Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Damping-Off Caused by *Mucor circinelloides* on *Aconitum carmichaelii* in China

L. Cui,¹ J. Chen,¹ X. Zhang,¹ Y. Yan,¹ and M. Li^{2,†}

¹ National Engineering Laboratory for Resource Developing of Endangered Chinese Crude Drugs in Northwest China, Shaanxi Normal University, Xi'an 710119, China

² College of Life Sciences, Shaanxi Normal University, Xi'an 710119, China

Funding: This research was supported by the Key Technologies R & D Program of Shaanxi Province (program no. 2019ZDLSF04-01-0), National Science and Technology Project to Benefit the People (project no. 2012GS610102), Natural Science Basic Research Program of Shaanxi (program no. 2019JM-491), and the Fundamental Research Funds for the Central Universities of P.R. China (grant nos. GK201703033 and GK202001009). Plant Dis. 105:507, 2021; published online as <https://doi.org/10.1094/PDIS-02-20-0359-PDN>. Accepted for publication 19 August 2020.

Aconitum carmichaelii is a typical traditional Chinese medicinal herb that has been grown for more than 1,000 years in China (Singhuber et al. 2009). Surveys for damping-off of *A. carmichaelii* were conducted from 2016 to 2018 in three of China's major planting areas (Shaanxi, Sichuan, and Yunnan Provinces). Damping-off was observed from April to June with disease incidences ranging from 5 to 11% in 10 investigated fields. In the early stage of disease development, the roots were fully covered by white mycelia. When the disease was severe, seedlings were stunted, turned yellow, had withered roots, and some eventually died. One fungus was consistently isolated from the diseased roots in the planting areas of Shaanxi Province (33°7'42"N, 107°20'27"E) on potato dextrose agar (PDA) medium. It was identified as *Mucor circinelloides*, based on morphological characteristics (Schipper 1976). Three isolates from different regions were characterized by yellowish colonies composed of tall and short sporangiospores 6 to 11 µm in width, terminal and globose sporangia,

ellipsoidal sporangiospores 5 to 8 µm in length and 4 to 5 µm in width, and obovoid columellae. The internal transcribed spacer regions (ITS) and the large subunit (28S) of ribosomal RNA gene from the representative isolate, MC180610 (GenBank accession nos. MK087755 and MT043749), were also amplified and sequenced using the universal primer sets, ITS1/ITS4 and NL1/NL4, respectively. BLAST analyses of the ITS sequence showed 99.38% identity with the type strain (CBS 195.68) of *M. circinelloides* (GenBank accession no. NR_126116), and the 28S sequence showed 99.44% identity with the strain (CBS 274.49) of *M. circinelloides* f. *circinelloides* (GenBank accession no. MH868051). The pathogenicity of *M. circinelloides* isolate (MC180610) to *A. carmichaelii* was examined by inoculating 150 ml of the hyphal suspension of *M. circinelloides* prepared from a 10-day-old potato dextrose broth culture into the soils of healthy potted *A. carmichaelii* plants. Uninoculated potted *A. carmichaelii* plants served as controls. There were three replicates for the inoculated and control plants. All the potted *A. carmichaelii* plants were incubated at 25°C under 12-h light and 12-h dark conditions. The symptoms that developed on *M. circinelloides*-inoculated *A. carmichaelii* plants were similar to those observed in the field; control plants did not show symptoms. The pathogen was reisolated from symptomatic roots onto the PDA medium and morphologically identified as *M. circinelloides*. *M. circinelloides* has been reported as a pathogen of papaya (*Carica papaya*), mandarin fruits (*Citrus reticulata*), and sweet potatoes (*Ipomea batatas*) (Cruz-Lachica et al. 2018; Oladoye et al. 2016; Saito et al. 2016), but it has never been reported on *A. carmichaelii* before. This is the first report of damping-off caused by *M. circinelloides* on *A. carmichaelii*. This pathogen may present a threat to the production of *A. carmichaelii* in China.

References:

- Cruz-Lachica, I., et al. 2018. Fungal Biol. 122:810.
Oladoye, C., et al. 2016. J. Zhejiang Univ. Sci. B 17:317.
Saito, S., et al. 2016. Plant Dis. 100:1054.
Schipper, M. 1976. Stud. Mycol. 12:1.
Singhuber, J., et al. 2009. J. Ethnopharmacol. 126:18.

The author(s) declare no conflict of interest.

e-Xtra

Keywords: *Mucor circinelloides*, *Aconitum carmichaelii*, damping-off

[†]Indicates the corresponding author.
E-mail: limz@snnu.edu.cn (M.L.)