



e-GRO Alert

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Spring Thielaviopsis? Look To Your Roots!

Eractic, uneven growth in your bedding plants? Are your properly fertilized bedding plants showing signs of nutritional deficiencies? A thorough inspection of the roots may reveal you have an infestation of black root rot, Thielaviopsis. Dr. Jean Woodward and Paul Thomas talk about what to look for and what to do if you find this disease.

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Keep an eye out for irregular growth and yellow new growth. It may be *Thielaviopsis*!

Black root rot, caused by the fungus, *Thielaviopsis basicola*, has become an increasingly common problem in plug production. One of the main reasons is the difficulty in eradicating the pathogen from production facilities. Once *Thielaviopsis* takes hold in a facility, strict sanitation procedures are necessary to combat this pathogen. *Thielaviopsis* produces darkly-pigmented chlamydospores (survival spores) within infected root tissue and soil debris that are not easily killed in the nooks and crannies within wooden benches, Styrofoam trays, and on contaminated containers and surfaces. It can survive within soil underneath benches. It can also be spread by fungus gnats and shore flies



*Vinca plugs showing chlorotic leaves in a random pattern within the tray is a symptom of black root rot, caused by *Thielaviopsis basicola*. Check the roots for the characteristic symptom of infection - darkly discolored root tips.*

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requiring both fungus and insect control measures.

What Do I Look For?

Many annual bedding plants are susceptible to black root rot, including pansy, viola, snapdragon, petunia, Calibrachoa, vinca (*Catharanthus*), begonia, dianthus, geranium and dusty miller. Initial symptoms of *Thielaviopsis* infection often mimic nutritional deficiencies. Plants will look off-color or yellow. Infection is often spotty resulting in random plants show this symptom within a plug tray or production bench. If the problem was truly due to nutritional stress, then the whole crop will most likely show the same symptoms. Diseases show a random symptom pattern, whereas an abiotic problem (nutrition, environment, cultural issues) have more uniform symptoms. As the disease progresses, plants wilt and die.

Symptoms of black root rot are more obvious on the roots. Given the disease's common name, infected roots become darkly discolored and are often stunted. The dark roots are filled with *Thielaviopsis* chlamydospores (Figure



In most cases you can easily see the difference between healthy white roots on the left image and infested darker roots on the right. (Photos courtesy of Dr. Alan Windham, University of Tennessee).

A.) Infection occurs at the root tips and moves upward into the lower stem. The best thing a production or pest manager can do is look at the roots of all incoming plugs. Healthy roots should be light-colored and easily visible against the rooting medium. Black root rot infected roots are often difficult to see against the rooting medium. Tease the roots from the medium and look at the root tips against a light-



A. The tell-tale spotty black root tissue easily seen with a hand lens. B. Dark chlamydospores from infested roots seen through a microscope.

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colored surface (palm or paper). Washing roots of medium can aid in seeing root discoloration. *Thielaviopsis* infection can cause the roots to break off (leaving the infected root pieces within the rooting medium). Often, only a small section of the root tip will show the characteristic blackening symptom. Never forget to check the roots!



***Calibrichoa* trays showing the advanced symptoms of a significant *Thielaviopsis* infestation.**

Where Does This Come In From and When?

Thielaviopsis basicola is naturally occurring in soil and on plant debris. It has also been recovered from peat moss. *Thielaviopsis* produces two distinct types of spores: chlamyospores and endoconidia. The chlamyospores are cylindrical, dark brown and multi-septate, with individual cells eventually breaking apart. The endoconidia are cylindrical, hyaline and unicellular, and

are extruded in chains from special spore-producing structure (conidiophore) (Figure B), and are easily spread in irrigation water. The endoconidia are relatively short-lived, surviving for only a few months, but the chlamyospores can survive within soil for several years.

When host roots are present, either the chlamyospores or the endoconidia will germinate and infect the roots, either directly through the surface cells or through injuries or natural openings between cells. Greatest disease development is often seen at cool to moderate temperatures (55 - 65°F), especially when cool temperatures are combined with high soil moisture. *Thielaviopsis* infection is also favored by alkaline soil pH. Keeping rooting medium pH at or below 5.6 can reduce disease development. Disease can also be worse when calcium nitrate fertilizers are used as compared to the more acidic aluminum-based fertilizers.

