e-GRO Alert

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Black root rot is still a problem

Last fall, I saw a lot of black root rot on bedding plant transplants. The disease is still popping up on spring plants. Check your roots!

Black root rot is caused by the fungus, *Berkeleyomyces basicola* (formerly *Thielaviopsis basicola*). Black root rot infection is often overlooked or misdiagnosed because foliar symptoms often resemble nutritional deficiencies like nitrogen and iron (Figure 2). In effect, infected plants are suffering from nutritional deficiencies because infected roots cannot absorb and translocate water and nutrients. Initial symptoms are often leaf yellowing, plant stunting, and eventual collapse and death of the plants.

Figure 1: Viola production with dying plants in the foreground. (Image by J. Williams-Woodward)

Many annual bedding plants are susceptible to black root rot, including pansy, viola, snapdragon, petunia, *Calibrachoa*, vinca (*Catharanthus*), begonia, dianthus, geranium and dusty miller. Black root rot can also infect other greenhouse crops such as lettuce. Because the initial symptoms of *Berkelyomyces* (*Thielaviopsis*) infection often mimic nutritional deficiencies, you need to look at the entire crop for symptom patterns. Black root rot infection is often spotty resulting in random plants within a plug tray, flat, or production bench showing symptoms. If the problem was truly due to nutritional stress, then the whole crop will most likely show the same symptom. Diseases usually show a

Figure 2. Pansy plants showing leaf yellowing that resembles nutritional deficiency symptoms. Plants are infected with black root rot (*Berkeleyomyces basicola*), and as infection progresses, plants are stunted and unthrifty. (Image by J. Williams-Woodward)

Image 3. Progression of severity and damage to pansy roots infected with black root rot. Plant on left is not infected. Plants on right show almost complete loss of roots due to infection. (Image by A. Windham; used with permission)

random symptom pattern, whereas an abiotic problem (nutrition, environment, cultural issues) has more uniform symptoms and affects the whole planting or area.

Berkelyomyces root infection can often be difficult to see because the black roots, and more often just black root tips, are easily broken or washed from the roots during rinsing. Roots will appear darkened or with dark areas scattered along the root system. Infection may be confused with *Pythium*; however, the roots are not as soft and do not slough like with *Pythium* infection. *Berkelyomyces* is a “root nibbler” infecting the root tips and then progressing throughout the root system. Minor infections may go unnoticed – until it is too late. Often microscopic examination of the roots is needed to confirm *Berkeleyomyces* infection. Severely infected root systems are small and eventually almost nonexistent (Figure 3). The infected roots cannot support the foliage canopy, which leads to plant death (Figure 4).

One of the main reasons the black root rot pathogen rears its ugly head in some years more than others is due to the difficulty in eradicating the pathogen from production facilities. Once *Berkeleyomyces* (*Thielaviopsis*) takes hold in a facility, strict sanitation procedures are necessary to combat this pathogen. The fungus produces darkly pigmented chlamydospores (survival spores) within infected root tissue (Figure 4) 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 also can survive within plant debris and soil beneath benches. The fungus can also be spread by fungus gnats and shore flies requiring both fungus and insect control measures.

The best thing a production or pest manager can do is look at the roots of all incoming plugs and plant material. 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. If back root rot is suspected, and you have a microscope, Look for the darkly colored chlamydospores within the roots (Figures 5 and 6). If you don’t have a

microscope, then submit a sample to a state, university or private lab for confirmation. Once present, infected plants should be discarded.

Black root rot disease development is favored by cool to moderate temperatures (55 - 65ºF), high soil moisture, and alkaline soil pH. Keeping rooting medium pH at or below 5.6 can help reduce disease development. Disease can also be worse when calcium nitrate fertilizers are used as compared to the more acidic ammonium-based fertilizers.

Spores (endoconidia; Figure 6) of *Berkeleyomyces* 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. The key is to wash and remove organic debris prior to disinfecting. Pathogen reduction is greatest when surfaces are cleaned of organic debris. Different surfaces may require different disinfectants to reduce *Berkeleyomyces*. 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.

