

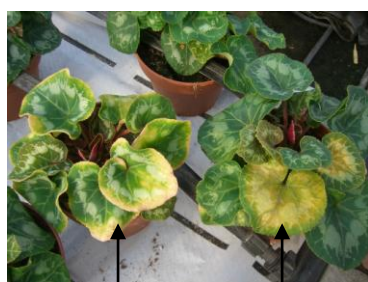


FUSARIUM

Fusarium is a vascular disease due to a fungus present in the soil, *Fusarium oxysporum f. sp. Cyclaminis*

I – SYMPTOMS

The external symptoms are not immediately detectable. Therefore an infected plant will sometimes be difficult to detect but will nonetheless be a lethal source of contamination.

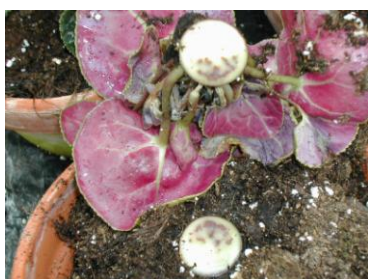


Manque d'eau

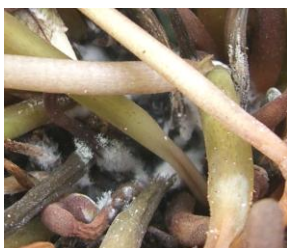
Fusariose

The most common symptom is a lateral and partial wilting of the plant due to an infection of some vessels. In general a **yellowing** appears in the centre of the leaves irrigated by the infected vessels.

Warning, the yellowing of the leaves can be caused by other reasons than fusarium.



To confirm this infection, just cut the tuber cross-sectionally and look for the presence of **brown/orange spots** obstructing the vessels on one side of the plant.



Less frequently, depending on the humidity and temperature levels, white and pinkish fruiting bodies may develop from the necrotized areas of the tuber towards the stems. This is a way of spreading spores.



At the start of the infection, the roots can stay healthy then become putrefied as the disease progresses.

Plants can be affected whatever their age. However, the more adult they are (just before and during flowering), the more visible and dramatic the symptoms are.

II – PROPAGATION

Fusarium oxysporum produces 3 kinds of spores: microspores, macrospores and chlamydozoospores. Micro and macrospores spread through the air by infecting healthy plants, while chlamydozoospores can remain in the soil for years waiting to attack the roots.

Each stress factor during growing may foster the plant's sensitivity to Fusarium:

- Contamination is more important when **temperatures are high** (optimal 28 °C/82.4°F), especially in summer.
- **The water from watering system** plays a leading role in spreading chlamydozoospores, either by splashing, or by flow.
- **Tools, a substrate, pots, trays and other objects** infected by previous cultivations or which have been in contact with an infected plant, may also be the cause of the contamination.
- **Excess nitrogen** (especially ammonia) in the summer can cause a water imbalance and stress the root system.
- **Cultivations** that are too dry and too bright can accelerate the damage caused by the disease.

Once the disease has been declared, **infected plants have to be thrown away immediately**. Up to this date, there is no effective treatment. The only solution is good prevention and balanced cultivation. Preventive treatments also exist.

III – PREVENTION

Cleaning and disinfecting are the first precautions to take.

Cultivation in direct contact with the ground (soil) represents a high risk of contamination, even if insulated with a geotextile membrane, (they are still permeable). In fact, even the most efficient disinfections will only reach the first few centimeters of the ground surface. Chlamydozoospores may be present deeper down and resurge at any time.

It is strongly recommended to use non-porous surfaces such as plastic and to avoid wood or soil.

Irrigation mats (3 layers) offer a good guarantee. They are thin and disinfecting them is very effective. In addition, their lower layer is waterproof and ensures good insulation.

Plants with damaged roots are more likely to be contaminated, even with a low infection rate. Warning, a crop that is too dry or too moist weakens the small capillary roots.

IV – CHEMICAL PREVENTION

Some active ingredients provide a powerful disinfection:

- Sodium hypochlorite
- Peracetic acid
- Quaternary ammonium
- Benzoic acid

V – BIOLOGICAL PREVENTION

Biological prevention consists of inoculation with other antagonist fungi which permits to fight directly against the pathogen:

- By destroying their cell membranes by using enzymes
- By occupying their living space through competition to absorb their nutrients.

Fuspiu® and Trichoderma are very effective antagonists to *Fusarium oxysporum*. They can be used in conjunction with a good initial disinfection and a balanced cultivation.

VI – CHEMICAL CONTROL

Controlling the spread of this disease using chemical combat does not offer a cure at the moment. Some fungicides demonstrate more efficiency on plants grown without stress and if all the preventive precautions have been followed correctly.

In some trials, the following active ingredients have had positive results:

- Azoxystrobin
- Fludioxonil

In the case of treatment of the substrate, please contact your suppliers in order to ensure yourself of the compatibility of these active matters with antagonistic mushrooms.

WARNING: check with your local branch for plant protection to find the latest updates to the regulations and guidelines for using phytosanitary products.