot of young seedlings, causing the

characteristic symptom called “dead heart.” Infected plants fail to grow or tiller properly, resulting in poor stand establishment and significant yield loss.

#### Damage symptoms:

- Drying of central shoot while outer leaves remain green.
- Dead heart formation in 2–3 leaf stage.
- Wilting and stunted growth in severely infested fields.

Shoot fly infestation is most severe when sowing is delayed, especially beyond the optimal sowing window. Late-planted crops are more vulnerable as adult flies find younger seedlings more suitable for egg laying.

#### 3. Factors Influencing Infestation

- Delayed sowing (after optimal window)
- High humidity and warm temperatures
- Sparse plant population
- Lack of crop rotation

#### Integrated Pest Management (IPM) of Shoot Fly in Proso Millet

Effective management of shoot fly requires an integrated approach combining cultural, mechanical, biological, and chemical methods. Key strategies include:

##### A. Cultural Control

- **Timely sowing:** Early sowing (June–July in India) avoids peak shoot fly activity.
- **Optimum seed rate and spacing:** Dense sowing discourages egg-laying by female flies.
- **Intercropping:** Intercrop with fast-growing legumes to reduce host concentration.

- **Crop rotation:** Avoid continuous millet cropping; rotate with non-hosts like pulses or oilseeds.

##### • Installation of fish meal trap

#### B. Biological Control

- Encourage natural enemies such as:
  - **Parasitoids** (e.g., *Trichogramma chilonis* for egg parasitism)
  - **Predators** (e.g., spiders, ground beetles)
- **Neem-based biopesticides:** Neem oil or neem seed kernel extract (NSKE 5%) as seed treatment or foliar spray deters oviposition.

#### C. Chemical Control

- **Seed treatment:** Use imidacloprid 70WS @ 5 g/kg seed before sowing.
- **Soil application:** Carbofuran 3G @ 20 kg/ha at sowing can protect early-stage seedlings.
- **Foliar spray:** Dimethoate 30 EC or malathion 50 EC @ 1 ml/l at early seedling stage when infestation is noticed.

Note: Chemical control should be used as a last resort and aligned with Integrated Pest Management (IPM) principles to avoid pest resistance and ecological disruption.

#### Yield Loss and Economic Impact

Shoot fly can cause **up to 46% yield loss** in Proso millet if left unmanaged. Dead hearts reduce plant population and tillering, leading to poor panicle development. In regions with repeated infestations, farmers often abandon millet cultivation, highlighting the need for effective pest monitoring and control. (Kamakshi *et al.*, 2021)

### Prospects for the Future and Research Needs

Millet is still not as well studied as other major cereals, despite its potential. The creation of pest-resistant cultivars, particularly those that are resistant to shoot flies, is urgently needed.

- Promotion of farmer-friendly IPM tools and inexpensive biopesticides.
- Programs to educate and train millet farmers on eco-friendly management and pest identification.
- Adding Proso millet to value-added food chains and public distribution networks to increase production incentives.

There are now more opportunities for millet research and policy support thanks to government programs like the International Year of Millets (2023).

### CONCLUSION

Proso millet is indeed a hardy crop that is quite nutritious and also sustainable possessing great potential in resource-poor together with rainfed farming systems. Its hardiness facing climate change plus soil decay makes it a vital element of food systems later. However, its productivity faces some serious challenges from pests like shoot fly. When we integrate early sowing with biological controls plus farmers are aware, we can manage shoot fly effectively also stable yields are ensured. For livelihoods, farmers promote Proso millet cultivation using proper pest management

practices. This farming aids food security and protects the environment.

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