المقاومة الحيوية Biological Control

المحاضرة الثانية

الكائنات الحية المستخدمة في المقاومة الأحيائية

Importance or benefits of biological resistance:

1- Specialization: that is, pest problems using biological resistance cannot increase and cannot create a new problem.

2- Vital enemies are already present in nature and have the ability to increase and spread, and they search in nature for their families or prey.

3- The pest does not have the ability to develop immunity or resistance against vital enemies.

4- Vital enemies are environmentally friendly and do not cause damage to the ecosystem.

5- The biological resistance programs are permanent and subjective, whether or not the person intervenes in them.

Disadvantages or criticisms of biological control:

1- Slow control process and inability to eradicate the pest.

2- It is difficult to predict the extent of its efficiency with the circumstances surrounding the pest or the natural enemy.

3- The need for specialists and trained workers in this field.

4- Numbers transferred from other environments that may be preoccupied with new pests.

5- Imported biological enemies may attack beneficial pests in the new environment.

6- The appearance of the biological enemy may not correspond to the appearance of the pest.

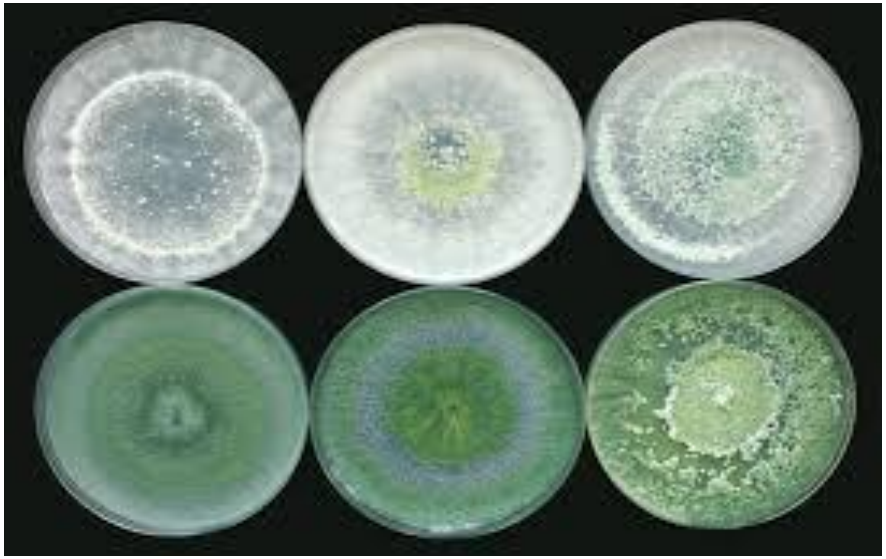
First: the fungus Trichoderma :

Trichoderma is one of the most famous fungi used in the field of biological control, and it is a widespread fungus in various types of soil and on plant residues, perhaps due to its different metabolic activities and its high competitiveness.

This fungus is characterized by its ease of isolation and its rapid growth in agricultural media. It often gives colonies of yellowish-green color and is characterized by the abundance of spore formation, but these characteristics cannot be relied upon in diagnosing the fungus, as the classification of this fungus to the species level is still a challenge for specialists.Currently, it relies heavily on molecular biotechnologies for the classification and diagnosis of this fungus.

- The type *T. harzianum* is one of the most widely used species in the field of biological control, as it is a fungus that is widely present in the soil and can be isolated easily as well. There are also other types of this genus used in this field, the most important of which are *T. viride*, *T. hamatum*, *T.koningii,* and others


Image Courtesy of Niall Hamilton
Copyright © 2003 Doctorfungus Corporation



- Production (preparation) of the fungus *T.harzianum*The type *T. harzianum* is one of the most famous types of Trichoderma fungus used in the field of biological control.
- This fungus is produced on a commercial scale in several countries such as the United States, Australia, Britain, France, Russia and some Arab countries under different trade names Several technologies are used to produce this fungus in the form of a commercial preparation, including growing it on a liquid medium such as molasses or yeast preparation and peptone, and after a growth period of 14 days or more, it is centrifuged and the spores are harvested and loaded on a carrier material such as diatom granules and others. It is also used as corn cobs, wheat bran or seeds Millet to produce fungi.

