

# Erwinia

Technical Bulletin C02/11



**Erwinia carotovora** sub spp. **carotovora**, bacterial soft-rot, is the most serious disease affecting *Zantedeschia* (Calla lily).

*Erwinia* results in a total melt down of plant & tuber tissue, and has a foul smell. It can also affect flower stems post harvest - *slimy stem*. One infected stem can ruin the vase life of associated product.

Plant stress combined with attack of fungal pathogens (eg. *pythium*) and poor crop hygiene are the primary cause of soft rot. Controlling *erwinia* is largely a management issue - a strong healthy plant and good hygiene will significantly reduce the incidence of the disease.

Common causes of stress and subsequent *erwinia* include:

## TEMPERATURE

Optimum soil/media temperature (root zone) for growing callas is 18-20°C. Soil temperatures above 23°C may result in stress, influx of fungal infection



followed by *erwinia* - secondary bacterial attack.

### Plants affected by *Erwinia*

Although greenhouse air temperatures may rise above 30°C, maintenance of plant canopy temperature at a maximum of 25°C is recommended.

#### Solution

1) Plant tubers deeper in hot conditions to reduce root zone temperature. Measure soil temperature at surface level and then at tuber depth (5-10cm), as temperature differential can be up to 5°C.

In hot or equatorial conditions ensure top of tuber is covered by at least 10cm of media/mulch - refer #5.

2) Ensure soil or media is free draining - irrigation water passes through easily at all times during the growing cycle, helping to cool the growing bed and tuber-root zone.

3) Use mulch: untreated pine sawdust, rice husk or straw on top of the growing media to reduce temperature and help retain soil moisture (also reduce weeds).

4) Use shade cloth (30-50%) in high light conditions to reflect sun and reduce temperature. Movable shade can be used during the hottest part of the day (eg. 11am – 4pm) to reduce temperature; it can be removed in the cooler part of the day to maintain high light.

Paint plastic greenhouses with chalk type white paint (eg. **Sowwhite**, **Redusol**) to reduce air temperature by up to 5°C. This may be washed off prior to tuber harvest to help dry soil and pre-cure tubers.

5) Maintain ventilation and horizontal air flow at all times, especially during high humidity. Open greenhouse every morning to introduce fresh air. Top vents and roll-up side vents are a big advantage for good airflow.

Use of large volume air fans for improved horizontal air movement is highly recommended - operate up to 24 hours a day through the growing cycle.

#### Crop Hygiene

If *erwinia* occurs, all affected plant tissue and tuber/s should be removed and disposed of. Wash hands before handling other plants or flowers.

Apply **Kocide**® (Copper hydroxide) or biostat to the affected area. Follow with a drench of **Ridomil**® within a few days to help prevent further fungal attack.

## WATER & IRRIGATION

If plants collapse with *erwinia* the tendency is to withdraw irrigation. Dry conditions however may lead to more stress and losses, as roots struggle to find enough moisture to keep up transpiration, tissue damage occurs.

Further root loss creates greater moisture deficit, more stress and eventually total plant collapse.

#### Solution

Callas require consistent watering throughout the growing cycle. Irrigation should be adjusted to meet demand especially when evapo-transpiration rates are high.

Monitor moisture levels on a daily basis. A tensiometer can assist, however constant observation of soil moisture at root level is essential.

Adjust irrigation in cool, overcast or rainy weather. Too much water can lead to constantly water logged roots. Plants are then prone to attack by primary fungal pathogens (eg. *pythium*).

Free draining soil or media is vital to ensure water and nutrient flows through the root zone during the total growing cycle to completion of tuber multiplication. Free drainage is especially important if growing outdoors with no rain control.

Untreated pine sawdust, coir, rice husk, and volcanic gravels used as hydroponic medias are now a preferred option by many growers, however daily nutrient status must be very closely monitored.

Commence drying off plants **ONLY** when the full growing cycle is completed (normally a minimum of 90 days after completion of flowering).

#### Water Quality

Dirty or pathogen loaded irrigation water is a common cause of infection, especially when the plant is in stress.

River or open reservoir water is often badly infected especially after rain when surrounding catchment water contaminates the source and results in high levels of *pythium*.

Clean water is essential during the tissue culture transfer growing cycle, as increased *pythium* load can devastate a growing crop.

Filter source water and treat with chlorine (Calcium Hypochlorite), ozone, peroxide or other available redox reagent. This is a two part process – cleaning the source water and secondly the adding of a residual disinfectant (eg. Chlorine)



Tuber affected by *Erwinia*

Maintaining a residual of 1.5-2ppm of chlorine in the irrigation water (at discharge) has been found to be very effective. Allow turnover time in the water tank prior to use – direct injection is much less effective. Particular care with water quality and overall hygiene at flower harvest is essential to help avoid infection.

#### EC (Soil Salt level)

High salt levels can damage sensitive new roots. *Erwinia* bacteria attacks damaged tissue and generally results in soft rot.

Optimum soil/media EC is 0.9 - 1.8. This will vary through the various stages of the crop – vegetative leaf establishment, flowering and tuberisation.

EC levels greater than 2.0 can be excessive and plants may suffer losses. Take care when drying off as EC may rise sharply, and cause root burn leading to pathogen infection.

#### Solution

Apply fertilizer according to soil test results and within recommended limits. Slow release NPK products like **Osmocote**® and **Nutricote**® work well, along with regular liquid feed applications.

Check EC daily. Use readily soluble N fertilisers (eg. CAN, DAP) at modest amounts. Use nitrate (NO<sub>3</sub>) sources of N instead of ammonium (NH<sub>4</sub>) sources. Monitor N-K ratios throughout the growing cycle.

