



ERWINIA *Erwinia carotovora* is a phytopathogenic bacteria. It is the agent of bacterial rot of the cyclamen tuber.
This rot is wet and develops in the bulb and stems.

I – SYMPTOMS

The visual evolution of the disease is very fast, almost one day to the next. When the symptoms appear, the disease is already at a very advanced stage. In fact the airborne symptoms are visible first. The plant wilts and subsides brutally onto the pot. The bulb browns from the inside and ends up rotting and releasing a characteristic stench. The stems of the leaves are soft, the bulb is soft and can be crushed under pressure of fingers.



Brutal wilt



Browning of the interior of the bulb

Sometimes:

- ✓ round oily stains appear at the insertion point between the petiole and the limb. This is rot.
- ✓ a yellowing (lemon-yellow colour) from the edge towards the center of the leaves can precede the fade.
- ✓ the bulb splits and lets spill a whitish mucous membrane.



Oily stains



Advanced stage of the disease
Yellowing (lemon-yellow colour)



Whitish mucous



Wilt

The roots are also invaded by bacteria and rot. The whole plant is finally contaminated from the bottom up, and the circulation of water and nutritive elements is blocked.

II – PROPAGATION

The germs can come only from the infected plants which introduced the disease to the greenhouse.

The bacteria penetrates the plant via natural paths (stomata) or, more often, via lesions and cracks in the bulb and the wounds caused by operations like repotting, stripping and removing of flowers, hence frequent contamination after this type of handling.

The bacteria remains in the ground and in the remains of planting. Its development requires a plant host and generally propagation occurs from plant to plant. It extends via stains, splashes or runs starting from the infected subject.

The bacteria can also survive in water and in substrates.

The total or partial destruction of the bulb releases billions of bacteria on and into the plant hosts. They are taken up by irrigation water and propagated quickly.

These are weakness parasites. Anything that weakens the plant can lead to the development of the disease.

The multiplication of the bacteria is helped by high temperatures (between 25 and 30°C/77-86°F) in humid environments.

Once inside the plant, it invades the bulb and spreads throughout the plant via the vascular pathways.

The bacteria can sometimes be carried by insects (small coprophagous flies in the middle of the plants for example), nematodes, greenhouse pests and humans. The eradication of pests constitutes a major aspect of controlling the disease.

III – PREVENTION

The trigger for the attacks of *Erwinia* are often the result of:

- ✓ variations in temperature
- ✓ potting too deep
- ✓ too much nitrogen in the fertiliser

There is not currently any means of fighting chemically against the degradation of the bulbs once they are attacked.

There does not exist any authorised use of antibiotics in agriculture. The fight is exclusively preventive.

The best prevention consists in balanced cultivation which guarantees optimal conditions and avoids stress factors. The following is necessary:

- ✓ avoid a too high hygrometry and temperatures (between 25 to 30 °C/77-86°F), in particular with plants watered at night
- ✓ avoid irregular irrigation (excess, lack)
- ✓ control and split the daily water supply during periods of strong heat in order to maintain a constant volume of root
- ✓ do not mist in hot weather to make the temperature fall, misting will never replace watering.
- ✓ Beware of sudden variations in temperature in the countries of Northern European climate type, where daily watering is not habitual with sub-irrigation and gutters, and anticipate watering regulation consequently



ERWINIA

III – PREVENTION (continuation)

- ✓ avoid too heavy and dense substrates (prefer ventilated composts) and nitrogen excess (in particular ammonia), or sudden shots of fertilisation
- ✓ avoid a too low pH (<5,5)
- ✓ use all possible means of ventilation to ventilate the greenhouse
- ✓ for cultivation at ground level (in drip irrigation), avoid puddles resulting from watering drainage
- ✓ beware of bacteria carried by drain water which can contaminate the other pots, in particular with the systems of sub-irrigation
- ✓ disinfect the plant pots, tools and other objects
- ✓ move plants off the ground (earth). Attention: a simple cover is not sufficient because they are always permeable. Indeed, even most effective disinfections will never penetrate beyond the first centimeters of earth surface. The bacterium can be present deeper and re-appear at any moment. It is strongly advised to use nonporous cultivation surfaces like plastic and avoid wood or earth. Irrigation carpets (3 layers) offer a good guarantee. They are fine and disinfection is very effective. Moreover their sub-base is impermeable and ensures good insulation
- ✓ do not bury the bulb too deeply in the substrate during potting
- ✓ do not re-use earth pots from infected plants, nor the substrate, they are difficult to disinfect

The precision of the current systems of irrigation as well as the compositions of substrates, more open and adapted to each type of watering, make it partly possible to avoid the propagation of this bacterium.

It is imperative to remove immediately any plant that is infected or suspect.

IV – ANOTHER INFECTIOUS BACTERIUM: *Erwinia chrysanthemi*

This bacteria also causes a wet rot of the bulb and sometimes even the wilting of the plant.

It is primarily vascular, which is at the origin of the wilting which accompanies the soft rot of the bulb.

Moreover, in the event of complete destruction of the bulb, the bacterium is able to spread itself widely around the infected pot, in particular when the planting conditions lend themselves to it (for example in planting on baize).

The symptoms and the means for prevention are identical to those of *Erwinia carotovora*. At the moment, there is no curative solution once the plants are infected.

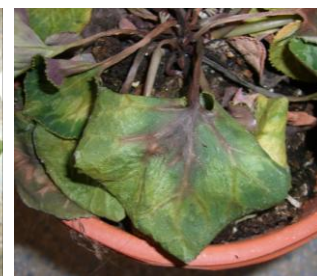
V – POSSIBLE CONFUSIONS WITH OTHER DISEASES

It is possible to confuse attacks of *Erwinia* with fungi:

- ✓ of the **Pythiaceae (*Pythium*, *Phytophthora*)** family. In this case, the roots are infected and the bulb remains hard. On the other hand a wilting identical to that caused by *Erwinia* occurs and black stains also appear at the insertion point between the petiole and the limb. They follow the veins of the leaves and do not have an oily aspect. This is not rot.



Wilt due to *Phytophthora* sp.



Non oily black stain which follows the veins of the leaf



The bulb remains hard with an attack of *Phytophthora* sp.

- ✓ ***Fusarium oxysporum* F. sp.** In this case, the bulb also remains hard and a horizontal cut of this makes it possible to see the brown vessels blocked by the fungi. On the other hand, at the beginning, only one lateral part of the plant presents sulfurous yellowish and not lemon yellow leaves.



Fusarium oxysporum F. sp.
Sulfurous yellow colour from the interior towards the outside of the leaves



The bulb remains hard in the event of *Fusarium oxysporum* F. sp.
The vessels are blocked by the fungi and present brown stains