- This fngus is usually produced in the form of wettable powder, emulsion liquid, gel, granules, or others. Several local studies showed the ability of Trichoderma fungus, especially *T. harzianum*, to com bat several plant diseases Such as tomato root rot, seedling death, fusarium wilt, gray rot, charcoal rot, palm pollen sludge, top rot disease, shoot death and others.The head of the palm, with its sap and fiber, may provide a suitable environment for the growth and survival of the fungus Trichoderma, thus enhancing the chances of its success in combating palm pollen and top rot.

Mechanisms of action of the fungus

Trichoderma Trichoderma fungus have several mechanisms that enable it to kill or inhibit plant pathogenic fungi. The most important mechanisms are:

A- Direct parasitism on the fungal mycelium of pathogenic fungi and the process is accompanied by the secretion of some enzymes that degrade cell walls and enzymes that degrade proteins.

-
-

- The enzymes penetrate the fungal hyphae of the fungus Trichoderma and destroy the fungal hyphae of the pathogenic fungus. Lectin appears to have a role in the process of adhesion and wrapping of the fungus biota around the pathogenic fungus. As someone 20 genes participate in the parasitism process
- b- Competition for nutrients and space, especially in the area around the roots, which is known as Rhizosphere competence, which means the ability of the organism to grow and perform its vital functions in the root area. harzianum T-22.

- C - Production of enzymes that degrade the cell walls of plant pathogenic fungi, including types of chitinase enzymes and many enzymes that degrade β-glucanases, cellulases and proteases.
- D- Secretion of some antibiotics that kill plant pathogenic fungi cells, and Trichoderma mushrooms produce about 43 compounds that have anti-fungal properties that are pathogenic to plants. The most important of these compounds are Alkyl pyrones, Isonitriles, Diketopiperaziens, Sesquiterpenes, Steroid and other compounds

- Stimulating systemic resistance in plants: Several species of Trichoderma have shown the ability to stimulate systemic resistance in plants such as stimulating systemic resistance in cucumber plants against powdery mildew and stimulating resistance in strawberries against brown rot caused by Botrytis cinerea,Several compounds have been isolated from Trichoderma species that have a role in stimulating systemic resistance, such as xylanases, which stimulate plants to synthesize phytoalexin compounds.

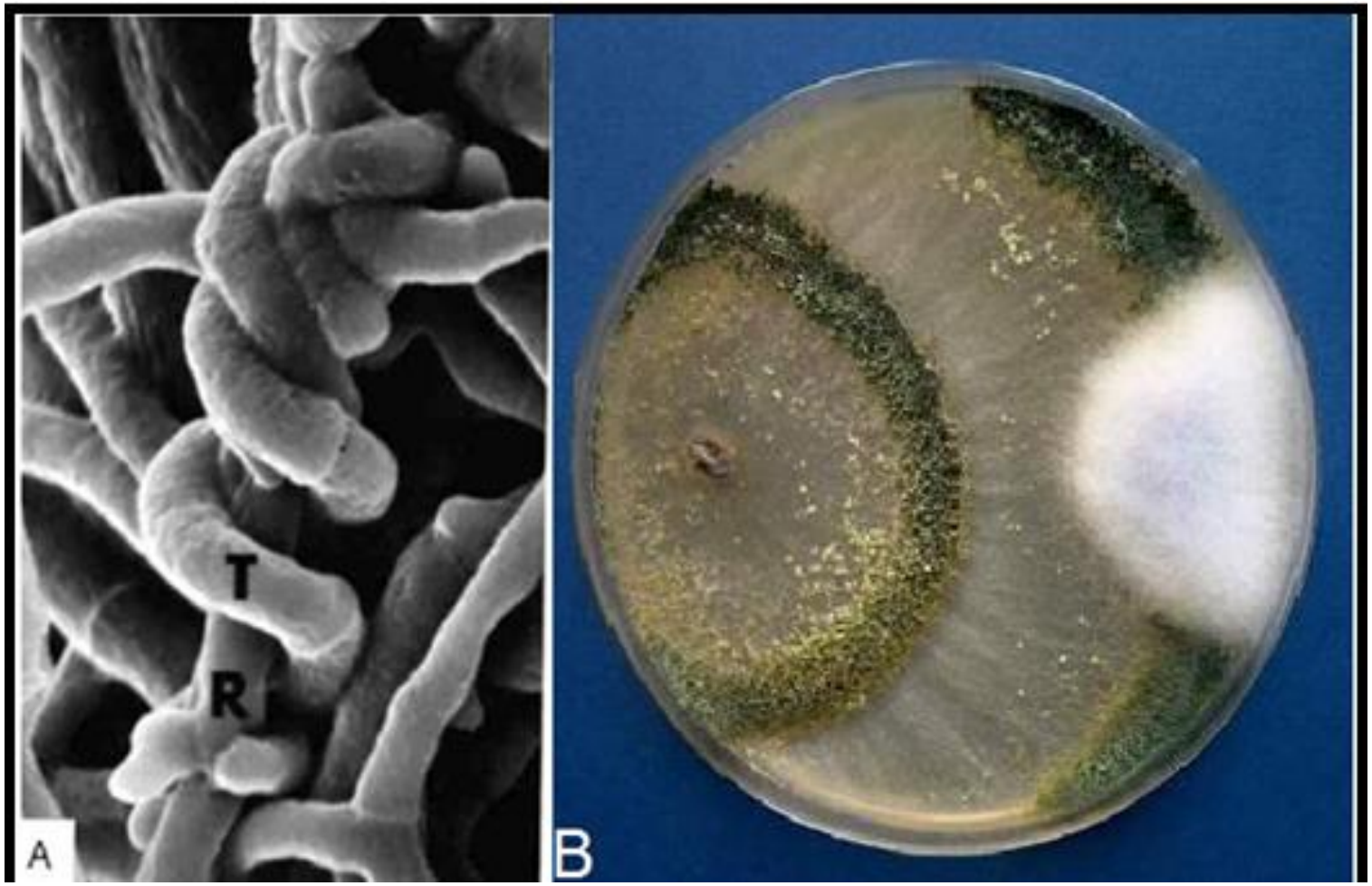
- Inhibition of pathogenic enzymes and toxins: The pathogenicity of some fungi, including

