

Calibrachoa: Guidelines for Growers

Powdery Mildew (*Podosphaera xanthii*)

- Early stages of infection are difficult to see; carefully scout
- Basal leaves in the interior of plant typically show symptoms first
- Subtle yellowing of leaves, sometimes with gray spotting is observed
- Infected leaves become necrotic (tan in color) and die over time
- Center of the plant becomes bare
- White, talcum-like fungal colonies may or may not be visible on leaves, stems or flowers

Background on Powdery Mildew

Powdery mildew on calibrachoa was first observed about 6 years ago and the frequency of this disease appears to be increasing each year.

The powdery mildew (*Podosphaera xanthii*) infecting Calibrachoa can be easily transferred to or from cucumber, squash and verbena. **Attempts to inoculate petunia have not been successful.** However, there are two additional powdery mildew species that have been identified on Calibrachoa in Germany (one that also infect tomato, and one that can also infect petunia and verbena). Both of these powdery mildews species do occur in the US, but have not been reported on Calibrachoa (to date).

Powdery mildews produce an abundance of spores that are easily dispersed by wind and air currents. The pathogen also produces a sexual spore that allows it to survive over the winter in crop debris. The movement of this pathogen from agricultural fields to greenhouse production could have important implications in the successful management of *P. xanthii* on greenhouse ornamentals.

Application of fungicides is the principal practice for managing powdery mildew on cucurbit crops, but successful control is being challenged by the development of resistance to key fungicides. Powdery mildew strains have been detected with resistance to as many as four classes of fungicides. This means that fungicide-resistant populations pose a similar threat to successful control of powdery mildew on Calibrachoa in the greenhouse.

Cultural Practices to Manage Powdery Mildew

- Frequently and carefully scout crop, especially the lower, interior leaves
- Increase spacing between plants to lower humidity in the canopy
- Free water inhibits powdery mildew; so cuttings under mist are not as likely to become infected and/or exhibit symptoms
- Adhere to a strict spray schedule and have a program in place of what to apply and in what sequence

Chemical Management of Powdery Mildew

- ❖ Alternate between systemic fungicides with different modes of action and apply with a protectant fungicide (Daconil) in order to delay resistance.

Suggestion Rotation:

- 1st spray: Eagle (Nova), Trinity or Terraguard + Daconil
- 2nd spray: Pageant (Pristine) + Daconil
- 3rd spray: Compass + Daconil

Note: sulfur pots can be quite effective for managing powdery mildew in the greenhouse

List of fungicides with FRAC codes can be found on the next page.

Black Root Rot (*Thielaviopsis basicola*)

- Plants may appear to have a nutritional deficiency (chlorosis)
- Plants are typically stunted and fail to grow
- Roots and root tips may appear black (wash roots to observe)
- Eventually the entire root system may appear black
- Plants may wilt, especially under heat stress
- Infected crown and lower stems may appear black in color and rot
- Plants are often infected with both *Pythium* and *Thielaviopsis*

Cultural Practices to Manage Black Root Rot

- Clean floors and surfaces in the potting area to remove old substrate. Pre-rinse and disinfest benches and potting lines with 1:50 dilution of ZeroTol
- Use new trays and pots if possible; avoid using old flats unless they have been steamed, or disinfested by pre-rinsing in water and then soaking in fresh 10% bleach or 1:50 dilution ZeroTol for a minimum of 10 minutes
- Maintain substrate pH within the range of 5.4 - 5.8, which is optimum for growing Calibrachoa
- Monitor fertility to avoid stressing plants; a stressed plant is a more susceptible plant
- Careful water management to avoid
 1. Long periods of saturated substrate
 2. Hard dry downs or wilts
- Control fungus gnats, which can move the pathogen around the greenhouse
- Preventive fungicide drenches
- **Root rots can look similar: get a lab diagnosis for confirmation**

Chemical Management Practices for Black Root Rot

- ❖ **PREVENTIVE** fungicide applications are the most effective as it is very difficult, if not impossible, to reverse a root rot problem once it has started

Rooting Stations:

- Drench rooted cuttings about 18 days after sticking when roots are well-developed

Finish Growers:

- Drench transplants immediately after transplanting

Thielaviopsis Control: Drench with thiophanate-methyl

Cleary 3336 50WP or OHP-6672 50W:

apply 12 oz/100 gal; retreat in 21-28 days

In Canada:

Senator 70WP apply 850g/1000L; retreat in 21-28 days

Pythium and Phytophthora Control: Drench with etridiazole

Terrazole 35WP apply 10 oz/100gal; retreat in 28 days

In California:

Terrazole CA apply 6 oz/100gal; retreat once in 30 days. May only be used if a *Pythium* or *Phytophthora* metalaxyl- or mefenoxam-resistant isolate is documented.

California Alternative: Subdue MAXX 22%EC apply 1 flo oz/100gal; retreat in 6 weeks

In Canada:

Truban 30WP apply 900 g/1200L, retreat in 28 days

List of Fungicides and FRAC code for powdery mildew fungicides

Daconil Weatherstik (chlorothalonil) = Daconil 2787 in Canada (FRAC code M5 protectant)

Eagle (myclobutanil) = Nova in Canada (FRAC code 3)

Trinity (triconazole) in US only (FRAC code 3)

Terraguard (triflumizole) in US only (FRAC code 3)

Trigo (triadimefon+trifloxystrobin) in US only (FRAC code 3+11)

Pageant (boscalid + pyraclostrobin) = Pristine WG in Canada (FRAC code 11+7)

Compass (trifloxystrobin) = Compass 50 WG in Canada (FRAC code 11)

Black Root Rot Signs and Symptoms



Plants may wilt under heat stress; roots appear black; roots washed free of substrate have black lesions and/or root tips
Rotted crown and lower stem appears black. Thick-walled, black chlamydozoospores in root tissue.

Progression of Powdery Mildew



Yellowing begins on the lower leaves in the interior of the canopy, leaves turn necrotic and die leaving the center of the plant bare.