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DISEASE NOTES

Powdery Mildew Caused by *Podosphaera macularis* on Hop (*Humulus lupulus*) in North Carolina

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ABSTRACT

Hop (*Humulus lupulus* L.) production recently has expanded across the United States to include areas of the country that have not previously grown hop commercially. In June 2015, a grower in western North Carolina detected powdery mildew in a small (<0.5-ha) yard during routine scouting. Characteristic signs of powdery mildew (caused by *Podosphaera macularis*) were observed on cultivars 'Cashmere', 'Cascade', and 'Chinook'. The incidence of affected leaves ranged from 0.5 to 7% among cultivars when the disease was first found, which is sufficiently severe to cause damage to cones if control measures are not implemented (Mahaffee et al. 2003). Occurrence of the disease on Cascade was of particular concern because Cascade is thought to possess some resistance to powdery mildew, although Cascade-adapted strains of *P. macularis* have been detected in the U.S. Pacific Northwest. Affected leaves were collected for confirmation of pathogen identity. Chasmothecia were absent. Five isolates were obtained by transferring conidia from infected leaves to healthy leaves of the powdery-mildew-susceptible cultivar Symphony. Within 7 days, powdery mildew colonies with barrel-shaped conidia and nonbranching conidiophores typical of *P. macularis* were visible (Ocamb et al. 1999). Two isolates from North Carolina (HPM-915 and HPM-916) and a non-Cascade-adapted isolate from Oregon (HPM-333) were each inoculated individually onto 3 leaves of Cascade (suspension of 2 × 10^4 conidia/ml). After 10 days of incubation at 18°C, a significantly greater number of lesions developed on leaves inoculated with isolates from North Carolina as compared with a non-Cascade-adapted isolate, indicating an adaption to this cultivar. Noninoculated controls remained

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healthy. Similar results were obtained in two repetitions of the inoculations. To further confirm the identity of the organism as *P. macularis*, two isolates from North Carolina were coinoculated individually with mating type tester isolates of *P. macularis* confirmed to be either mating type MAT1-1 or MAT1-2 idiomorph (Wolfenbarger et al. 2015). Chasmothecia only formed when isolates were paired with a MAT1-2 isolate, indicating both isolates were *P. macularis* and MAT1-1 idiomorph. Mating type also was determined using PCR assays (Wolfenbarger et al. 2015), which confirmed all five isolates as MAT1-1. The PCR products were sequenced bidirectionally and compared with a sequence of *P. macularis* from the Pacific Northwest (GenBank Accession No. KJ922755.1). The sequences of all five isolates were identical to this accession. A representative sequence was deposited (KT899949). At present, powdery mildew occurs only sporadically in commercial yards in the eastern United States, in part because resistant cultivars are widely planted. However, powdery mildew is a damaging disease of hop and surveys are warranted to better understand the distribution of the disease on Cascade and other cultivars in the region. The isolates recovered in North Carolina may have originated from the Pacific Northwest given that only the MAT1-1 idiomorph was detected and virulence of the isolates recovered matched that of isolates only known to exist at present in the western United States.

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Section: Choose

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