

Effective Strategies for Managing Root Diseases in Mulberry Plants

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Mulberry and sericulture have played a significant role in human civilization for centuries, intertwining nature, culture and economic prosperity. The cultivation of mulberry trees, particularly the white mulberry species (*Morus alba*) serves as a crucial foundation for sericulture, the practice of rearing silkworms to produce silk. This symbiotic relationship between mulberry trees and sericulture has been nurtured for centuries, contributing to the growth of

adoption of suitable management measures is essential.

In the present article the efforts have been made to consolidate the information available on various root diseases which is affecting growth and development of mulberry gardens. The management strategies for effective control and mitigation of root diseases to ensure the sustainable growth of mulberry crops were also discussed.



Root-knot Nematodes

vibrant silk industries in different parts of the world. From the intricate silk fabrics adorning royal garments to the economic benefits for farmers and the preservation of cultural heritage, mulberry and sericulture have left an indelible mark on society.

Mulberry (*Morus* spp.) is a perennial, fast growing and predominantly cross-pollinated plant. Commercially exploited mulberry varieties are prone to number of diseases and creates major constraint in the production of quality leaves. Plant disease can be defined as any malfunctioning of host cells and tissues that result from continuous irritation by a pathogenic agent or environmental factor and leads to development of symptom(s). Moreover, mulberry garden is being maintained over 20 years with regular pruning in every year in India. Therefore, pathogens seem to perpetuate in various seasons over the year. Diseases account for 10-25% leaf yield loss and reduce leaf quality, which in turn affecting the overall silkworm cocoon productivity. Therefore, timely

Root rot

Dry root rot

Black root rot

Root diseases of mulberry

As per the records or literature available in social domain portraits that there are numerous pathogens which causes the root diseases in the mulberry garden. The brief on various root diseases along with its causal agents, symptoms and favourable conditions for disease incidence is given below table.

Integrated Disease Management (IDM) in Root Disease of Mulberry

Integrated Disease Management (IDM) is a decision-based strategy that involves the coordinated application of multiple methods to optimise pathogen control in an environmentally and economically sustainable manner. Implementing an integrated pest management approach is crucial for comprehensive root disease management. IDM involves combining multiple strategies such as cultural practices, biological control and targeted chemical interventions, if necessary. By integrating various methods, farmers

can optimize disease control while minimizing environmental impact.

Table 1: Diseases and Symptoms

- Soil Preparation: Ensure well-drained soil with adequate organic matter to promote healthy root development and prevent waterlogging, which can exacerbate root diseases.

Disease	Causal organism	Symptoms	Favourable conditions
Root-knot Nematodes	<i>Meloidogyne</i> spp.	They form galls or knots on the roots, leading to stunted growth, yellowing leaves, and overall decline in plant health.	Soil temp. - 20-30 °C, Soil moisture- 60 %, pH of 4-8
Rhizoctonia Root Rot	<i>Rhizoctonia</i> spp.	Symptoms include discolored and decaying roots, stunted growth, and wilting.	Soil temp.- 28-34°C, Soil moisture- >40%
Dry (Fusarium) Root Rot	<i>Fusarium solani</i> and <i>F. oxysporum</i>	<ul style="list-style-type: none"> • Infected trees may exhibit yellowing or browning, sudden withering and defoliation of the leaves. • Decay of roots, vascular discoloration and bark can be peeled off easily. Wilting and a decline in overall vigor. 	Soil temp.-26-35°C, Soil moisture- >40%, pH- 5-10
Armillaria Root Rot	<i>Armillaria</i> spp.	<ul style="list-style-type: none"> • Infected trees may display yellowing leaves, wilting, and a decline in overall health. • The presence of honey-colored mushrooms around the base of the tree is a common sign of Armillaria infection. 	Soil temp.-26-28°C, Soil moisture- 70%, pH- 4.2-7.2
Black root rot	<i>Botrydiplodia theobromae</i>	<ul style="list-style-type: none"> • Sudden wilting and defoliation of leaves. • Drying of branches, decay of roots, rotting and peeling of the bark extends up to stem region near the soil line. 	Temp.- 25-30°C, Soil moisture- 40-60%
Charcoal rot	<i>Macrophomina phaseolina</i>	<ul style="list-style-type: none"> • Yellowing of the leaves and drooping of the branches. • Roots turn brownish black charcoal like, sclerotial bodies on roots and weak tissues breaking off easily. 	Soil temp.-25-35°C, Soil moisture- >40%

