

# INFOLETTER

## How does Prestop® biofungicide (*Gliocladium catenulatum*) act in disease control?

### Introduction

The active substance of Prestop®, *Gliocladium catenulatum* fungal strain J1446, has antagonistic effects against many fungal pathogens. It is able to control diseases in both soil/growing media and in foliage. *G. catenulatum* mainly acts preventively, although in certain special cases (*Botrytis* and *Didymella*) it can even stop the development of already existing disease lesions, if the Prestop treatment is given immediately after noticing the symptoms.

The activity of *Gliocladium* is based on several mechanisms. Depending on the circumstances and the situations, one or more of the mechanisms is involved.

Due to the several modes of action of *Gliocladium*, there is no risk for resistant pathogen strains - not even after frequent use.

### Colonization

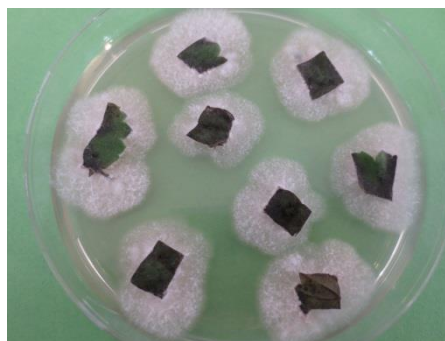
A strong ability to colonize roots, foliage and flowers is the most essential mode of action of *G. catenulatum*. Being the first colonizer the antagonist inhibits the penetration of the pathogen into plant cells. Therefore the early timing of treatments is very important.



*G. catenulatum* is an efficient root-colonizer.

In rockwool the colonization of the rhizosphere is especially easy for *Gliocladium* due to lack of competing microbes. *Gliocladium* persists also well in other growing media like peat and soil. In spite of the good colonization ability of *G. catenulatum*

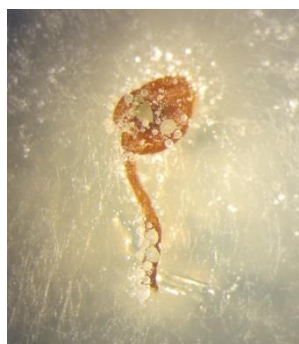
the population density gradually decreases and thus repeated treatments are needed.



*G. catenulatum* survives on foliage for around 4 weeks protecting the plant from fungal attack.



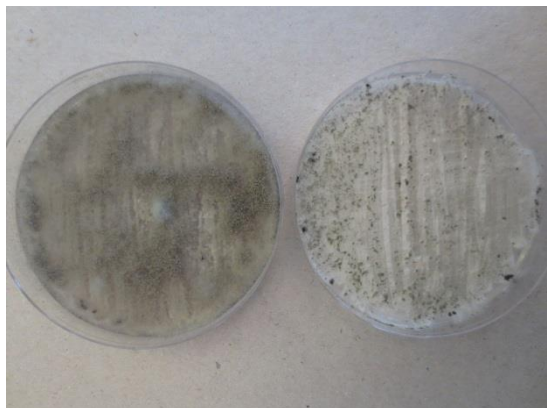
Mycelium of *Gliocladium* on the surface of tomato leaf.



*G. catenulatum* (on the left) colonizing a stamen of apple preventing *Fusarium avenaceum* to invade the developing fruit. On the right a stamen infected by *F. avenaceum*, the causal agent of core rot.

## Competition

Competition is also a part of the disease control mechanism of *Gliocladium*. This is indicated in lab conditions e.g. when *Gliocladium* and *Botrytis* are inoculated at the same time as seen in the picture below. The growth of the pathogen is entirely prevented by the antagonist, which is an indication of a good competitive ability of *G. catenulatum*.



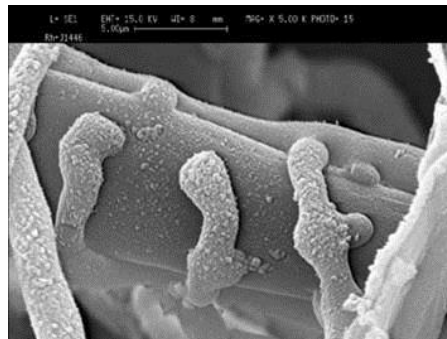
*Gliocladium* (on the right) inhibiting the growth of *Botrytis* by competing on nutrients and living space. Untreated *Botrytis* on the left.

The same phenomenon observed in lab is also shown in practice: If visible symptoms of grey mould on tomato stems or black stem rot on cucumber stems already occur, it is still possible to stop the further development of the diseases. This provides nevertheless that the Prestop treatments are started immediately after observing the disease. In this case it is more than likely that *Gliocladium* can effectively compete for nutrients and living space.

It is not always easy to make difference between competition and colonization. In inorganic substrates such as rockwool *Gliocladium* needs not compete, because there are hardly any native microbes in the beginning of cultivation. Instead, organic growing media contain a lot of natural micro-organisms. In spite of that, *Gliocladium* can easily colonize also organic substrates.

## Hyperparasitism

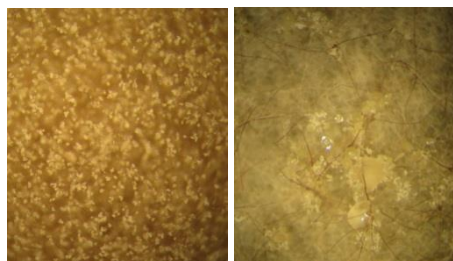
*G. catenulatum* J1446 acts as a mycoparasite deriving nutrients from the pathogen. The antagonist coils around the hyphae of fungal pathogens and adheres to the surface of them by forming appressorium-like structures. Assisted by certain enzymes *Gliocladium* penetrates into the host hypha, which enables the destruction of the pathogen.



*G. catenulatum* invading a hypha of the *Rhizoctonia solani* pathogen indicating hyperparasitism.



*G. catenulatum* (on the right) parasitizing on *Fusarium avenaceum*.



*Botrytis* sporulation (on the left) and *Botrytis* after parasitizing by *Gliocladium* (on the right).

## Enzyme activity

Observations of collapsed pathogen hyphae, when *Gliocladium* J1446 grows near the pathogen, suggest that enzyme activity is a part of the mode of action of this strain. Enzymes are also needed in hyperparasitism. *G. catenulatum* is able to excrete both chitinase and  $\beta$ -1,3-glucan enzymes, which can break down chitin and glucan cellulose respectively. These substances are the main components of cell walls of fungi. Therefore enzyme activity is a part of decomposing fungal pathogens in the case of *G. catenulatum*.

## Induced resistance

There is a strong indication that certain foliar diseases are suppressed after root treatments with *G. catenulatum*, which is a sign of induced resistance. As an example, when the roots are treated with Prestop, powdery mildew occurs later and the symptoms are not as severe as without this biofungicide.