Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Tomato Powdery Mildew Caused by *Leveillula taurica* in Taiwan

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Tomato (*Solanum lycopersicum* L.) is one of the common and important economic crops in Taiwan. In July 2018, tomato leaves with unusual yellowing and lesions were observed in Taichung, Changhua, Nantou, and Yunlin counties in Taiwan. Symptomatic leaves initially showed chlorotic, irregularly shaped patches on adaxial side of leaves, and days later necrosis appeared in the center of patches. The disease incidence was 4 to 25% and occurred mostly on large-type tomato in the field and greenhouse, although rarely on cherry tomato. Because the pathogen could not be cultured in potato dextrose agar, for initial pathogen observation, symptomatic leaves were examined directly under a light microscope. Conidiophores were found emerged through abaxial stomata of the lesion, and were erect, single, and sometimes branched, with single-celled and dimorphic conidia, suggesting the lesions were associated with a powdery mildew. The white to hyaline pathogens collected directly from fresh signs were also examined. Primary conidia were lanceolate, tip point, 50 to 78 × 14 to 22 µm, ratio of 2.3 to 5.9; secondary conidia were cylindrical to clavate, 47 to 72 × 14 to 22 µm, ratio of 2.5 to 4.6. Conidial germ tubes were mainly terminal to subterminal and sometimes lateral. Conidial appressoria were alobate to multilobed, and hyphal appressoria were nipple-shaped, lobed to multilobed or even coralloid. No chasmothecia were found in the field samples. One representative specimen of isolate TARI_PM-3 was deposited in the National Museum of Natural Science in Taiwan (accession no. F0034683), and DNA extracted from the fresh conidia was amplified

respectively with primers PMITS1 and PMITS2 (Cunnington et al. 2003) for the sequences of the internal transcribed spacer region (ITS1+5.8S+ITS2, partial sequence). The segment of sequence (accession no. MT370494 in GenBank) showed 99.8% identity with the sequence of AB045000, which was identified as *Leveillula taurica* (Khodaparast et al. 2001). Based on morphology and molecular analysis, the fungus was identified as *L. taurica* (Braun and Cook 2012; Choi et al. 2019). To confirm pathogenicity, conidial suspensions (4×10^4 conidia/ml) of *L. taurica* (isolate TARI_PM-3) were used to inoculate by dropping (10 µl/site) on the abaxial side of leaves of 4-week-old potted tomato (cv. Golden Lucky). The plants were covered with transparent plastic bags for 1 day and then maintained at 16 to 26°C in a greenhouse. Lesion symptoms of leaves similar to those in the field were observed 4 weeks after inoculation, whereas the controlled plants inoculated with ddH₂O remained symptomless. The same fungus was observed on the necrotic patches of the inoculated leaves. In Taiwan, the recorded pathogens causing tomato powdery mildew are *Erysiphe orontii* and *E. cichoracearum* (Tzen et al. 2019). To our knowledge, this is the first report of tomato powdery mildew caused by *L. taurica*. Typical lesions appeared in the beginning of the disease progress in the field. Through inoculation, the same pathogen could infect sweet peppers (*Capsicum annuum* L.), which has been also reported as a host of *L. taurica* (Tzen et al. 2019), suggesting these two crops could be alternate hosts of *L. taurica* in the field. Cross-species infection should be taken into consideration while managing the disease.

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