How Can I Prevent This Disease?

Spores of *Thielaviopsis* can be moved on anything which moves soil or rooting medium, including tools, irrigation water, containers/trays, or hands and clothing. Good sanitation is critical in keeping this disease under control! There are numerous products available to clean and disinfect surfaces including sodium hypochlorite (bleach), hydrogen dioxide, and quaternary ammonia products, as well as steam and heat sterilization. The key is to wash and remove organic debris prior to disinfecting. Different surfaces may require different disinfectants to reduce *Thielaviopsis*. On wooden benches, dilute chlorine bleach solutions were found to be most effective (Copes

and Hendrix, 1996). On non-porous plug trays, hydrogen dioxide (ZeroTol) effectively eliminated *Thielaviopsis* when sprayed at 2.5 fl.oz/gal or when trays were dipped for 10 minutes in 10% bleach (5.25% sodium hypochlorite) (Warfield and Konczal, 2003). Quaternary ammonia (GreenShield) was effective in reducing *Thielaviopsis* when used at 1 Tbsp/gal as a 10-minute dip; however, it did not eliminate the pathogen completely.

What Do I Do If I Find *Thielaviopsis*?

Black root rot has become extremely common on some plants. All incoming Calibrachoa, petunia, vinca, viola, and pansy should be checked for symptoms of black root rot. It is beneficial to preventively drench these plants after transplanting to reduce *Thielaviopsis* infection and spread. One of the mainstay fungicides to control black root rot is thiophanate methyl (Clear's 3336, OHP 6672, etc.). When applied as a drench at the higher labeled rate, it can effectively reduce *Thielaviopsis* infection. Other fungicides that can be used in rotation to effectively manage black root rot include fludioxonil (Medallion), triflumizole (Terraguard), and polyoxin-D zinc salt (Vernada, Affirm). Always read and use fungicides according to labeled rates and directions.

Are There Resistant Bedding Plant Cultivars?

Few cultivar evaluation studies have been conducted on ornamental plant for resistance to black root rot. One study evaluating Calibrachoa cultivars found that the Cabaret Series Red, Cherry Rose, Apricot, White, Scarlet, Purple; Superbells Series White, Pink Kiss, Trailing Rose, Blue; and Million Bells Cherry Pink and Crackling Fire were more

resistant to black root rot than the very susceptible cultivar Million Bells Terra Cotta (Daughtrey, 2006). Another study evaluating pansy cultivars identified Clear Sky Primrose, Clear Sky True Blue, Clear Sky White, Crown Golden, Delta Blue W/ Blotch, Delta Pure Violet, Delta White W/ Rose Wing, Fama Blue Angel, Fama Dark-Eyed White, Fama Love Me, Fama See Me,



Advanced stages of *Thielaviopsis* in Snapdragon. Removal of these plants and disinfecting the area is essential for control.

Fama Silver Blue, and Happy Face Yellow/ Blotch as black root rot resistant. Likely there are several companies with ongoing breeding programs to address this issue.

Black root rot is generally managed through preventative measures. By the time aboveground symptoms are evident, the root system is usually too damaged to salvage. Best control involves using both chemical and cultural control practices.

The Golden Rules:

- Inspect incoming plug shipments for symptoms of black root rot. (See eGro 5.09)
- Use clean, unused plug trays or flats for new crops.
- If re-using trays or flats, wash and disinfect to reduce *Thielaviopsis* contamination.

- Never re-use rooting medium.
- Sanitize benches, floors, and other surfaces.
- Avoid excessive irrigation which could attract fungus gnats and shore flies.
- Adjusting pH of mix to 5.6 or below and using certain nitrogen sources can help, but will not completely reduce disease development.
- Grow resistant cultivars, if possible.
- Protective fungicide drenches should be used for black root rot prevention.
- Remember this: There are no curative treatments for black root rot! Scouting is your best bet for control.**

Resources:

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