Use of Trichoderma in Disease Management

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Trichoderma spp., are free-living fungi that are common in soil and root ecosystems. They are highly interactive in root, soil and foliar environments. They produce or release a variety of compounds that induce localized or systemic resistance responses in plants. Trichoderma strains have long been recognized as biological agents, for the control of plant disease and for their ability to increase root growth and development, crop productivity, resistance to abiotic stresses, and uptake and use of nutrients.

Benefits of Trichoderma

1. **Disease Control:** Trichoderma is a potent biocontrol agent and used extensively for post-harvest disease control. It has been used successfully against various pathogenic fungi belonging to various genera, viz. Fusarium, Phytopthara, Sceleroti.a

2. **Plant Growth Promoter:** Trichoderma strains solubilize phosphates and micronutrients. The application of Trichoderma strains with plants such as grasses increases the number of deep roots, thereby increasing the plant's ability to resist drought.

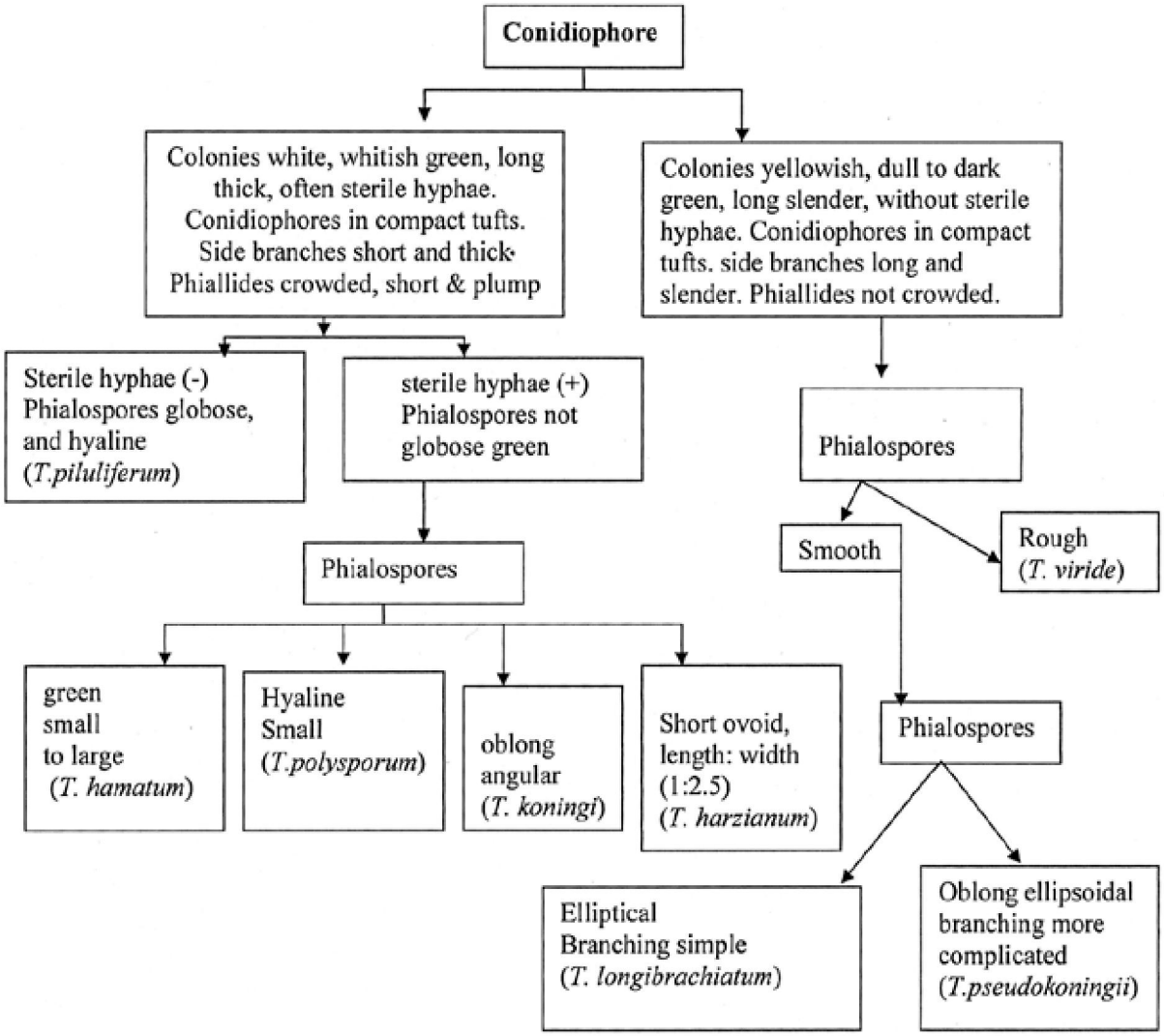
3. **Biochemical Elicitors of Disease Resistance:** Trichoderma strains are known to induce resistance in plants. Three classes of compounds that are produced by Trichoderma and induce resistance in plants are now known. These compounds induce ethylene production, hypersensitive responses and other defence related reactions in plant cultivates.

