

Synergy Between *Paecilomyces lilacinus* and Soil Microbes for *Meloidogyne Incognita* Control

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Abstract

Root-knot nematodes, particularly *Meloidogyne incognita*, are among the most destructive soil-borne pathogens affecting a wide range of agricultural crops. Their management has traditionally relied on chemical nematicides, but concerns regarding environmental contamination, resistance development, and risks to beneficial organisms have increased the demand for sustainable biological control strategies. *Paecilomyces lilacinus* is an important entomopathogenic and nematophagous fungus that has demonstrated considerable potential against root-knot nematodes through mechanisms such as egg parasitism, penetration of nematode structures, and production of antagonistic metabolites. The interaction between *P. lilacinus* and naturally occurring soil microorganisms may further enhance nematode suppression through complementary biological activities. Beneficial bacteria and fungi can improve soil microbial diversity, compete with pathogens, produce nematicidal compounds, stimulate plant defense responses, and promote healthier root development. This synergistic interaction may create an unfavorable soil environment for *M. incognita* while supporting plant growth and soil health. The present study focuses on the potential synergy between *P. lilacinus* and beneficial soil microbes for the biological management of *M. incognita*. Particular emphasis is placed on their combined effects on nematode egg hatching, juvenile mortality, root gall formation, nematode reproduction, and crop growth. Understanding these microbial interactions can contribute to the development of effective, environmentally friendly, and integrated nematode-management approaches. Such biological combinations may provide a promising alternative or supplement to conventional chemical control methods in sustainable agriculture.

Keywords: *Paecilomyces lilacinus*, *Meloidogyne incognita*, Soil Microbes, Biological Control, Root-Knot Nematode, Microbial Synergy, Nematode Management, Soil Health, Sustainable Agriculture.