Chemical and Biological Approaches to Control of Pythium Root Rot of Poinsettia

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Root rot of poinsettia can result from infection by a number of fungi. In California, *Pythium irregulare* Buis. and *Pythium debaryanum* Hesse have been isolated from infected plants. Infection of the roots results in yellowing and defoliation of lower leaves, wilting, and possible complete defoliation, except for the bracts. Symptom expression is more pronounced when plants are moved from greenhouses into homes where light and watering conditions are not optimum.

Because this disease is a continuing problem, various approaches to control have been investigated. Fungicides offer good control, but interest in biological controls is increasing; therefore, they should be considered. Several approaches have been tried experimentally to see if satisfactory control can be attained.

In the first of two experiments reported here, both *Pythium* species were grown on autoclaved millet seed, which was used to infest a modified UC mix. Partially rooted cuttings of the cultivar Annette Hegg Dark Red were planted in UC mix in 3-inch pots in a greenhouse and were put under a mist system to finish rooting. Then the plants were transplanted into the *Pythium*-infested UC mix in 6-inch clay pots. Each treatment consisted of five replications of 5 plants, totaling 25 plants per treatment.

Root damage was determined by visual inspection of the root ball and expressed as a percentage of roots that appeared rotted. Both *P. irregulare* and *P. debaryanum* were recovered from selected samples of test plants.

Three different fungicides were applied at 400 ml per pot at the time of transplanting, and again at 1- and 2-month intervals following planting. In addition, at time of transplating, 25 plants were drenched with a suspension mixture of five bacteria (four isolates of *Bacillus subtilus* Ehrenberg Cohn and one isolate of *B. uniflagellatus* Mann) grown on potato dextrose agar. These were selected for their ability to control certain root rotting fungi.

In addition, 25 plants were planted in infested soil mix to which a mycorrhizal fungus, *Glomus fasiculatus* Thaxter (Gerd. & Trappe) had been added. Mycorrhizal fungi infect the roots of many plants and form a beneficial relationship with the plants by helping them to obtain nutrients from the soil. Container-grown plants such as poinsettias are grown under high nutrient levels so this is not important. However, because they actually invade the roots, there is a possibility that the presence of the fungus in the roots might prevent the entrance of the *Pythium* species and in that way give control. Other treatments included 25 plants planted in infested UC mix, 25 planted in non-infested UC mix, and 25 planted in UC mix which had no *Pythium* but to which *G. fasiculatus* had been added.

Table 1 summarizes treatment concentrations and results.

The three chemicals used gave excellent control. The bacteria failed to give control and the addition of the mycorrhizal fungus to the soil mix reduced the amount of disease but not to an acceptable level.

In a second experiment, four chemicals and two species of mycorrhizal fungi, *Glomi fasiculatus* and *G. mosseae* (Nicole & Gerd.) Gerd. & Trappe were tested. Compost gives control of some pathogens so material from a rapid-composting pile in which animal manure was incorporated, and material from a rapid-composting pile in which no animal manure was incorporated, were added as amendments (25 percent by volume). In addition, an experimental preparation of *Trichoderma harzianum* Rifai grown on nutrient-supplemented vermiculite (Abbott Laboratories) was used as an amendment.

Plants of the cultivar Annette Hegg Diva, rooted in Oasis blocks, were planted in 3-inch clay pots. Thirty plants were used for each treatment. Where the mycorrhizae fungi were used, the plants were planted into a mixture of two-thirds UC mix, one-third mycorrhizae infected Sudan grass roots. In the *Trichoderma* treatment, about one-half inch of the fungus-vermiculite mixture was placed on the top of each pot after planting.

The remaining plants were planted in UC mix. After 1 week, all plants were moved to 5-inch clay pots into which UC mix, previously infested with *Pythium debaryanum* and *P. irregulare* grown on autoclaved milled seed, had been added.

Plants treated with chemicals were drenched with 200 ml of fungicide per pot following transplanting. Following the original treatment, the plants were drenched twice at 1-month intervals. An additional treatment of *Trichoderma* was added to that treatment one week after planting.

Concentrations of materials, and the results, are given in Table 2.

The chemical treatments gave excellent control of the two *Pythium* species used in the experiment. Neither the mycorrhizal fungi nor the *Trichoderma* gave control as compared to the check

Table 1. Effect of Various Treatments on the Control of *Pythium* Root Rot of Poinsettia Cultivar Annette Hegg Dark Red

Treatment	Concentration per gallon	Equivalent concentration per 100 gallons	Average percent diseased roots (25 plants)
Nurelle*† (pyroxychlor 6%)	5.28 ml	0.56 qt.	0.0
Trubant† (etridiazole 30%)	1.26 g	4.5 ounces	1.6
Lesant† (fenaminosulf 35%)	1.08 g	4 ounces	9.2
Glomus fasiculatus			28.7
Bacterial mixture			40.4
Ck in infested mix			46.8
Ck in non-infested mix			0.5
Ck in UC mix + *Glomus fasiculatus*			0.9

*Discontinued experimental fungicide, Dow Chemical.
†Applied three times at monthly intervals.

Table 2. Effect of Various Treatments on the control of *Pythium* Root Rot of Poinsettia, Cultivar Annette Hegg Diva

Treatment	Concentration per gallon	Equivalent concentration per 100 gallons	Percent diseased roots
Banrot (etridiazole 15% + thiophanate methyl 25%)	2.52 g	8½ oz	1.2
Lesan (fenaminosulf 35%) + Benlate (benomyl 50%)	1.08 g 0.76 g	4 oz 2⅔ oz	0.0
Ciba Geigy 38140 (metalaxyl 50%)	0.15 g	0.53 oz	0.0
Ciba Geigy 1-118 (metalaxyl 5%)	1.5 g	5.3 oz	0.0
Previcur (propamocarb 70%)	6.3 ml	1⅓ pints	0.4
Glomus fasiculatus			14.7
Glomus mosseae			18.0
Trichoderma	(2 treatments each of .254 gm per pot)	12 oz/cu yd	14.6
Garden compost (with manure) 25% by volume			46.7
Garden compost (no manure) 25% by volume			41.7
Check in infested soil mix			17.2
Check in non-infested soil mix			0.3

in the infested UC mix. Addition of the garden composts greatly increased the amount of root rot. The reason for this is not known but additional studies are being made. The fact that addition of Benlate did not improve root rot control suggests that only *Pythium* root-rotting fungi were present and there was no contamination with other root-rotting fungi.

Lesan, Truban, Banrot, and Benlate are the only chemicals used in these studies which are presently registered and available.

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