B. cinerea, depends on the production of

- enzymes that degrade plant cell walls, such as pectin-degrading enzymes.Cutinolytic enzymes and cellulolytic enzymesIt was found that some strains of T. harzianum produce proteolytic enzymes such as Serine protease that inhibit the enzymes of B. cinerea and reduce its pathogenicity.

g- Stimulating plant growth and increasing the readiness of some mineral elements such as phosphorous, Some types of Trichoderma, such as T. longibrachiatum, produce growth hormones such as indole acetic acid (IAA), which have a role in increasing plant growth.

-



A- هايفات الفطر ترايكوديرما (T)تلتف حول هايفات الفطر رايزوكتونيا (R).

B التضاد بين الفطر *T. harzianum* والفطر*Fusarium oxysporum*

Is Trichoderma fungus safe for humans?

- Trichoderma fungus are generally safe for humans, but there are 7 recorded cases of people suffering from immunodeficiency or undergoing treatments that reduce immunity, the most important of which is inflammation of the peritoneum due to infection with the fungus *T. viride* for a person undergoing a dialysis program Another infection with the fungus *T. viride* of a person who has had a liver transplant, as well as *T. pseudokoningii* and other *T. longibrachiatum* infections of the bone marrow, bloodstream and brain of people undergoing immunosuppressive therapies.

