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NEMATODE MANAGEMENT IN TURMERIC INTERCROPPED UNDER PLANATION CROPS

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Introduction

Mixed cropping systems of Kerala involve perennial crops *viz.*, coconut, arecanut, coffee, betelvine, cardamom, black pepper, ginger and turmeric in the same piece of land. Plant parasitic nematodes cause significant damage in coconut and arecanut based cropping systems leading to reduced yield and economic loss. Turmeric (*Curcuma longa* L.) is an herbaceous plant belonging to the family Zingiberaceae and the order Scitamineae, native to India. It is widely used in food, cosmetics, and pharmaceuticals. In Southern India, turmeric is commonly cultivated as an intercrop in coconut and arecanut gardens to utilize the available interspace efficiently and enhance farmer income. It is also grown as a sole crop, particularly in the States of Tamil Nadu, Assam, Andhra Pradesh, Karnataka, Maharashtra, Gujarat, and Odisha.Turmeric rhizomes contain several pigments, with curcumin being the major one responsible for their characteristic yellow color, varying from 3.5 to 9.0% among different varieties.

Fig.1. View of turmeric intercropped in coconut

The crop is susceptible to various nematode pests and diseases, among which root-knot nematodes (*Meloidogyne* spp.) are considered major threats. *Meloidogyne incognita*, commonly known as the root gall nematode, is widely distributed in coconut and arecanut plantations growing districts of Kerala and Karnataka, and causes significant damage. Turmeric serves as a host to at least 14 nematode species, with *M. incognita*, *Radopholus similis*, and *Pratylenchus coffeae* being the most economically important in Indian turmeric cultivation. Plant-parasitic nematodes are estimated to cause 21.3% annual yield loss in India.

Damaging symptoms of *M.incognita* in turmeric

Infested plants exhibit small to large root galls, and nematode-affected plants show stunted growth, yellowing of leaves, reduced tillering, and dried leaf margins. In severe cases, *Meloidogyne incognita* causes root rot, reduced size of underground rhizomes, and yield loss of up to 33.6% were recorded.

Under 'safe to eat' policy of the State, chemical nematicides are not allowed, because a significant quantity of the spices produced are intended for export to foreign countries and some are consumed in raw state without being processed. While synthetic nematicides are

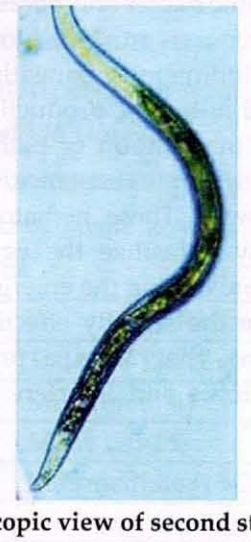

Fig. 2. Microscopic view of second stage juvenile (J2) of *M. incognita*

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Fig. 3. Root Galls Caused by *M. incognita* on Turmeric

commonly used for nematode control globally, their repeated application poses significant environmental and health concerns. To address these issues, integrated nematode management strategies are essential.

Integrated Nematode Management (INM)

A key component of INM is the use of bio-agents—organisms that naturally suppress pest populations and diseases. Fungal bio-agents such as *Trichoderma* and *Pochonia* have shown promise in managing *Meloidogyne incognita* in coconut and arecanut based cropping systems due to their strong antagonistic activity, plant growth promotion, and enhancement of nutrient uptake. These fungi produce various enzymes, including cellulases and chitinases, which enable them to degrade organic matter and parasitize pathogens. Their effectiveness is attributed to multiple modes of action, including mycoparasitism, competition for space and nutrients, production of inhibitory compounds, inactivation of pathogen enzymes, induction of systemic resistance, and stimulation of plant growth. These nematode antagonistic fungi directly parasitize the eggs of root-knot nematodes, preventing the emergence of juvenile nematodes in the soil. By effectively colonizing the root zone, they form a protective barrier around the roots and interfere with nematode penetration

Application

Talc-based formulations of *Pochonia chlamydosporia* and *Trichoderma harzianum* were

Fig.4. Organic turmeric produce free from nematode infestation

applied to the rhizosphere of turmeric plants as a spot treatment at the rate of 50 g talc powder mixed with 2 kg FYM per 2 m² bed (30 plants) at the time of planting (June) and 45 days after planting (September) resulted in significant reduction of root-knot nematode population up to 60 -74%. These fugal bio-agents are found promising alternative to synthetic nematicides for the management of *M. incognita* due to its high antagonistic and good plant growth promotion activities.

References

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