Chemical Disinfestation of *Thielaviopsis basicola* on Greenhouse Growing Surfaces

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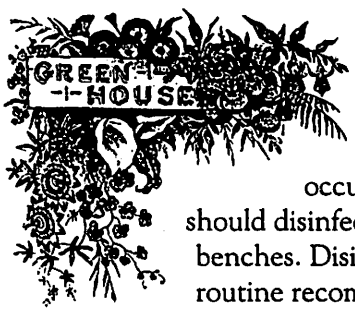

Once the crop is sold, you still have a lot to do — like preparing for the next crop. If disease problems occurred in the last crop, you should disinfect the greenhouse benches. Disinfection of benches is a routine recommendation for control of many diseases. The purpose is to remove structures (called propagules) of the fungus, bacterium or virus that remain on the greenhouse surfaces.

These propagules can be the source of a disease problem in your next crop if conditions are favorable for disease. Most disease propagules are too small to see so disinfection requires treating the surfaces with a disinfectant solution and not just removing pot media and dead plant material. Does it matter which disinfectant is used against a particular pathogen? Unfortunately, yes.

Disinfectant Study

Koponen, H., Avikainen, H., and Tahvonen, R. tested efficacy of eight disinfectants against 11 fungi grown on polyethylene plastic, stainless steel and untreated pine surfaces. They found differences between disinfectants whose effectiveness varied with surface material. In their experiment, each fungus was grown over a 1 cm diameter disc of each material which was soaked in a disinfectant solution for sixty minutes.

Polyethylene plastic was disinfected of *Botrytis cinerea*, *Fusarium oxysporum*, *Fusarium culorum*, *Pythium* sp., *Rhizoctonia solani*, and *Verticillium dahliae* with either Desinfektol EL (60% ethanol) or a 1:9 bleach:water solution (sodium hypochlorite). Other disinfectants had a more selective activity. Plastic was disinfected of *F. culorum* with Menno-Ter-forte (32.5% quaternary ammonium) and of *V. dahliae* with Iobac P (1.8% Iodine). Two quaternary amnnonium compounds with a lower percent active ingredient, approximately 3%, were generally not effective.

On the stainless steel surface, all eight disinfectants worked well against most of the 11 fungi. Desinfektol EL and bleach were the only two solutions which disinfected stainless steel surfaces of all fungi tested.

On untreated pine surfaces, only a few disinfectants worked and then only against a few fungi. Wood was disinfected of *B. cinerea* only with the 1:9 bleach:water solution, *R. solani* only with Desinfektol EL and *Pythium* sp. with both disinfectants. Desinfektol EL and 1:9 bleach:water solution did not work against the other fungi. The other six disinfectants did not work against any of the fungi on untreated pine wood.

Do these results apply to black root rot on greenhouse grown plants? If black root rot (*Thielaviopsis basicola* (Berk. & Broome) Ferraris (=*Chalara elegans* Nag Raj & Kendrick)) was a problem on your last greenhouse crop, bleach, quaternary ammonium and bromide solutions would be recommended, but these chemicals have not been tested for that use.

Our Studies

Thielaviopsis basicola causes the disease called black root rot on several ornamentals including pansy (*Viola X wittrockiana* Gams) and poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch). The black root rot fungus produces two types of spores, aleuriospores (also called chlamydospores) and endoconidia (also called phialospores), which can survive for 1 to 7 months on bench surfaces and in peat debris left on and under benches. The spores, splashed in water drops and aerially scattered on dry organic matter, pose a potentially serious problem for subsequent crops. The purpose of this study was to test efficacy of several chemicals against *T. basicola* infested on three greenhouse surfaces.

