Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Powdery Mildew Caused by *Golovinomyces monardae* on Scarlet Beebalm (*Monarda didyma*) in China

Y. Y. Xu, J. T. Zhang, M. Xu, D. M. Liu, J. P. Ding, D. L. Pei, and Q. C. Hong[†]

Henan Academician Workstation for Industrial Technology of Dry Chili, Key Laboratory of Plant-Microbe Interactions, School of Biology and Food, Shangqiu Normal University, Shangqiu 476000, China

Plant Dis. 106:1525, 2022; published online as <https://doi.org/10.1094/PDIS-08-21-1803-PDN>. Accepted for publication 8 November 2021.

Scarlet beebalm (*Monarda didyma*) is a perennial ornamental flowering plant in the mint family, Labiatae. Due to its low maintenance and long blooming period, it is commonly cultivated in gardens as an ornamental plant in China. In May 2021, a disease was observed on the leaves of a scarlet beebalm plant in a Ten Mile Flower Sea in Xiayi county (116°13'8"E, 34°14'45"N), Henan province, China. Symptoms first appeared as nearly circular, small, white, powdery mildew-like spots on the leaves that gradually expanded, covering entire leaves. The lesions spread from lower leaves to the upper canopy, and the stems were also covered by white mycelia. In severe cases, early defoliation occurred. About 30% of plants were affected. Representative voucher specimens (SQNUMd04, SQNUNd4) were deposited in the herbarium of Shangqiu Normal University (SQNU), Shangqiu, China. Conidiophores ($n = 30$) were cylindrical, 92.0 to 142.2 $\times$ 10.8 to 14.2 μm , and produced five to seven immature conidia in a chain. Foot-cells of conidiophores were mostly curved at the base. Conidia ($n = 30$) were hyaline, ellipsoid, 23.3 to 29.8 (avg. 26.6) $\times$ 11.2 to 16.9 (avg. 14.5) μm , a length/width ratio of 1.5 to 2.1, and germ tubes were produced at the perihilar position. No chasmothecia were observed. Based on morphological comparison using the description by Scholler et al. (2016), the fungus was tentatively identified as

Golovinomyces monardae (G.S. Nagy) M. Scholler, U. Braun & Anke Schmidt. For molecular identification, DNA was extracted from mycelia and conidia, which were collected by scraping symptomatic leaves. The ITS regions and LSU were amplified using primers ITS1/ITS4 (White et al. 1990) and NL1/NL4 (Horisawa et al. 2013), respectively. BLASTn analysis of the (MZ303741) and LSU (MZ305434) sequences showed 100% identity with those of *G. monardae* (AB307667, LC076800, LC076802, LC076808, and AB077691) reported on *Monarda* species (Matsuda et al. 2003; Scholler et al. 2016; Takamatsu et al. 2013). Pathogenicity tests were carried out by gently dusting conidia from infected leaves onto healthy leaves of five *M. didyma* plants and five noninoculated plants used as controls. After 9 days, typical powdery mildew colonies started to appear on the inoculated leaves while control plants remained disease free. All plants were placed in a greenhouse without temperature and humidity control. Based on morphology, the fungus was identified as the same as that used for the inoculum, fulfilling Koch's postulates. Although *G. monardae* has been reported on various genera in the Labiatae and Verbenaceae (Farr and Rossman 2021), to our knowledge, this is the first report of *G. monardae* causing powdery mildew of scarlet beebalm (*M. didyma*) in China.

References:

- Farr, D. F., and Rossman, A. Y. 2021. Fungal Databases. Syst. Mycol. Microbiol. Lab., USDA-ARS. <https://nt.ars-grin.gov/fungal databases/>
- Horisawa, S., et al. 2013. J. Wood Sci. 59:432.
- Matsuda, S., et al. 2003. Mol. Phylogenet. Evol. 27:314.
- Scholler, M., et al. 2016. Mycol. Prog. 15:56.
- Takamatsu, S., et al. 2013. Mycologia 105:1135.
- White, T. J., et al. 1990. Page 315 in: PCR Protocols: A Guide to Methods and Applications. Academic Press, San Diego, CA.

The author(s) declare no conflict of interest.

e-Xtra

Keywords: fungi, *Golovinomyces monardae*, powdery mildew, scarlet beebalm

[†]Indicates the corresponding author.

Q. C. Hong; hongquanchun@163.com