Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 05 (SEP-OCT, 2024)
Available online at http://www.agriarticles.com

Role of Trichoderma as a Biocontrol agent of Plant Parasitic Nematodes

(*Ramavath Abhi and Manisha)
Research Scholar, Department of Nematology,
Rajasthan College of Agriculture, MPUAT, Udaipur-313001, Rajasthan, India
*Corresponding Author's email: ramavathabhi1401@gmail.com

Nematodes act as plant pathogens, negatively impacting the production of food, fiber, and biofuels by causing plant diseases. Various chemical nematicides are applied to soil, seeds, or foliage to prevent these diseases. Although these chemicals are effective against plant-parasitic nematodes, their prolonged residual toxicity, potential harm to human health, environmental pollution, and the risk of resistance development remain significant concerns. Consequently, many of these chemicals are continuously being banned or restricted within crop production systems. As a result, there is an increasing need for long-term strategies and integrated approaches to manage plant diseases. Trichoderma spp. are commonly used in agriculture as biological control agents (BCAs). However, to our knowledge, there is little to no recent information available on the latest developments regarding Trichoderma-mediated biological control of plant-parasitic nematodes. This review highlights the latest advances in using Trichoderma as a BCA and plant growth regulator, with a specific focus on plant-parasitic nematodes.

Introduction

Nematode worms are the most ubiquitous denizens of the soil environment (Jones *et al.*, 2013). Besides several free-living species, there are over 4100 plant-parasitic nematodes (PPNs) that impose devastating effects on several economically important crops. PPNs, including cyst nematodes (CNs) and root-knot nematodes (RKNs) are among the most detrimental agricultural pests. Overall, PPNs cause 21.3 per cent yield losses of Rs. 102,039.79 million (1.58 billion USD) annually (Kumar *et al.*, 2020). Despite the extensive use of chemical nematicides to control phytoparasitic nematodes, different factors including non-target activity, development of resistance, toxicity to human and environmental pollution are of great concern.

The application of chemical pesticides and fertilizers to control phytopathogens can be replaced by use of antagonistic, plant growth-promoting microorganisms. Biological control of plant pathogens has attracted the interest of the scientific community, because of its safer use and environmental friendliness as compared to chemical control measures.

Trichoderma spp., are soil born filamentous fungi and have been frequently used for a variety of plant health benefits by controlling nematodes. They are widely distributed in root ecosystem of plants, easily culturable, can colonize roots, improve growth, increase disease resistance and enhance nutrient use efficiency.

There are several scientific publications on *Trichoderma*-plant-interactions that explain the use and efficacy of *Trichoderma* spp. against phytoparasitic nematodes. However, to our knowledge, there's no comprehensive description that combines the most recent

advancements in *Trichoderma*-plant-nematode interactions. The latest progress involving *Trichoderma*-mediated control of PPNs and highlight the underlying mechanisms. Additionally, the future possibilities of using the *Trichoderma* as a multidimensional BCA are discussed to enrich our current information in perspective of planning, establishment, and field application of integrated pest management strategies.

***Trichoderma* against plant-parasitic-nematodes:** Recently, scientists are more interested in the biological control agents of phytoparasitic nematodes. *Trichoderma* species are mainly being used against root-knot nematode (*Meloidogyne* spp.) as they have been tested as biological control agents (BCA) against *M. javanica* and *M. incognita* on various crops under different experimental conditions. Significant results achieved regarding nematode control and plant growth promotion.

Trichoderma-plant interactions: *Trichoderma* spp. beneficially affects plant growth and development with enhanced resistance to both biotic and abiotic stresses. It increases the overall growth of plants, including root development, shoots fresh weight, and leaf area. The vital functions of *Trichoderma* during interactions with plants not only improve plant growth and development but also induce resistance to various diseases.

Insight into mechanism of actions: The general concept about mechanisms for controlling the plant pathogens by *Trichoderma* spp., includes mycoparasitism, competition, induced resistance in host plant and antibiosis. *Trichoderma* employs a variety of mechanisms for biocontrol activities against PPNs and other phytopathogens.

Conclusion

The focus of the scientific community toward biological control of fungi and nematodes is being increased because of rising environmental concerns worldwide and human health issues. Fungicides and nematicides, on the other hand, are potentially toxic to the environment and different forms of life. Although many of them are efficient in disease control programs, their long-term exposures and residual effects are the most important public concern.

References

1. Kumar, V., Khan, R. M. and Walia, R. K. 2020. Crop loss estimations due to plant parasitic nematode in major crops in India. *National Academy Science Letters*.
2. Jones, J. T., Haegeman, A., Danchin, E. G. J., Gaur, H. S., Helder, J. and Jones, M. G. K. 2013. Review- top 10 plant-parasitic nematodes in molecular plant pathology. *Molecular Plant Pathology*, **1**:16.