Diseases Caused by Fungi and Fungus-Like Organisms

First Report on Ovate-Leaf Atractylodes Damping-Off Caused by *Fusarium oxysporum* Species Complex in South Korea

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In South Korea, ovate-leaf atractylodes (OLA) (*Atractylodes ovata*) is cultivated for herbal medicine. During May to June 2019, a disease with damping-off symptoms on OLA seedlings was observed at three farmer fields in Mungyeong, South Korea. Disease incidence was estimated to be approximately 20% based on calculating the proportion of symptomatic seedlings in three randomly selected fields. Six randomly selected seedlings (two from each field) showing damping-off symptoms were collected. Small pieces (1 cm²) were cut from infected roots, surface-sterilized (1 min in 0.5% sodium hypochlorite), rinsed twice with sterile water, air-dried, and then plated on potato dextrose agar (PDA, Difco, and Becton Dickinson). Hyphal tips were excised and transferred to fresh PDA. Six morphologically similar isolates were obtained from six samples. Seven-day-old colonies, incubated at 25°C in the dark on PDA, were whitish with light purple mycelia on the upper side and white with light purple at the center on the reverse side. Macroconidia were 3 to 5 septate, curved, both ends were pointed, and were 19.8 to 36.62 × 3.3 to 4.7 μm (*n* = 30). Microconidia were cylindrical or ellipsoid and 5.5 to 11.6 × 2.5 to 3.8 μm (*n* = 30). Chlamydospores were globose and 9.6 to 16.3 × 9.4 to 15.0 μm (*n* = 30). The morphological characteristics of present isolates were comparable with those of *Fusarium* spp. (Maryani et al. 2019). Genomic DNA was extracted from 4-day-old cultures of each isolate of SRRM 4.2, SRRH3, and SRRH5; the *EF-1α* and *rpb2* regions were amplified using EF792 + EF829 and RPB2-5f2 + RPB2-7cr primer sets, respectively (Carbone and Kohn 1999; O'Donnell et al. 2010), and sequenced (GenBank

accession nos. LC569791 to LC569793 and LC600806 to LC600808). BLAST query against *Fusarium* loci sampled and multilocus sequence typing database revealed that 99 to 100% identity to corresponding sequences of the *F. oxysporum* species complex (strains NRRL 28395 and 26379). Maximum likelihood phylogenetic analysis with MEGA v. 6.0 using the concatenated sequencing data for *EF-1α* and *rpb2* showed that the isolates belonged to *F. oxysporum* species complex. Three healthy seedlings of similar size (big flower sabju) grown for 20 days in a plastic pot containing autoclaved peat soil were used for pathogenicity tests. Conidial suspensions (10⁶ conidia ml⁻¹) of 20-day-old colonies of two isolates were prepared in sterile water. Three pots per strain were inoculated by pouring 50 ml of the conidial suspension or by the same quantity of sterile distilled water as control. After inoculation, all pots were incubated at 25°C with a 16-h light/8-h dark cycle in a growth chamber. This experiment was repeated twice. Inoculated seedlings were watered twice a week. Approximately 60% of the inoculated seedlings per strain wilted after 15 days of inoculation and control seedlings remained asymptomatic. *F. oxysporum* was successfully isolated from infected seedlings and identified based on morphology and *EF-1α* sequences data to confirm Koch's postulates. *F. oxysporum* is responsible for damping-off of many plant species, including larch, tomato, melon, bean, banana, cotton, chickpea, and *Arabidopsis thaliana* (Fourie et al. 2011; Hassan et al. 2019). To the best of our knowledge, this is the first report on damping-off of ovate-leaf atractylodes caused by *F. oxysporum* in South Korea. This finding provides a basis for studying the epidemic and management of the disease.

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