Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Powdery Mildew of *Salvia nemorosa* Caused by *Golovinomyces biocellatus* in Italy

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Woodland sage (*Salvia nemorosa* L.) is a hardy herbaceous perennial plant of the Lamiaceae family, widely used in parks and private gardens in Italy. During early summer of 2016, severe outbreaks of a previously unknown powdery mildew were observed in Piedmont (northern Italy) on 6-month-old woodland sage plants grown in a garden near Biella and on 90-day-old plants grown in public gardens in Torino. At temperatures between 20 and 30°C, 50 to 70% of plants grown in the gardens were affected, although at different rates. Conspicuous powdery mildew appears on adaxial surfaces of leaves, stems, and petioles as a white powdery, containing fungal mycelium and conidia. Spots consist of isolated circular colonies that become numerous, coalesce, and spread over the entire leaf, sometimes causing reddish spots on the leaf tissues. As the disease progresses, infected leaves turn yellow and drop. Conidia are hyaline, elliptical to doliform, sometimes cylindrical, borne in short chains, and measure 22.4 to 33.7 × 9.1 to 17.5 (average 27.9 × 14.2) µm, lacking distinct fibrosin bodies. Germ tubes subapically inserted, are generally nonseptate, terminating simply or in a club-shaped appressorium. Conidiophores measure 85.4 to 230.0 × 7.9 to 10.6 (average 159.6 × 9.4) µm; foot cells measure 37.9 to 97.6 × 6.9 to 12.2 µm (average 62.3 × 10.2 µm) and are followed by one to three shorter cells, measuring 11.2 to 28.3 × 9.1 to 16.3 (average 21.1 × 11.2) µm. Chasmothecia scattered to clustered measure 56.6 to 124.6 µm diameter, with six to 13 asci per chasmothecium, showing numerous simple appendages, rarely branched, arising from the lower half. Based on its morphology, the causal agent was determined to belong to the genus *Golovinomyces* (Scholler et al. 2016). The internal transcribed spacer (ITS) region of rDNA was amplified using the primers ITS4 (White et al. 1990) and ITS6 (Matsuda et al. 2005)

and sequenced. BLASTn analysis of the 446 bp obtained showed 99.5% identity (an E-value of 0.0) with *Golovinomyces biocellatus* reference isolates MUMH4294 and MUMH935 from *Salvia officinalis* and *S. pratensis*, respectively (Takamatsu et al. 2013) and 99.8% identity with *G. biocellatus* reference isolate AB769436 from *Glechoma hederacea* (Scholler et al. 2016), whereas the identity was lower (99.4 to 99.5%) with the reference *Salvia* isolates from other close fungal species identified as *Golovinomyces salviae* from Scholler et al. (2016). The nucleotide sequence has been assigned the GenBank accession number MT223765. Pathogenicity was confirmed by spraying leaves of healthy 60-day-old woodland sage plants with a suspension of the pathogen at 1 × 10⁵ conidia/ml. Five plants were inoculated, and the same number of water-inoculated plants served as controls. Plants were maintained in a greenhouse at temperatures ranging from 20 to 26°C. Typical spots of powdery mildew developed on inoculated plants 10 to 12 days after inoculation. The fungus that resulted was morphologically identical to that originally observed. Noninoculated plants did not show symptoms. The pathogenicity test was carried out twice, providing the same results. According to taxonomic and phylogenetic studies of the *G. biocellatus* complex, the same pathogen has been reported on *S. nemorosa* in Hungary (Nagy and Kiss 2006), and *G. salviae* was identified on *S. nemorosa* in Germany (Scholler et al. 2016). We cannot distinguish *G. salviae*, *G. neosalviae*, and *G. biocellatus* by 446 bp of ITS region; however, to our knowledge, this is the first report of powdery mildew caused by *G. biocellatus* sensu Braun and Cook (2012) on *S. nemorosa* in Italy. The disease is spreading in several public gardens in northern Italy, becoming more severe every year during the spring and late summer to early autumn. Disease severity might increase due to the widespread use of this species as a bedding plant.

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