Miniature bench replicates (9 X 12 inches) made of either galvanized metal, polypropylene ground cover fabric or pressure treated wood were arranged on a bench in the greenhouse. The surface of the bench replicates were wetted with a solution containing a high concentration of aleuriospores and endoconidia. Chemicals were sprayed with a backpack sprayer on the upper surface of the bench replicates 24 hours after spores had been applied. Chemical treatments:

- Agribrom, Great Lakes Chemical Corporation (1-Bromo-3-chloro-5,5-dimethyl-2,4-imidazolidinedione, 93.5% a.i.) at 0.265 g a.i./l
- Prevent, The Buffalo Co. (quaternary ammonium, 10% a.i.) at 2.07 ml a.i./l
- bleach (sodium hypochlorite, 5.25% a.i.) at 0.525% a.i.,
- bleach (sodium hypochlorite 5.25% a.i.) at 0.525% a.i. + Sparkleen, Fischer Scientific Co. (detergent) at 5 g/l, + scrubbing of upper bench surfaces with a stiff bristled brush (in the first experiment only),
- bleach (sodium hypochlorite, 5.25% a.i.) at 1.05% a.i. (in the second experiment only),
- Captan 50 WP, ICI Corp. (captan, 43.7% a.i.) at 3.0 g a.i./l, and
- water (control)

Twenty-four hours after chemical application, ten 1 cm^2 pieces were cut from the surface of each miniature bench replicate then placed surface down on an agar media. The agar media allowed viable spores to germinate and grow into colonies. The colonies were counted two weeks later. The experiment was performed twice.

Bleach and captan worked well as disinfectants against *T. basicola* (Table 1). Bleach (sodium hypochlorite) would be cheaper and require fewer worker safety precautions than captan which has a four day reentry restriction. In commercial operations, it would be necessary to remove organic debris before applying bleach because chlorine is inactivated by dirt and organic matter. Captan is not normally used as a disinfectant but may control a broader range of fungi than bleach.

There were no statistical differences among the three treatments that contained bleach, but the 2:8 bleach:water solution and scrubbing bench surfaces treated with a 1:9 bleach:water plus detergent solution consistently reduced recovery of *T. basicola* compared to the 1:9 bleach:water solution on polypropylene fabric and pressure-treated wood surfaces (Table 1).

Since the goal is 100% disinfection, I think the differences are important. It would be easier to use the 2:8 bleach:water solution versus scrubbing bench surfaces treated with a 1:9 bleach:water plus detergent solution, because scrubbing would be labor intensive.

In summary, a 1:9 bleach:water solution would be an effective disinfectant for eliminating infective propagules of *T. basicola* from galvanized metal bench surfaces but a 2:8 bleach:water solution would be more effective on pressure-treated wood and polypropylene fabric surfaces. Bromine and quaternary ammonium solutions did not disinfect *T. basicola* from any of the surfaces tested (Table 1). These results show a need to test efficacy of disinfectants which are commonly used in production systems.

Based on this data, the procedures for disinfecting greenhouse benches infested with the black root rot fungus (*T. basicola*) are as follows.

- Remove all plants from that bench or section.
- Sweep the surface with either a brush or

Table 1. Percent recovery of *Thielaviopsis basicola* from three greenhouse growing surfaces.

Treatments	Rate, a.i./gal	Plastic	Wood	Metal
Water (control)		90.0[a] A[b]	76.3 A	95.0 A
Bromide	(0.27g)	78.8 A	82.9 A	98.8 A
Quaternary ammonium	(2.1 ml)	85.0 A	73.8 A	92.5 A
10% sodium hypochlorite	(0.52%)	6.3 B	10.0 B	0.0 B
10% sodium hypochlorite + detergent + scrubbing[c]	(0.52% + 5 g)	0.0 B	0.0 B	0.0 B
20% sodium hypochlorite[c]	(1.04%)	0.0 B	5.0 B	0.0 B
Captan	(3.0g)	0.0 B	0.0 B	5.0 B

[a] Recovery was calculated as a percentage from 10 pieces/replicate, 4 replications. Percents were averaged over two experiments.
[b] Values within a column followed by the same letter are not significantly different (P=0.05) according to Tukey's test (df=21).
[c] Treatment not tested in both experiments.

broom to remove all organic material such as peat media and plant parts.

- Mix the disinfectant solution.
  - If treating a galvanized metal surface, mix 1 part bleach in 9 parts water (for example: 1 quart bleach in 9 quarts water).
  - If treating a pressure-treated wood surface or polypropylene ground fabric, mix 2 parts bleach in 8 parts water (for example: 2 quarts bleach in 8 quarts water).
- Spray disinfectant solution so the greenhouse benchsurface is thoroughly wet.

[Kooponen, H., H. Avikainen, & R. Tahvonen. 1992. The effect of disinfectants on fungi in pure culture and on different surface materials. *Agric. Sci. Finland 1*:587-596.]