Diseases Caused by Fungi and Fungus-Like Organisms

Identification of Leaf Spot and Stem Rot on *Plectranthus verticillatus* Caused by *Rhizoctonia solani* AG-4 HGI in China

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Plectranthus verticillatus (Swedish ivy) is a plant in the family Lamiaceae (Labiatae) native to southeastern Africa that is commonly grown as a houseplant in China. In June 2018, the initial symptom of water-soaked spots was found on the stem bases of 16 *P. verticillatus* 1-year-old plants in a commercial greenhouse situated in Daxing District, Beijing, China (116°22'E, 39°42'N), where 150 potted *P. verticillatus* plants were obtained by cuttage propagation and grown in conventional nutrient soils. Almost a month later, the disease was more severe, and symptoms appeared on the leaves. Infected leaves displayed water-soaked, dark-brown lesions and fell off easily. Stems became dark brown and rotted and showed lodging. In a survey, the incidence of affected plants was 70%. To isolate the causal agent, the infected leaf and stem tissues were cut into 3-mm segments and surface disinfected in 1% NaClO for 1 min, rinsed three times with sterile distilled water, and cultured on potato dextrose agar (PDA) at 25 ± 1°C with a 12-h photoperiod. After 2 days, hyphal tips were transferred to new PDA plates to obtain pure cultures. Six morphologically similar isolates (CC1 to CC6) were obtained from the symptomatic samples. All the fungal colonies were white initially, turned brown gradually, and formed irregularly shaped sclerotia after 9 days of incubation on PDA. Observation of microstructures indicated that all

the isolates resembled *Rhizoctonia* sp. (Sneh et al. 1991), with septate hyphae with right-angled branching, slight constriction at the base of hyphal branches, and three to eight nuclei per cell. Total genomic DNA was extracted from pure isolates using a Fungal DNA Kit (GBCBIO, Guangzhou, China), and the internal transcribed spacer (ITS) region of rDNA was amplified with the primers ITS1 and ITS4 and sequenced (Garibaldi et al. 2019; White et al. 1990). The results showed that the sequences of six isolates were identical and had 100% identity with those of *Rhizoctonia solani* AG-4 HGI (GenBank accession nos. MH172679 and MH172664). Phylogenetic analysis performed by the neighbor-joining method (MEGA 7 software) showed that the representative isolate (accession no. MZ723940) was assigned to the *R. solani* AG-4 HG-I group. The pathogenicity of the six isolates to the leaves and stems of *P. verticillatus* was determined. Healthy *P. verticillatus* 1-year-old plants were grown in 2-liter pots with sterile substrate in a greenhouse at 14 to 19°C (night) and 23 to 28°C (day). After 7 days, for each isolate, five *P. verticillatus* plants were inoculated with a 6-mm-diameter PDA plug taken from a 10-day-old PDA culture, which was placed onto the leaf blade and the base of the stem. Five control plants were inoculated with sterile PDA plugs. All the inoculated plants were incubated in a glass cabinet under 90% humidity and 25°C for 2 days, then moved back to the greenhouse with natural daylight conditions. The test was repeated three times. Ten days later, all inoculated leaves and stems exhibited dark-brown and water-soaked lesions similar to those observed on naturally infected plants, whereas control plants remained asymptomatic. The fungus that was reisolated from the diseased tissues had the same morphological characteristics as the original isolates and was confirmed to be *R. solani* AG-4 HG-I by molecular identification. *R. solani* AG-4 HGI has an extensive host range and was previously reported to cause leaf, root, and stem rot on *Plectranthus* spp. in Florida in 1984 (Alfieri et al. 1984). To our knowledge, this is the first report of *R. solani* AG-4 HGI infecting *P. verticillatus* in China. Its confirmation is a significant step toward management recommendations for growers.

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