Novel Strategies and Technologies for Management of Water Molds and Foliar Blights Affecting Floral Crops

PRINCIPAL INVESTIGATOR: Dr. Mary K. Hausbeck, Michigan State University

PROJECT OBJECTIVES:
(A) Determine the role of the environment in prompting atmospheric concentrations of *Peronospora* sp., the causal agent of downy mildew on coleus. (B) Determine the susceptibility among different coleus cultivars to downy mildew. (C) Characterize the efficacy of new active ingredients, including reduced-risk fungicides, biocontrol agents or biopesticides, against *Botrytis cinerea*, *Pythium* spp., *Phytophthora* spp., and downy mildew.

ACCOMPLISHMENTS SINCE 2006:
OBJECTIVE A: Over a period of 2 years, our research has shown that the environment plays an important role in the release of sporangia (seeds) of the downy mildew pathogen in the greenhouse atmosphere. In particular, when the growing environment was humid (relative humidity was more than 95 percent) for at least 6 hours and then began to dry (relative humidity was less than 70 percent) the number of downy mildew sporangia released into the air was especially high. These results indicate that in order for the sporangium to develop and mature, six or more hours of leaf wetness is needed. However, for the sporangium to be released from its stalk into the air where then it is available to infect new plants, a period of lowered relative humidity or a drying time is needed. Many downy mildews are sensitive to temperature and our studies with this pathogen on coleus showed that sporangia were readily produced even when temperatures exceeded 22ºC. Consistently high temperatures did not occur over the course of our greenhouse study. Follow-up studies were conducted in growth chambers to evaluate the influence of temperature on downy mildew sporangial development. Temperatures of 15ºC and 20ºC appeared to be more favorable for downy mildew sporangia on coleus than the higher temperatures of 25ºC and 30ºC. The development of sporangia on diseased coleus plants seemed to be closely associated with temperature with the amount of sporangia ranging from a low of 8.8 percent of leaf area at 25ºC to a high of 80.8 percent at 15ºC. There were no downy mildew sporangia observed when the temperature was 30ºC.

It is not clear what environmental parameters favor the ability of the downy mildew sporangium to infect the coleus and cause new symptoms. Although we placed healthy coleus plants among those that were diseased, the environmental conditions present in our greenhouse study did not appear favorable for downy mildew to develop on the healthy plants. Under these same greenhouse environmental conditions we were able to increase the production of sporangia on plants already diseased.

OBJECTIVE B: Suppliers/growers reported that the coleus cultivars Black Dragon, Wizard Sun Golden, Wizard Golden, Wizard Rose, and Wizard Jade seem especially susceptible to downy mildew, and each of these was included in 2 or more trials. We obtained 24 cultivars for testing in each of years 1 and 2, and 18 in year 3. Cultivar testing was complicated by the finding that many varieties arrived already infected before the trials could be initiated. 'Dragon Black' and

'Volcano' consistently showed susceptibility; however, none of the cultivars consistently showed resistance to downy mildew.

OBJECTIVE C: Fifty-one products (11 reduced-risk fungicides, 4 biocontrol agents, 4 biopesticides, and 13 experimentals) were tested in *Botrytis*, downy mildew, *Phytophthora*, and *Pythium* trials. Geranium, poinsettia, and flowering tobacco were used for the *Botrytis* trials; rose and coleus for downy mildew; snapdragon, vinca, pansy, and gerbera for *Phytophthora;* and geranium, poinsettia, and snapdragon for *Pythium*. Dosages and application interval were also evaluated.

We tested promising new products which will give growers effective rotation choices for disease management. FenStop 500SC (fenamidone, reduced-risk, labeled in 2007) performed well in trials for downy mildew, *Phytophthora*, and *Pythium*, and is especially recommended for downy mildew and *Phytophthora*. Segway 400SC (cyazofamid, reduced-risk, labeled in 2009) was included in trials for downy mildew and *Phytophthora*. Segway is recommended for *Phytophthora*; more testing is needed for downy mildew. Pageant 38WG (pyraclostrobin + boscalid, labeled in 2008) performed well in trials for *Botrytis* and downy mildew. Polyoxin D zinc salt (biopesticide, labeled in 2008 as Endorse but now labeled as Veranda O 11.3WDG) was included in trials for *Botrytis*, downy mildew, and *Pythium*, and is especially recommended for *Botrytis*. Promising unlabeled products include Adorn 4FL (fluopicolide), Mandipropamid 250SC (reduced-risk), Fluazinam 500F (reduced-risk), and Palladium 62.5WDG (cyprodinil + fludioxonil, reduced-risk). Adorn and Mandipropamid proved especially effective for downy mildew and *Phytophthora* control; Adorn and Mandipropamid were tested against downy mildew, *Phytophthora*, and *Pythium*. Fluazinam was especially effective at managing *Phytophthora* and also performed well for *Botrytis*. Palladium is recommended for *Botrytis* control; it performed well against *Botrytis* and downy mildew.

TECHNOLOGY TRANSFER/IMPACT:
Our research on downy mildew on coleus has helped the industry manage this new disease. The fungicide recommendations resulting from this project has guided growers on effective ways of managing this disease. Overall, recommendations from our research on coleus downy mildew and other diseases are communicated directly with growers at workshops and extension/industry-sponsored meetings. Trade journal articles, grower newsletters, and conference proceedings are also vehicles by which recommendations including newly registered products are communicated to the industry. Results of our trials assist registrants in defining the activity of new, unregistered products among pathogens that are most troublesome to the ornamental industry.

ADDITIONAL FUNDING/EXTERNAL SUPPORT:
From 2006-2009, the American Floral Endowment funded ($162,988) Dr. Hausbeck for downy (and powdery) mildew research. Chemical companies contributed products and $98,310 to Dr. Hausbeck's research program for testing their products' efficacy for management of water molds and foliar blights.

COLLABORATOR: Stephen Wraight, USDA ARS, Ithaca, New York.