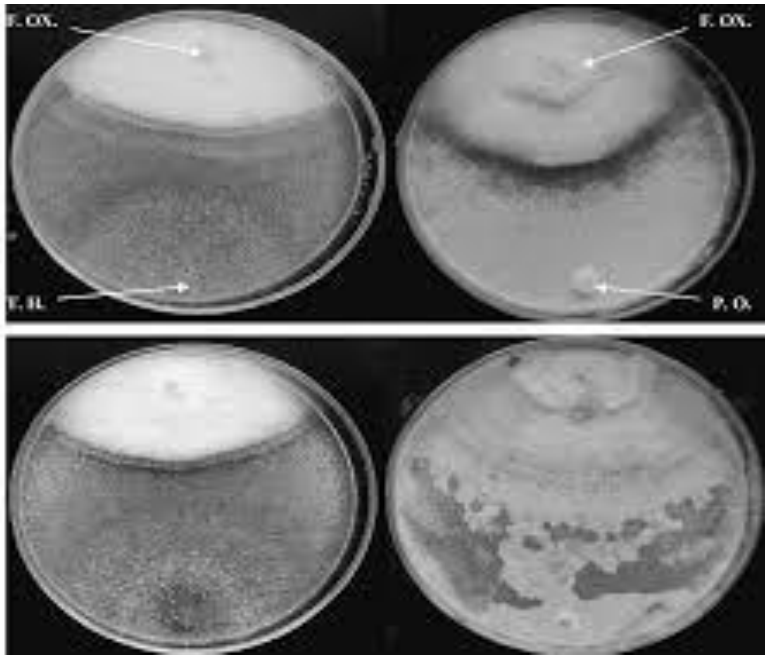
Second: the fungus Gliocladium

- The fungus G. catenulatum was developed as a fungicide in both the United States of America and Europe, and the results proved its efficiency in combating seedling death diseases on vegetables, crops and seedlings, and in combating rotting of roots and stems caused by Didymella on both tomatoes and eggplant.It also proved its effectiveness in combating several pathogens of plant roots, such as Pythium, Phytophthora, and Rhizoctonia, and in combating plant pathogens such as Alternaria, Botrytis and Helminthosporium.

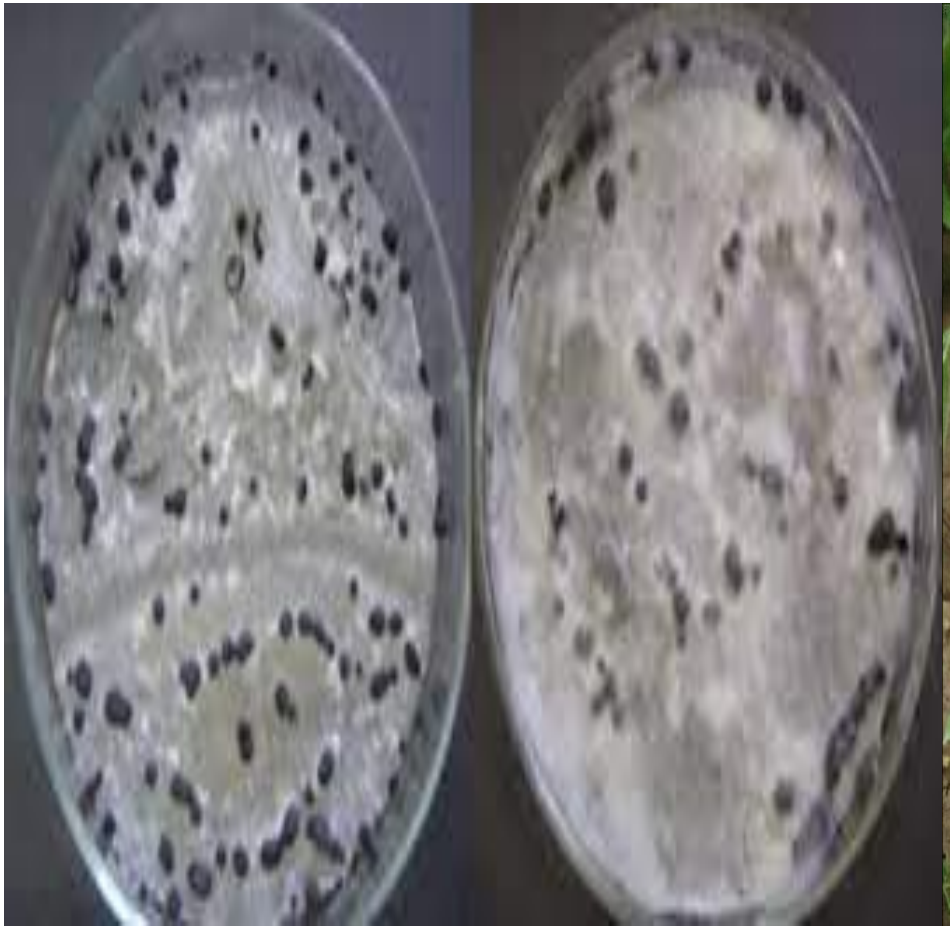
Third: The fungus-like *Pythium oligandrum*

- The fungus P. oligandrum was developed as a commercial product under the name Polgandrom and was used to control diseases caused by the fungus *Its* mechanism of *Sclerotinia sclerotiorum* action is due to the ability of its zoospores to infect the stony bodies of Sclerotinia and inhibit its germination.Some studies also showed the susceptibility of the fungus-like *P. oligandrum* on the production of several enzymes that degrade the cell walls of fungi, the most important of which is the enzyme N-acetyl-β-D-glucosaminidase.

