

Dry Root Rot of Black gram: A Silent Threat to Pulse Production

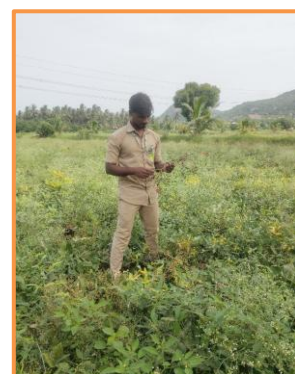
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Black gram (*Vigna mungo*), an important leguminous crop in South and Southeast Asia, is prized for its rich protein content and nitrogen-fixing ability. As demand for pulses continues to rise, ensuring black gram health has become increasingly vital for food security and rural income. However, among the many biotic stresses that affect its cultivation, *dry root rot* has emerged as a serious concern, especially under moisture stress and high temperature. Dry root rot, caused primarily by the fungal pathogen *Macrophomina phaseolina*, is one of the most destructive diseases affecting black gram and other pulses. The disease leads to poor plant stand, yield loss and deterioration of soil health in pulse-growing regions.



Causal Organism and Epidemiology

The causal agent, *Macrophomina phaseolina*, is a soil-borne fungus with a wide host range. It produces **microsclerotia**, which are hardened, black resting structures capable of surviving in soil and infected debris for extended periods—even in harsh environments. These microsclerotia germinate under favorable conditions, especially:

- Soil temperature: 30–35°C
- Soil moisture: **Below 60% field capacity**
- Sandy loam soils with poor organic matter

Once inside the root, the fungus colonizes the vascular tissues, blocking water transport and ultimately killing the plant. The disease is more prevalent during dry spells following heavy rainfall or irrigation, which causes stress to the plant roots. Black gram grown in **rainfed** areas or **late-sown** conditions is especially vulnerable.

Symptoms of Dry Root Rot

Recognizing the symptoms early is crucial for effective management. Dry root rot typically appears **20–30 days after sowing**, especially during flowering to pod-filling stages.

Key Symptoms:

- Sudden wilting of plants, especially during midday, with partial or no recovery
- Drying and drooping of leaves starting from the lower part
- Brown to black discoloration of taproot and lateral roots
- Root bark shredding, leading to hollow, brittle roots
- Affected plants are easily uprooted

- Formation of black micro sclerotia inside infected root tissue (visible under magnification)
- In severe cases, disease incidence may reach up to **40–60%**, especially under stressed conditions.

Economic Impact

Dry root rot can cause **15–50% yield loss** depending on environmental conditions and the stage of attack. In severe infestations, entire plots may fail, leading to major losses for smallholder farmers. Beyond yield reduction, the pathogen also weakens soil biodiversity by affecting beneficial microbes, further aggravating soil health problems in mono cropped pulse regions.

Integrated Disease Management (IDM)

As *Macrophomina phaseolina* is a persistent soil pathogen, **integrated and preventive approaches** are the most effective.

1. Cultural Practices

- Crop rotation with non-host crops like cereals (e.g., maize, sorghum)
- Deep summer ploughing to expose micro sclerotia
- Use of well-decomposed FYM or compost to improve soil health
- Avoid water stress through timely irrigation

2. Resistant Varieties

Some **moderately resistant varieties** (e.g., VBN 8, VBN 4) have shown better tolerance under field trials.

3. Biological Control

- Seed treatment with *Trichoderma viride* or *Pseudomonas fluorescens*
- Soil application of **neem cake + biocontrol agents**

4. Chemical Management

- Seed treatment with **Carbendazim (2 g/kg)** or **Thiram**
- Soil drenching with **Carbendazim 0.1%** around infected roots (though not preferred for long-term use)

Future Prospects

As climate change accelerates and blackgram cultivation expands into marginal lands, dry root rot is expected to become more widespread and severe. Tackling this issue requires a forward-looking, multi-disciplinary approach that combines technology, ecology, and farmer-centric innovations.

1. Development of Climate-Resilient Varieties

- Marker-Assisted Selection (MAS)
- Genomic Selection
- CRISPR-based genome editing

2. Enhanced Biocontrol Strategies

- Microbial consortia (e.g., combining *Trichoderma*, *Pseudomonas*, *Bacillus subtilis*)
- Nanoformulations of biocontrol agents
- Biostimulants that boost root health and immunity

3. Digital Disease Surveillance

- Remote sensing via drones or satellite imagery
- Mobile-based plant health monitoring apps
- AI-powered disease diagnostics

4. Soil Health Restoration Initiatives

- Vermicompost, green manuring
- Cover cropping (e.g., sunnhemp)
- Soil microbiome enrichment

5. Farmer Capacity Building & Policy Support

- Inclusion of dry root rot modules in KrishiVigyan Kendra (KVK) trainings

- Subsidies on biocontrol kits and resistant varieties
- Community-based soil testing and health card systems

6. Integration into Sustainable Pulse Farming Models

- Integrated Pest and Disease Management (IPDM)
- Organic blackgram farming clusters
- Agroforestry systems that buffer climate impacts

Conclusion

Dry root rot of blackgram, though often overlooked, poses a **serious threat** to pulse productivity and soil sustainability. A clear understanding of its symptoms, life cycle, and integrated management is essential to reduce its impact on farmers' livelihoods. Sustainable control of this disease lies not just in chemical use but in **ecologically sound, preventive measures** that restore the health of both crop and soil.

References

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