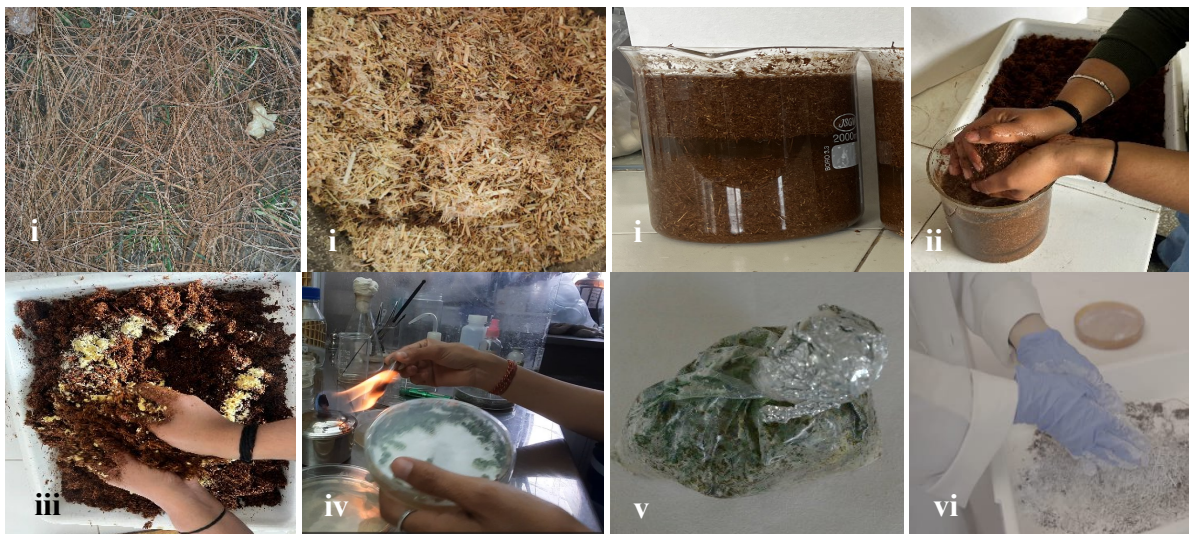


Trichoderma asperellum based biofungicide: Cultivation on Pine Needles and Application

Trichoderma is a genus of filamentous fungi widely recognized for its significant role in agriculture, forestry, and industry. *Trichoderma* species are known for their rapid multiplication, wide adaptability to varied environmental conditions, and effective colonization of rhizosphere soil. They exhibit strong antagonistic activity, suppressing a wide range of phytopathogens by employing diverse mechanisms such as mycoparasitism, competition for nutrients and space, and the production of antifungal metabolites and enzymes. In addition to disease control, *Trichoderma* species are known to enhance plant growth and productivity by promoting nutrient uptake, stimulating root development, and inducing systemic resistance in plants. Therefore, *Trichoderma* species serve as an important component of integrated disease management and soil health improvement. *Trichoderma* species can be cultivated on a variety of substrates; however, the use of dropped out chir pine needles offers the added benefits of utilizing forestry waste and reducing forest fire risk. At the institute, *Trichoderma asperellum* has been successfully cultivated on dropped chir pine needles following the steps outlined below.

Cultivation Protocol

- i. Spread the dropped pine needles in sunlight for 4–5 days, grind them into a coarse powder, and soak the powder in water for 24 hours.
- ii. Squeeze out excess water from the soaked material and mix it with wheat bran in a 4:1 ratio.
- iii. Fill the mixture into bags and sterilize them by autoclaving.
- iv. After cooling, inoculate the substrate with *T. asperellum* culture and incubate at 25°C.
- v. The substrate becomes fully colonized with spores and mycelium of *T. asperellum* within 20–22 days.
- vi. Mix the colonized substrate with talc powder in a 1:3 ratio and store it for later use as a bio-fungicide.



Modes of Application

- **Seed-borne diseases:** Thoroughly mix 4–5 g of the biofungicide formulation with 1 kg of seeds before sowing. Keep the treated seeds at room temperature for about 6 hours, then sow them directly in the nursery or field.
- **Root rot diseases of seedlings:** Prepare a slurry by mixing 40–50 g of bio-fungicide with 250 g of cow dung compost in 1 litre of water. Before outplanting, dip the seedling roots in the mixture and then transplant them immediately.
- **Soil-borne diseases of trees:** prepare a slurry by mixing 50 g of bio-fungicide with 100g of cow dung compost in 1 L of water. Dig a circular pit about 1 foot deep around the diseased tree trunk. Place a layer of dry grass at the bottom to serve as the substrate, pour the bio-fungicide slurry over it, and then cover the pit with soil. Water lightly as needed.
- **Foliar diseases:** Thoroughly mix 50 g of the biofungicide in 1 L of water and spray the solution uniformly on the leaves of the diseased plants.