Treatment for high EC - reduce nutrient and flush affected area with water to reduce the soluble salts. Stabilise to normal moisture levels then flush again. Resume normal watering once soil moisture has returned to acceptable levels.

## FUNGAL PATHOGENS

Primary fungal pathogens – *pythium*, *rhizoctonia*, *fusarium*, and *phytophthora* can cause damage to plant and root tissue during plant stress, which provides entry for *erwinia* and subsequent soft-rot.

### Solution

Treatment of tubers with **Previcur**<sup>®</sup>N prior to planting (mixed with GA) is an effective preventative. Incorporation of a suitable fungicide mix (**Ridomil**<sup>®</sup>- **Risolex**<sup>®</sup>) within the soil/media can also give early crop protection for up to 4-6 weeks.

A preventative spray programme throughout the crop cycle with **Kocide**<sup>®</sup> (2-3g/l) or **Phyton27**<sup>®</sup> can help manage bacterial & fungal infections, especially in damp humid conditions. Don't use when flowers are open as staining will occur.

As an alternative, an organic approach using **Trichoderma**<sup>™</sup> and other beneficial bacteria can be successfully employed.

1) *Pythium* attacks roots. Healthy calla tubers have strong, white branching, contractile roots. Roots from a healthy tuber may travel up to 30cm. When *pythium* attacks, the roots are initially affected by pink lesions, then turn opaque and eventually rot away.

*Pythium* is water and dust-borne and 'halo' like patches of plant death often occur 10 days after rain and initial infection. This can result in stress and associated *erwinia* attack.

Even a minor *pythium* attack can affect 30-50% of the fine feeding roots even though sections of the root are left intact. Root damage results in stress as the plant tries to draw up nutrient and water required for growth.



**Root lesions (infection & damage)**

Prevention – Following pre-planting incorporation of fungicide, drench with **Ridomil**<sup>®</sup>- after rain, particularly where irrigation is reliant on untreated river or pond water. **Ridomil**<sup>®</sup> (metalaxyl) should be limited to 2-3 times in any crop cycle. Treatment with carbendazim (**Bavestin**<sup>®</sup>, **Protek**<sup>®</sup>) has also been effective in callas.

Effective foliar applied preventatives include **Aliette**<sup>®</sup> (fosetyl aluminium), **Fostonic 80WP**<sup>®</sup> or Phosphorous Acid formulations (**Foli-R-Fos**<sup>®</sup>, **Foschek**<sup>™</sup> or **Phosgard**<sup>™</sup>). These systemics should be used sparingly as repeated applications may affect plant performance.

Take care where copper residues are present on leaves as a phytotoxic reaction can occur.

2) *Rhizoctonia* results in basal stem rot of the growing plant causing leaf and shoot collapse. A clear symptom is curling leaves, which is very obvious in pink varieties.



**Typical symptoms of rhizoctonia**

Treatment – Soil drenches during the crop cycle can include a mixture of fungicides to provide broad spectrum action against the range of soil borne fungal pathogens that affect callas. Use **Terraclor**<sup>®</sup> (quintozene), **Ridomil**<sup>®</sup>, **Rizolex**<sup>®</sup> or **Maxim**<sup>®</sup> (fludioxanil).

As for *pythium* use a foliar spray of **Aliette**<sup>®</sup>. No more than two applications 28 days apart are advised to avoid potential damage to plant growth.

## BACTERIAL PATHOGENS

*Pseudomonas blight* can attack the leaf area of the plant in cold damp conditions, especially when the crop canopy is heavy and the greenhouse unventilated.

Leaves become translucent and turn to a slimy mush and may lead to further bacterial infection. Remove infected material and treat with **Mankocide DF**<sup>®</sup> (mancozeb & copper hydroxide) or **Kocide**<sup>®</sup>. Dry the leaf canopy.

## SLIMY STEM IN FLOWERS

*Erwinia* can affect flowers post harvest. Often referred to as slimy stem, the surface of the lower part of the stem turns pink and mushy and is again characterised by the foul smell of bacterial collapse.

### Solution

Care with crop hygiene, washing buckets with bacteriostat and regular sanitation of packhouse equipment is essential during flower harvest. Ensure hydration solution is clean and preferably treated water.

Add **Keystrepto**<sup>™</sup> (streptomycin), or **Enhance**<sup>™</sup> (2-3ml/20l) to protect against slimy stem and increase vase life. Do not use sugar based preservatives.

Any affected plant material must be removed from the crop on a daily basis. Flower stems showing any bacterial breakdown should be thrown out and infected buckets /equipment re-sanitized.

Wash hands with germicidal soap after contact with infected material.

## TUBER STORAGE

*Erwinia* can be a significant problem immediately after tuber lifting and during the early curing process. If tubers are lifted immature, during wet conditions or are washed, they need to be dried very rapidly to reduce moisture and high humidity, to avoid bacterial attack and tuber mortality.

Handling damage to the surface skin of the tuber prior to full curing can lead to infection and onset of softrot. An excellent pre-cure spray is DuPont<sup>™</sup> **Virkon**<sup>®</sup>S - also very effective for disinfecting machinery.

Use of high velocity drying fans and commercial dehumidifiers is essential to achieve sufficient drying.

## SUMMARY

The key to reduction of *Erwinia* in *Zantedeschia* is prevention, from storage prior to planting through to flower and tuber harvest, using an integrated management system.

Once an attack has occurred it becomes increasingly difficult to halt further contamination, especially if environmental conditions predispose to *erwinia*.

Disclaimer - No guarantee of production performance is expressed or implied by BLOOMZ New Zealand Ltd. All chemical products recommended are those found to be appropriate by Calla growers and are a guide rather than registered products with specific application to *Zantedeschia* (Coloured Calla Lily).

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