In order to effective control of root diseases in mulberry various practices can be taken-up. These practices are discussed in brief:

Cultural Practices: One of the fundamental approaches to managing root diseases in mulberry plants is to adopt proper cultural practices. These practices include:

- Sufficient quantity of organic matter should be applied in the affected areas.
- Deep ploughing of the infested land and soil should be exposed to sunlight during summers to kill the pathogen.
- Intercropping: with marigold, sesame, sun hemp at 30 cm distance between the rows reduces 60-65% root galls and egg masses of nematode.

Physical Practices:

- Sanitation: Remove and destroy infected plant debris to prevent the spread of pathogens. Proper disposal of infected plant material reduces the chances of disease recurrence.
- Hot water treatment at temperature of 48°C for 20 min used for the saplings of mulberry roots to eliminate nematode population.

Disease-Resistant Varieties: Selecting disease-resistant varieties is a proactive measure in managing root diseases. Breeding programs have developed mulberry cultivars that exhibit resistance to specific pathogens. By planting resistant varieties, farmers can minimize the risk of disease occurrence and reduce the need for chemical interventions.

Biological Control: Employing biological control agents can be an effective and environmentally friendly approach to combat root diseases. Beneficial microorganisms, such as certain strains of bacteria and fungi, can suppress pathogen growth and enhance plant defence mechanisms. These bio-control agents can be applied to the soil or directly to the roots, providing a natural defense against root diseases.

Talc based bio-nematicide (Bio-nema) produced by *Verticillium chlamydosporium* used with neem oil cake can parasitise the eggs of *M. incognita* and stops egg hatching also neem oil cake kills the larvae present in the soil (Alam, 1993).

Combined application of Dithane M-45 (10 gm/pit) and after 15-20 days, talc-based biofungicide named Raksha produced by *Trichoderma harzianum* at the rate of 500 g/plant should be applied in the root zone and irrigated and FYM (1:24:200) @ 200gm/plant is recommended at three split doses.

Dipping of cuttings in Dithane M-45 (0.1%) solution and application of bioformulation called as

Nursery-Guard prepared by using *Trichoderma pseudokoningii* (a product of CSRTI, Mysore).

Chemical Treatments: Chemical treatments should be considered as a last resort and used judiciously. Fungicides and nematicides can provide effective control against specific root pathogens. However, their use should be based on thorough diagnosis, adherence to recommended dosage, and proper timing. It is important to follow safety guidelines and regulations to minimize potential risks associated with chemical applications.

Root dipping of saplings in 0.1% bavistin (Carbendazim 50% WP) solution for 30 min and planting in pits dusted with 10 g of Dithane M-45 (Mancozeb 75% WP).

Nematicides like Furadon 3G @ 40 kg/ha/year or Rugby 10G @ 30kg/ha/year in four split doses is recommended.

Conclusion

The management of root diseases in mulberry plants requires a multi-faceted approach that combines cultural practices, disease-resistant varieties, biological control, integrated disease management and when necessary, targeted chemical treatments. By implementing these strategies, farmers can minimize the impact of root diseases, maintain healthy mulberry crops and ensure a sustainable supply of high-quality leaves for the sericulture industry. It is essential to promote awareness and provide support to farmers in adopting these management practices to protect their livelihoods and contribute to the overall success of the mulberry silk industry.

Reference

Sharma, D. D., Naik, V. N., Chowdary, N. B., & Mala, V. R. (2003). Soilborne diseases of mulberry and their management. *International Journal of Industrial Entomology*, 7(2), 93-106.

Kumari, V. N. (2014). Ecofriendly technologies for disease & pest management in mulberry-A review. *IOSR Journal of Agriculture and Veterinary Science*, 7(2), 1-6.

Govindaiah, Gupta, V. P., Sharma, D. D., Rajadurai, S. and Nishitha Naik, V. (2005). *Mulberry*

Crop Protection – Part 1. Central Sericultural Research and Training Institute, Mysore, India.

Dandin, S. B., Jayaswal, J. and Giridhar, K. (2003). *Handbook of Sericulture Technologies*, Central Silk Board, Bangalore, India.

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