Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 04 (JULY-AUGUST, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Unleashing Nature's Secret Weapon: Trichoderma, the Versatile Fungus

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One intriguing fungus stands out among microscopic species for its adaptability and amazing skills. Introducing Trichoderma, an unsung hero that can be found in your backyard, on decaying wood, and in the soil. Scientists, farmers, and environmentalists are all interested in this inconspicuous fungus because it has a variety of superpowers.

Trichoderma: What is it? The Ascomycota phylum of fungus contains the widespread genus Trichoderma. Its numerous species are found all over the world in a variety of environments. Trichoderma frequently goes overlooked due to its thread-like appearance, but its impact is far from minimal.

Applications for Versatility: Trichoderma is distinguished by its extraordinary adaptability. When it comes to useful uses in several industries, this tiny fungus is a powerhouse. Numerous applications in horticulture, agriculture, and environmental preservation have resulted from scientists' discovery that Trichoderma has special interactions with plants.

Role in Agriculture: Trichoderma has shown to be a game-changer in the agriculture industry. By fighting for resources and space, it functions as a natural biocontrol agent and aids in the fight against well-known plant infections. Trichoderma can help farmers use less dangerous chemical pesticides on their crops, encouraging more environmentally friendly and sustainable farming methods

The use of chemical pesticides by farmers to manage plant diseases is widespread in developing nations. Not only can pesticides contaminate the soil, but they also harm people and the ecosystem. The most often employed fungal biocontrol agent against plant diseases is Trichoderma spp. Trichoderma has been selected as the genus having the greatest potential for biocontrol due to the largest amount of isolated anti-fungal bioactive chemicals.

Numerous Trichoderma species are hostile to nematodes and phytopathogenic fungi because they produce both volatile and nonvolatile antibiotics and enzymes. Trichoderma spp. are mycoparasitic of numerous soilborne plant diseases and are free-living organisms that are widely distributed in the soil and rhizosphere. As a biocontrol agent for foliar diseases of economically significant plants, it has also been successfully used. The fungus is efficient against pathogens that cause numerous diseases in the root zone of plants, such as collar rot, foot rot, and damping off..

Potential for Bioremediation: Trichoderma's capacity for bioremediation is another amazing part of its skills. This fungus is an effective ally in the cleanup of polluted soil and water because of its talent for dissolving contaminants and toxins. The use of trichomonia in bioremediation raises hopes for a cleaner and greener future.

Trichoderma spp.have great resistance to a variety of toxicants, including cyanide (CN), heavy metals, organometallic compounds, tannery effluents, and other dangerous substances . They are therefore a crucial fungal genus that should be researched for use as a genetic resource in the bioremediation of harmful contaminants.

Trichoderma are becoming known for their ability to effectively biodegrade hazardous pollutants. The ability of the fungi to breakdown aromatic hazardous compounds is facilitated by an extracellular enzyme system. They are helpful for the cleanup of pesticide-contaminated locations since they are capable of decomposing a variety of compounds, including pesticide residues in soil like chlordane, lindane, and DDT.

Trichoderma was found to be the most prevalent fungus in the diesel-contaminated compost, which explains its potential for colonisation and degradation of diesel-contaminated soil.

Promotion of Plant Growth: Trichoderma not only defends plants but also encourages their expansion! Trichoderma encourages root growth, increases nutrient uptake, and raises plant health in general through a symbiotic interaction. The outcome? stronger, healthier crops that produce better harvests.

These species are capable of enhancing the soil environment and promoting plant growth . The Trichoderma fungi's mycelia twine around the plant roots to form an appressorium-like structure during the colonisation process , then penetrate the root epidermis layer and persist for a long time between the plant cells of the epidermis and the cortex, directly promoting seedling growth , nutrient uptake in the rhizosphere , and the improvement of rhizosphere microbial community structure .

Numerous nutrients in the soil are either sparingly soluble or insoluble, which has some impact on the movement of nutrients in the soil. Trichoderma species encourage the intake of nutrients by secreting organic acids that breakdown minerals and activate nutrients in the soil, causing the nutrients to circulate and be used by the soil. Due to the Trichoderma species' high colonisation capacity, they also increase the rhizosphere's contact area with the soil and secrete more extracellular enzymes like sucrase, urease, and phosphatase as well as organic acids, which helps the soil's nutrient cycling and enzyme activity.

Commercial Importance: The agriculture business has taken note of Trichoderma's outstanding contributions. Trichoderma-based products are now a crucial component of contemporary horticultural and agricultural practises. These products are used by farmers all over the world since they are effective and environmentally beneficial.

There are currently at least 77 commercial Trichoderma-based biofungicides on the market worldwide, seven of which have been authorised for use in EU Member States by the European Commission.

Following is a list of various trichoderma species and their applications:

1. Trichoderma harzianum - Known for its ability to act as a biocontrol agent, particularly against a number of plant pathogens include Rhizoctonia, Fusarium, and Botrytis.
2. Trichoderma viride - A widely employed biocontrol agent in agriculture, particularly for fending off illnesses like damping-off and root rot brought on by fungi.
3. Trichoderma koningii - Known for its enzymatic capacity to break down complex organic matter, Trichoderma koningii is important in the processes of nutrient cycling and decomposition.
4. Trichoderma atroviride - A potent biocontrol agent capable of eradicating a variety of plant diseases, including those inflicting fusarium wilt and charcoal rot.
5. Trichoderma reesei: Used in the manufacture of biofuels and the destruction of cellulose, this fungus is highly prized for its extraordinary capacity to produce cellulase enzymes.

6. Trichoderma longibrachiatum - Known for its antagonistic properties against fungi that cause plant diseases, this plant is frequently used in agriculture to combat ailments including damping-off and root rot.

Limitations: Despite the enormous potential of trichoderma, there are still some difficulties to be overcome, such as identifying the species that are most suited for various habitats and developing application techniques to increase their efficacy.

Conclusion

Trichoderma, the unsung hero of the fungus world, never ceases to amaze with its versatility and prowess. This adaptable fungus is nature's untapped resource for a more wealthy and sustainable future, protecting crops and restoring polluted regions. Accepting the power of Trichoderma is a step towards achieving environmental harmony and benefiting from the untapped resources of our planet.

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