Pythium oligandrum



Sclerotinia sclerotiorum

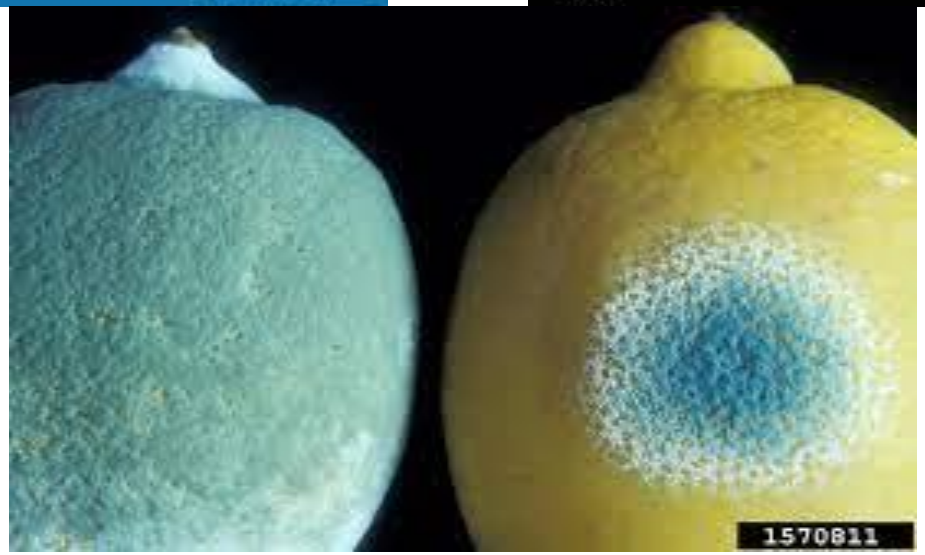


Fourth: Penicillium fungus

- The fungus *Penicillium spp* is effective in controlling verticillium wilt disease on potatoes, olives and eggplantIt was found that the addition of glucose oxidizing enzymes produced from this fungus was effective in reducing the growth of Verticillium dahliae in the presence of eggplant roots, but not in their absence. It appears that glucose, which is extracted from the roots of the eggplant, is converted by the oxidative enzymes produced by the fungus into hydrogen peroxide, which is toxic to the fungus V. dahliae; The fungus P. oxalicum was also used to control the fungus Monilinia laxa, which causes brown wilt of stone fruits.

