

Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Powdery Mildew Caused by *Golovinomyces ambrosiae* on *Verbena* **3** *hybrida* in the United States

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Verbena × *hybrida*, also known as common garden verbena, has an important ornamental value for their wide range of flower colors and for attracting hummingbirds and butterflies. During the winter of 2021 to 2022 (December through February), more than 50% pot-grown 'Quartz XP Violet with Eye' plants showed symptoms of powdery mildew in a field trial at a Syngenta Crop Protection research facility in Vero Beach, FL. Symptoms were characterized by the development of white, superficial mycelium on the adaxial sides of leaves which, eventually, progressed to covering the whole surface of leaves, causing leaf discoloration, shoot distortion, and eventual plant death. Morphological characterization was carried out by observing powdery mildew colonies under the microscope. This powdery mildew forms dense patches of white mycelia, mainly on the adaxial leaf surfaces. The mycelium was a mat of hyphae with septa. Conidiophores were erect. The foot cells were straight, followed by one to three short cells bearing short chains of up to four conidia. The conidia were hyaline and ellipsoidal to doliform in shape. Conidial germination was of the *Eudoidium* type. The conidia ranged from 25 to 32 µm long by 12 to 16 µm wide. The length-to-width ratio of the conidia ranged between 1.6 and 2.3, but most were between 2.0 and 2.2. This is further verification of its identity as *Golovinomyces ambrosiae* and not *G. latisporus*, because the length-to-width ratio of the latter species is consistently less than 2.0 (Qiu et al. 2020). Chasmothecia were not observed. Additionally, the internal transcribed spacer (ITS), glyceraldehyde-3-phosphate dehydrogenase (*GAPDH*), and intergenic spacer (IGS) regions were sequenced using the primer pairs ITS4/ITS5 (White et al. 1990), PMGAPDH1/PMGAPDH3R (Bradshaw et al. 2022a), and IGS-12a/NS1R (Carbone and Kohn 1999), respectively.

The ITS region (GenBank no. PP924119) cannot distinguish between *G. latisporus* and *G. ambrosiae* and as such aligned 100% with both species on GenBank. However, the *GAPDH* and IGS regions can be used to distinguish *G. ambrosiae* from *G. latisporus* (Bradshaw et al. 2022b). The *GAPDH* (GenBank no. PP931995) and IGS (GenBank no. PP931996) regions aligned 100% with multiple *G. ambrosiae* sequences from GenBank including ON360708 and MK452567, respectively. The specimen was deposited in the Larry F. Grand Mycological Herbarium (NCSLG 24479). To confirm pathogenicity, 'Tuscany Pink Picotee' and 'Quartz XP Violet with Eye' plugs were transplanted to 10-cm-diameter pots containing ProMix potting mix 30 days after sowing and maintained in a greenhouse (±26°C). Inoculation was carried out 21 days after transplanting by touching infected leaves onto healthy leaves of 15 disease-free plants of each variety. Fifteen noninoculated plants of each variety were used as controls. Typical powdery mildew symptoms and signs were first observed 10 days after inoculation, and the pathogen was more aggressive on 'Tuscany Pink Picotee'. Symptoms were not observed on noninoculated plants. The fungus was morphologically identical to the one originally recovered from infected plants in the field. There have been many reports of *Golovinomyces* spp. affecting *Verbena* spp. worldwide; however, this is the first report of *G. ambrosiae* causing powdery mildew on *Verbena* × *hybrida* in the United States (Bradshaw et al. 2024; Braun and Cook 2012; Choi et al. 2021). Powdery mildews reduce plant quality and decrease the aesthetic value of infected plants, causing great losses to the ornamental industry. Correct identification of the causal agent is crucial to recommend appropriate control methods, as they may differ according to the pathogen species.

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