Survey of Pythium Isolates for Resistance to Metalaxyl

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Pythium is the most common and important cause of damping off, crown rot and root rot of greenhouse crops. It is most effectively controlled by the systemic fungicide Subdue® (metalaxyl). Subdue has been the standard fungicide for *Pythium* root and crown rot. Ironically, because of its effectiveness, it may become far less useful in the future. There have been increasing reports of *Pythium* developing resistance to Subdue. It is important to realize that the new Subdue chemistry (mefenoxam) does not get around the problem of resistance. Aliette®, Banol®, and Truban® are alternatives to Subdue and should be used in rotation to prevent resistance from occurring.

On several occasions we recovered *Pythium* isolates from seedling geraniums that were extensively crown-rotted. The plants had been treated with Subdue and should have been protected. Subsequent laboratory and greenhouse tests demonstrated that the *Pythium* was resistant. There have been similar reports in other states, but we had no idea how extensive the problem was. With a grant from the Massachusetts Flower Growers Association, we were able to carry out a survey to determine if resistance to Subdue was widespread in our region.

Methods

Greenhouse crops and vegetable transplants submitted to the diagnostic clinic were cultured for *Pythium*. To determine resistance to Subdue, isolates were grown in petri dishes on corn meal agar medium containing 0, 25, 50 and 100 µg a.i. metalaxyl/ml. For each isolate tested, there were three replications per concentration. Colonies were measured after 24 hr in two different directions and the results for each isolate were averaged. Thirty nine isolates were tested. Five isolates were selected for greenhouse fungicide tests that ranged from nonresistant to highly resistant. For the greenhouse tests, tobacco seedlings were inoculated with the *Pythium* isolates and treated with Subdue. Inoculated plants with no fungicide, and noninoculated plants served as controls.

Results

Thirteen out of 39 isolates (33.3%) grew in the presence of 100 µg a.i./ml Subdue. Resistant isolates were arbitrarily assigned to two groups depending on the total growth on 100 µg a.i./ml metalaxyl; those with < 10 mm growth , and those with > 10 mm growth. Five out of seven on those growing less than 10 mm showed a clear distinction between no fungicide and 25 ppm. These isolates appear to be of intermediate resistance. Isolates 96 and 53 grew less than 10 mm but their growth on 100 ppm metalaxyl was 75% and 55% that of the controls. These isolates would probably not be controlled by Subdue. Isolates growing more than 10 mm grew nearly as well on 100 ppm Subdue as they did with no Subdue. It is very likely that these isolates would not be controlled by Subdue. In the greenhouse test, the isolate rated as nonresistant was controlled by Subdue. Two isolates rated as intermediate in resistance did not cause disease to the tobacco plants so their fungicide resistance could not be confirmed. The two isolates rated as highly resistant (52, 113) were not controlled by the fungicide. Growth on 100 ppm Subdue for isolate

52 was 77%. Isolate 113 grew about 5% faster on 100 ppm Subdue compared to the control. Data for 113 was not included in the Figures because the isolate was collected after the original trials were run.

Conclusion

Subdue has long been considered the best fungicide to control diseases caused by *Pythium* and *Phytophthora*; however, resistance to this fungicide is becoming increasingly common. The survey reported here indicated that up to 33% of the isolates collected were resistant in laboratory tests. This figure may be artificially high because in some cases several isolates from the same greenhouse were tested. Also, greenhouse trials need to be carried out to determine how well the laboratory tests support greenhouse challenge experiments with *Pythium*-inoculated plants. Our limited greenhouse test confirmed that the two resistant isolates tested were not controlled by Subdue. A total of six isolates had similarly high growth rates on 100 ppm Subdue, implying that 6 out of 40 isolates (15%) would probably not be controlled by this fungicide. More *Pythium* isolates are being tested in the laboratory and the greenhouse. We are currently trying to correlate resistance measured in the laboratory with actual fungicide performance in the greenhouse. Our goal is to be able to identify *Pythium* resistance to Subdue when we are culturing from the plant. This will allow us to more quickly advise the grower of the most effective fungicide.

Subdue resistance appears to be an emerging problem in the greenhouse industry. Growers should use Subdue in rotation with other *Pythium*-active fungicides. Conservative use of this excellent fungicide will allow us to use it effectively for years to come.

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