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DISEASE NOTES

First Report of the Resurgence of Hop Powdery Mildew (Podosphaera macularis) in a New England Commercial Hop Yard

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Powdery mildew, caused by Podosphaera macularis (Wallr.) U. Braun & S. Takam., is one of the major diseases of hop (Humulus lupulus) in North America. Historically, powdery mildew has been present in commercial hop yards throughout the Northeastern United States but has not been detected in New England since the reintroduction of hop to the growing region about 10 years ago. In June 2018, a hop grower in Colchester, Connecticut, contacted The Connecticut Agricultural Experiment Station in Windsor with suspected powdery mildew on hop. A visit to the farm confirmed the presence of white powdery circular

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fungus colonies that were amphigenous on leaves and a diffuse white powdery mycelia covering stems. No chasmothecia were observed. Fungus was present on nearly 100% of bines for the cultivar Zeus and about 20% of bines for the cultivar Cascade and had covered nearly 100% of lower leaves and stems of the affected bines. Infected leaves and stems from Zeus were collected for further identification. Mycelia were hyaline and septate. Conidia were hyaline, barrel-shaped, and approximately $28.17 \pm 2.49 \times 15.58 \pm 1.82$ μm , with fibrosin bodies in chains. Conidiophores were erect with cylindrical foot cells. The morphological characters matched the description of *P. macularis* (Braun 1987; Mahaffee et al. 2009). The partial ITS and 28S regions of ribosomal DNA were amplified from isolate-derived genomic DNA using primers V9G and LR1 and sequenced (GenBank accession no. MH687414) (Gerrits van den Ende and de Hoog 1999; White et al. 1990). A nucleotide BLAST search confirmed 99% identity to *P. macularis* GenBank accession number KX842348.1. Maximum likelihood phylogenetic analysis of 28S rDNA using GenBank accession numbers KX842348, KX858801, and MG076960 for *P. macularis* and numbers AB022384, MG183660, MG76955, MF919434, AB022410, AB022423, AB022393, AB022347, and AB022353 of closely related species supported the identification of our sequence as *P. macularis* with 90% bootstrap support. Only mating type idiomorph MAT1-1 was found from our isolate as determined by polymerase chain reaction using primers modified from Wolfenbarger et al. (2015), specifically forward MAT1-1A 5'-GCCGATCGTTACATTTCTTGA-3' and reverse MAT1-1B 5'-CGTCCAAACCGTAGTCGTAAA-3' for MAT1-1 and forward MAT1-2A 5'-GCAACCCTGGTCTTAGCAATA-3' and reverse MAT1-2C 5'-GTGGCCCACATTGAAGAGTA-3' for MAT1-2. Pathogenicity testing was conducted by brushing conidia from the diseased Zeus leaves onto leaves of a Cascade strap cutting. After 14 days, white mycelia were visible on the adaxial leaf surfaces of the inoculated plant but not on the negative control plant. Microscopic observation confirmed the presence of hyaline, barrel-shaped conidia matching the description of *P. macularis*. The reemergence of powdery mildew in Connecticut is a new challenge to hop growers in the region. Management practices to prevent the overwintering of this pathogen in buds may help to reduce disease in subsequent years because only one mating type was found, suggesting chasmothecia were not produced. The race of *P. macularis* present on hops in Connecticut should be determined (as in Gent et al. 2017), and an evaluation of disease susceptibilities of cultivars to the Connecticut isolate is important to provide recommendations for disease-tolerant plants to growers. Commercial hop yards throughout the Northeastern United States should actively scout for this disease, because its spread into surrounding areas is likely.

The author(s) declare no conflict of interest.

Caption

Green mottle mosaic and leaf deformation symptoms on watermelon (Sui, Li, Shamimuzzaman, Wu, and Ling). Photo credit: K.-S. Ling. Postharvest rot on cucumber caused by *Ceratocystis fimbriata* (Li, Xu, Zhang, Song, Xie, Sun, and Huang). Photo credit: H. Song.

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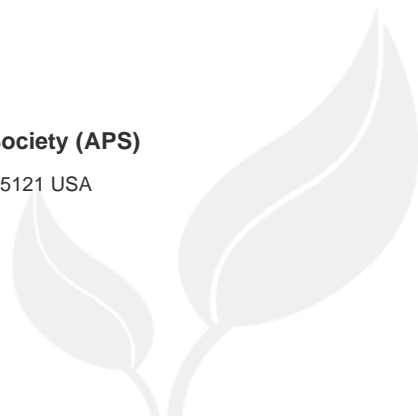
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