First Detection of Boscalid Resistance in *Podosphaera xanthii* in the United States Associated With Failure to Control Cucurbit Powdery Mildew in New York and New Jersey in 2009

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Podosphaera xanthii is an important pathogen of cucurbit crops that has developed resistance to fungicides with specific mode of action (McGrath 2001). The fungicide boscalid became an important tool for managing cucurbit powdery mildew in the United States following its registration in July 2003. It was the first succinate dehydrogenase inhibitor (SDHI) (FRAC code 7) registered in the United States. Boscalid, which was marketed as Pristine, was formulated with another active ingredient, pyraclostrobin, a quinone outside inhibitor (QoI) (FRAC code 11), to promote resistance management. Unfortunately, QoI resistance was documented in *P. xanthii* in several states including New York in 2002 and subsequently New Jersey (McGrath and Shishkoff 2003; Wyenandt et al. 2008).

As part of a long-term project on resistance, *P. xanthii* isolates were collected from research and commercial plantings of Halloween pumpkin (*Cucurbita pepo*) on Long Island, NY, at the end of the 2009 growing season. Isolates also were obtained from a research pumpkin planting in northern New Jersey. The pathogen was identified based on the presence of fibrosin bodies in conidia. In research plots treated with Pristine alone, powdery mildew was not effectively controlled on lower leaf surfaces at the last assessments made after four applications in New York (McGrath and Fox 2010) and eight in New Jersey (Cowgill et al. 2010) while Quintec (quinoxifen) was effective in both experiments, indicating application timing was appropriate. Endura (boscalid) and Cabrio (pyraclostrobin) were also ineffective in New Jersey in 2009 (Cowgill et al. 2010).

Isolates of *P. xanthii* were maintained on pumpkin cotyledons placed on 0.75% water agar in Petri dishes with the stem ends inserted in the agar. A leaf disk bioassay was used to determine ability of isolates to tolerate boscalid and other fungicides. Pumpkin (cv. Sorcerer) seedlings at the cotyledon leaf stage (about 7 days old) were sprayed with formulated fungicides in a fume hood and allowed to dry overnight. Disks (12 mm diameter) were cut with a no. 6 core borer from cotyledons and placed on water agar in petri dishes with four sections. Endura was used at 25, 50, 150, and 500 ppm boscalid. Isolates tolerating the lower concentrations were subsequently tested at 500 ppm. Six disks with the same treatment were placed in each section. Each dish used to test an isolate had a nontreated control. Disks were inoculated by transferring dry spores from cultures to the

center of each disk using a sterilized thin, glass rod. Isolate growth was assessed 7 and 10 days later when the control treatment usually had good growth of the pathogen. An isolate was considered to be insensitive (tolerant) to a particular fungicide concentration if it was able to grow and produce spores on at least half of the disks. Twelve isolates grew on leaf tissue treated with 500 ppm boscalid: all seven tested from the research planting in New Jersey, two of 10 isolates from the research planting in New York, and three of 20 isolates from three of seven commercial pumpkin crops sampled from in New York. These isolates are considered fully resistant to boscalid because this dose is in the concentration range for a commercial application, which varies with rate of Pristine and gallonage used. Five of these isolates were tested with the same procedure and confirmed to also be resistant to QoI fungicides. Flint at 50 ppm was used.

In 2009, when resistance was observed, Pristine had been in commercial use for seven years. During most of this time growers had only one chemistry, demethylation inhibitors (DMIs) (FRAC code 3), to alternate with Pristine for resistance management. Quintec (FRAC code 13) was labeled for use on melons in 2007 and other non-edible-peel cucurbits in 2009. This is the first known occurrence of resistance to boscalid in *Podosphaera xanthii* in the United States. Resistant isolates have been detected in New York every year since.

Literature Cited

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