4. **Transgenic Plants:** Introduction of endochitinase gene from Trichoderma into plants such as tobacco and potato plants have increased their resistance to fungal growth. Selected transgenic lines are highly tolerant to foliar pathogens such as Alternaria alternata, A. solani, and Botrytis cirerea as well as to the soil-borne pathogen, Rhizectonia spp.

5. **Bioremediation:** Trichoderma strains play an important role in the bioremediation of soil that are contaminated with pesticides and herbicides. They have the ability to degrade a wide range of insecticides: organochlorines, organophosphates and carbonates.

Trichoderma species can be identified based on the morphology and colour of the colonies obtained on the potato dextrose agar medium. Further identification can be confirmed on the basis of the morphology of the conidia and conidiophores of different Trichoderma species when viewed under a microscope. The following chart can be helpful in identifying Trichoderma species.

Classification of *Trichoderma* based on morphology of conidia and conidiophores



Disease Control

Trichoderma spp. are very widely used to control various crop diseases effectively and some of them are given below.

Name of the Crop	Name of the Disease	Disease causing micro-organism
Elephant foot yam	Collar rot	Sclerotium rolfsii
Chilli, Tomato, Brinjal	Damping off	Pythium, Phytopthara, Fusarium
Ginger, Turmeric, Onion	Rhizome rot	Pythium, Phytopthara, Fusarium
Banana, Cotton, Tomato, Brinjal	Wilt	Fusarium oxysporum

Method of application

Seed treatment: Mix 10g of Trichoderma formulation per litre of cow dung slurry for treatment of 1kg of seed before sowing, particularly for cereals, pulses and oilseeds.

Nursery treatment: Drench nursery beds with @ 5 Trichoderma formulation per litre of water before sowing.

Cutting and seedling root dip: Mix 10g of *Trichoderma* formulation per litre of water and dip the cuttings and seedlings for 10 minutes before planting.

Soil treatment: Mix 1kg of *Trichoderma* formulation in 100 kg of farmyard manure and cover it for 7 days with polythene. Turn the mixture in every 3-4 days interval and then broadcast in the field.

Trichoderma formulations: Important commercial formulations are available in the name of Sanjibani, Guard, Niprot and Bioderma. These formulations contain $3x10^6$ cfu per 1 g of carrier material.

Biocontrol mechanisms of *Trichoderma*

Antagonist microorganisms, such as *Trichoderma*, reduce growth, survival or infections caused by pathogens by different mechanisms like competition, antibiosis, mycoparasitism, hyphal interactions, and enzyme secretion.

Competition: It is the phenomenon in which the pathogen and the introduced biocontrol agent (antagonist) compete for the availability of space and nutrients. During this process, the antagonist may suppress the growth of the pathogen population in the rhizosphere and thus reduce disease development. For example, Trichoderma harzianum reduces collar rot in elephant foot yam by 80-85%.

Antibiosis: Trichoderma strains are known to produce antibiotics and toxins, which are volatile or nonvolatile in nature, and have a direct effect on other organisms. Examples of such chemicals are trichothecin and a sesquiterpine, Trichodermin that has antimicrobial effect on bacteria and fungi.

Mycoparasitism: It is the phenomenon in which the antagonist fungi parasitize other fungi. The mechanism covers different stages of interactions.

First stage: Chemical stimulus of pathogenic fungi attracts the antagonist fungi and induces a chemotropic response of the antagonist.

Second stage: Recognition between the pathogen and the antagonist is due to the lectins.

Third stage: It is followed by the interactions between hyphae of the pathogen and the antagonist. The antagonist (Trichoderma) hyphae either grow along the host hyphae or coil around it and secrete different lytic enzymes such as chitinase, glucanase and pectinase that are involved in the process of mycoparasitism.

Examples of such interactions are T. harzianum acting against Fusarium oxyporum, F. roseum, F. solani, Phytophthara colocaciae and Sclerotium rolfsii.

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