

Mycofungicides

- ❖ Mycofungicides are chemicals produced by fungi against other fungi. It is an antagonistic interaction. As there is interference in growth of other fungi
- ❖ Mycofungicides have applications in agriculture to control plant diseases caused by fungi. (soil borne diseases, air borne diseases , post harvest contaminations). These are applied to seeds, seedlings and mature plants.
- ❖ Advantages : are non-toxic to humans, compatible with other treatments
- ❖ Biological control against soil borne fungi, following fungi are used
 - *Gliocladium virens* (*Trichoderma virens*), is sold under trade name Glio Gard or Soil Gard for control of diseases in horticultural crops. *Gliocladium virens* produces anti-biotic metabolite called gliotoxin which have anti-bacterial, anti-fungal, anti-viral activities.
 - *Gliocladium catenulatum* has also been used under trade name Primastop® to reduce the incidence of damping-off disease caused by *Pythium* and *Rhizoctonia solani*
 - *Trichoderma harzianum* is sold under trade name BioTrek and F-stop. *Trichoderma* species have been used as biological control agents against pathogenic fungi e.g. *Rhizoctonia spp.*, *Pythium spp.*, *Botrytis cinerea*, and *Fusarium spp.*, *Phytophthora palmivora*. It protects crops such as, corn, soybean, potato, tomato, beans, cotton, peanut, and various trees
 - *Trichoderma harzianum* strain T-39 is marketed as TRICHODEX, for control of pink rot and stem rot of tomato caused by *Phytophthora sp* and control of blight disease caused by *Botrytis cinerea*
 - *Trichoderma viride* under trade name BioTrico
 - *T. harzianum*, *T. polysporum*, *T. viride* under trade name Binab T

Trichoderma species have been very successfully used as mycofungicides because its fast growing, inhibit a broad spectrum of fungal diseases, have a diversity of control mechanisms, have the ability to survive under unfavorable conditions have strong aggressiveness against phytopathogenic fungi.

- Other fungi that can be used as mycofungicides are *Aspergillus* and *Penicillium* species. *Aspergillus* species are effective against the white-rot basidiomycetes

Mode of action

As biological control agents they suppress the growth of fungi through competition (for substrate and nutrients), mycoparasitism, antibiosis

1. **Mycoparasitism** relies on the recognition, binding and enzymatic disruption of the host fungus cell wall . There are excretion of extracellular enzymes; and lysis of pathogenic fungi Biological control agents are able to lyse hyphae of pathogens by release the lytic enzymes as chitinases, proteases, and β -1, 3 glucanases
 - For eg β -1, 3 glucanases produced from *Chaetomium sp.* can degrade cell walls of plant pathogens including *Rhizoctonia solani*, *Fusarium sp.* *Colletotrichum* and *Phoma sp.*
 - Proteases produced by *Trichoderma harzianum* T-39 are involved in the degradation of pathogen hyphal membranes and cell walls. They can deactivate the hydrolytic enzymes, endo-polygalacturonase and exo-polygalacturonase produced by *Botrytis cinerea* causing agent of grey mold,
2. **Antibiosis:** Antibiosis is defined as the inhibition or destruction of the microorganism by by the production of anti-biotics that inhibit the growth of another microorganism These either reduce spore germination (fungistasis), or kill the cells (antibiosis)
 - Gliovirin is produced by *Gliocladium virens* can kill *Pythium ultimum* by causing coagulation of the
 - Many anti-biotics are produced by *Trichoderma* species. These include gliotoxin, harzianic acid , trichoviridin ,viridian, viridiol
 - *Gliocladium catenulatum* parasitic on fungus *Sporidesmium* and *Fusarium spp.* It destroys the fungal host by direct hyphal contact and forms pseudoappressoria
 - It may involve physical contact and synthesis of hydrolytic enzymes, toxic compounds or antibiotics
 - Trichotoxin A50 is produced by *T. harzianum* PC01 can inhibit the mycelial growth and sporangial production of *Phytophthora palmivora*
 - *Chaetomium globosum* produces the antibiotic chaetoglobusin C which suppresses the growth of plant pathogens such as

Colletotrichum gloeosporioides, Fusarium oxysporum, Phytophthora palmivora, P. parasitica, Rhizoctonia solani

3. **Competition:** Competition occurs between microorganisms when space and nutrients are a limiting factor . Biological control agents can compete with other fungi for food and essential elements in the soil and around the rhizosphere and can compete for the space or modify the rhizosphere by acidifying the soil, so that pathogens cannot grow For example, *Trichoderma harzianum* T-35 control of *Fusarium* species on various crops occurs via competition for nutrients and rhizosphere colonization



Fig. 2 Some formulation types of mycofungicides. **A** Ketocin[®] in powder formulation, **B** Ketomium[®] in pellet formulation, **C** Fungi Killer[®] in pellet formulation and **D** Novacide[®] in powder formulation.

Source:

Kaewchai, et al 2009

Ketomium [®] , formulated from <i>Chaetomium globosum</i> and <i>Ch. cupreum</i> ,
Promote [®] formulated from <i>Trichoderma harzianum</i> and <i>T. viride</i> ,
SoilGard [®] formulated from <i>Gliocladium virens</i> ,
Trichodex [®] from <i>T. harzianum</i> .