It is suggested that if you are not already preventively drenching incoming

Figure 4. *Calibrachoa* plugs dying from black root rot infection shortly after arrival in greenhouse. Even “healthy-looking” plants not showing symptoms are infected with black root rot at lower levels. (Image by J. Williams-Woodward)

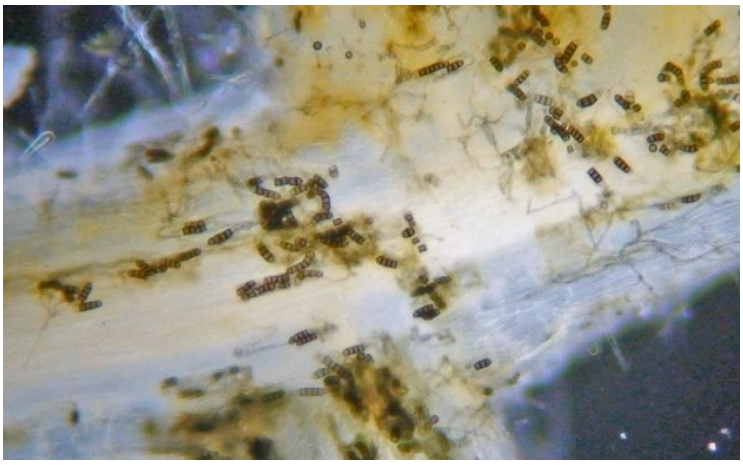

Figure 5. Darkly pigmented *Berkelyomyces* (*Thielaviopsis*) chlamydospores inside pansy roots as seen through a compound microscope. (Image by J. Williams-Woodward)

Figure 6. Highly magnified, darkly pigmented, block-like chlamydospores produced in chains as seen through a compound microscope (400X). Small, rectangular, clear spores (endoconidia) are to the right and above the dark line in the image. (Image by J. Williams-Woodward)

Calibrachoa, petunia, snapdragon, vinca, viola, and pansy that you check your roots and start a fungicide program. It is beneficial to preventively drench these plants to reduce *Berkelyeomyces* 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, Spirato), mefentrifluconazole (Avelyo), triflumizole (Terraguard), and polyoxin-D zinc salt (Affirm). Always read and use fungicides according to labeled rates and directions.

Please Note: The mention of specific active ingredients does not constitute an endorsement or recommendation of, nor discrimination against similar products not mentioned. ALWAYS READ PRODUCT LABELS AND USE THEM AS DIRECTED ON THE LABEL.

References:

Copes, W.E., and F.F. Hendrix. 1996. Chemical disinfestaton of greenhouse growing surface materials contaminated with *Thielaviopsis basicola*. Plant Disease. 80(8):885-886.

Warfield, C.Y., and K.M. Konczal. 2003. Survival of *Thielaviopsis* spores on re-used plug trays and efficacy of disinfestants on spore viability. SNA Res. Conf. Proceedings. 48:545-547.

Summary of Black Root Rot disease management:

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.

- Inspect incoming shipments for symptoms of black root rot.
- Use clean, unused plug trays or flats for new crops.
- If re-using trays or flats, wash and disinfect to reduce *Berkeleyomyces* 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. There are no curative treatments for black root rot.

On a Personal Note: After 29 years as an Extension Plant Pathologist at the University of Georgia, I have retired from UGA. You can now find me at the University of Wyoming in Laramie, WY where I will continue as an Extension Plant Pathologist for all crops and Director of the UW Extension Plant Diagnostic Lab.

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In cooperation with our local and state greenhouse organizations

Maumee Valley Growers — Choose the Very Best.

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NC Flower Power

Western Michigan Greenhouse Association

Connecticut Greenhouse Growers Association

Indiana Flower Growers Association

LIFGA

Cincinnati Flower Growers Association

Michigan Greenhouse Growers Council

NYSFI New York State Flower Industries, Inc.