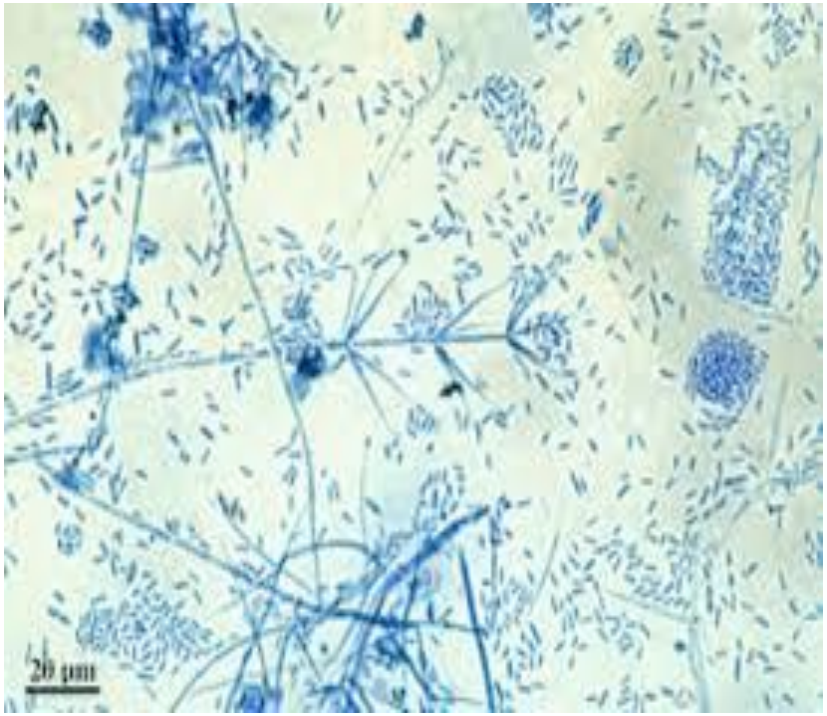

Penicillium
dreamstime.com


alamy


1570811

Fifth: The fungus *Verticillium lecanii*

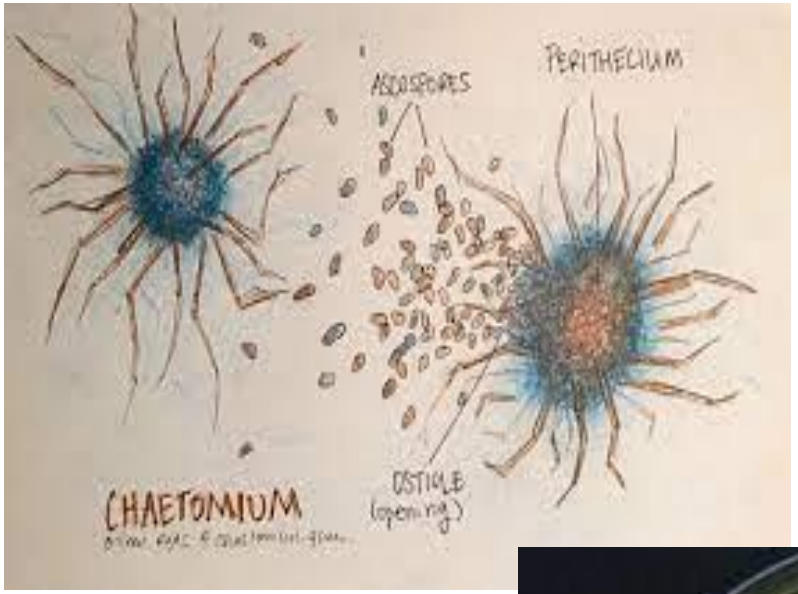
- It is one of the most promising fungi in the fight against rust and powdery mildewIt was used in controlling powdery mildew on cucumber caused by Sphaerotheca fuliginea and in controlling striped rust caused by Puccinia striiformis.The fungus grows in a wide range of temperatures, but it needs high humidity of up to 90% for the germination of its conidia spores.


20 µm

Sixth: Chaetomium fungus

- This genus includes more than 80 species restored in soil, organic waste and animal dung Most species are characterized by their ability to produce cellulose-degrading enzymes, and some species of the genus Chaetomium, especially C. globosum and C. cupreumThe ability to inhibit the growth of several plant pathogenic fungi such as Fusarium, Alternaria and Cochliobolus sativus.

- Chaetomium fungus have several mechanisms that enable them to oppose plant pathogenic fungi and reduce their damage, including the production of antibiotics such as Chaetomium, competition for food and space, production of decomposing enzymes and stimulating plant growth,He developed a biological preparation from the fungus Chaetomium which is a mixture of several isolates of C. globosum and C. cupreum


ASCOSPORES
PERITHECIUM
CHAETOMIUM
OSTIOLE
(opening)

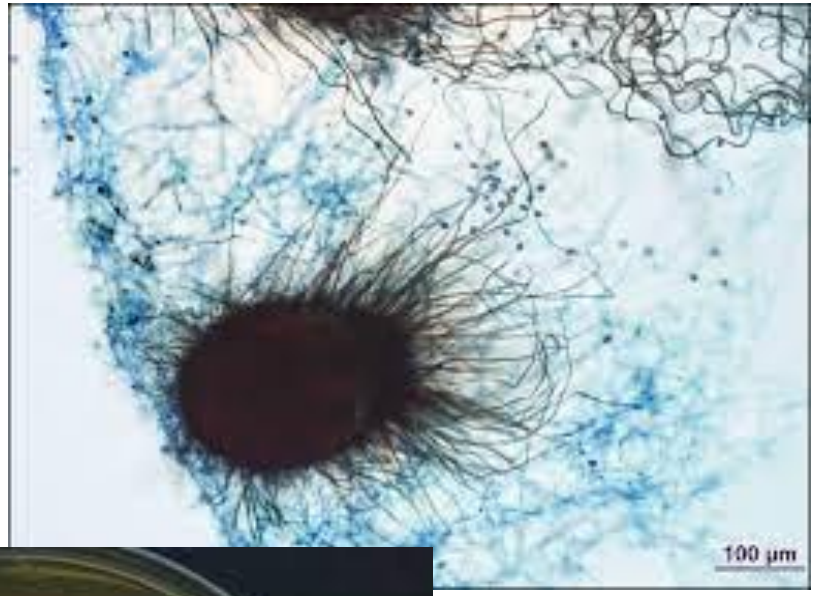

100 µm


Image Courtesy of Niall Hamilton
Copyright © 2003 Doctorfungus Corporation