Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Coleosporium clematidis* Causing Rust Disease on *Clematis patens* in Korea

Jae Sung Lee,¹ Young-Joon Choi,^{1,†} and Hyeon-Dong Shin²

¹ Department of Biology, Kunsan National University, Gunsan 54150, Korea

² Division of Environmental Science and Ecological Engineering, Korea University, Seoul 02841, Korea

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Clematis patens (Ranunculaceae), often called big-flower clematis, is a perennial plant native to Northeast Asia, including China, Japan, and Korea. It is a popular ornamental plant because of its large, colorful flowers. In Korea, it is widely cultivated for public and private gardening and medicinal purposes. In September 2021, symptoms of rust disease were found on *C. patens* at a public park (ca. 30 ha) in Jeonju (35°52'16"N, 127°03'16"E), Korea, where the disease occurred on 80% of *C. patens* plants ($n = 50$) surveyed, and disease severity in each affected plant ranged from 60 to 90%. Symptoms appeared as light green, vein-limited chlorotic spots on the upper surface of infected leaves, and yellow or orange rust pustules were formed on the corresponding lower surface of leaves. A representative sample was deposited in the Kunsan National University Herbarium (KSNUH1522). Uredinia were yellow or orange, round to ellipsoidal, mostly scattered, and 0.5 to 1 mm in diameter. Urediniospores were pale yellow, ellipsoid or ovoid, 23.1 to 34.8 × 14.9 to 24.7 μm (average 29.3 ± 2.7 × 18.8 ± 2.2 μm [mean ± SD], $n = 50$), with a verrucose and hyaline wall of 1.0 to 2.0 μm thick. The morphological characteristics were similar to those reported for *Coleosporium clematidis* (Barclay 1889; Hiratsuka et al. 1992). To confirm morphological identification, genomic DNA was extracted from a representative specimen (KSNUH1522). The internal transcribed spacer (ITS) rDNA with primers ITS5-u and ITS4rust (Pfunder and Schürch 2001) and large subunit (LSU) rDNA with primers LRust1R and LRust3 (Beenken et al. 2012) were amplified for sequencing. Two resulting sequences (acc. nos. OM200310 for ITS, OM184262 for LSU) were blasted in GenBank. The ITS sequence of

the Korean sample differs at a nucleotide with a sequence of *C. clematidis* from *Clematis* sp. (KX386005) but at eight nucleotides with three other sequences of *C. clematidis* (KX386007, KX386008, and KX386010). The LSU sequence differs at a nucleotide from the sequences of *C. clematidis* from *Clematis* sp. (KX386039, KX386040, and KX386042). In phylogenetic trees of the ITS and LSU sequences, the Korean sample formed a well-supported clade with the reference sequences of *C. clematidis*. For a pathogenicity test, urediniospores (1.25×10^6 ml⁻¹) were harvested from infected leaves and inoculated onto three healthy *C. patens*. Three noninoculated plants served as controls. Inoculated and noninoculated plants were kept in a plant growth chamber at 22°C, a 16/8 h light cycle, and 80% humidity. After 3 weeks, all inoculated plants formed yellow rust pustules on the lower surface of leaves, identical to what was previously observed in the field, whereas the control plants remained symptomless. The same pathogen was confirmed from the symptomatic plants, fulfilling Koch's postulates. Based on morphological characteristics, sequence data, and a pathogenicity test, the causal agent of rust on *Clematis patens* was identified as *C. clematidis*. To our knowledge, this is the first report of rust disease caused by *C. clematidis* on *C. patens* in Korea, previously recorded only in Japan (Hiratsuka et al. 1992). *Coleosporium clematidis* has been reported on about 60 species of *Clematis* in Asia and Africa but has not been reported in Europe and North America (Farr and Rossman 2022). In Korea, *Clematis fusca* var. *violacea* was previously reported as a host plant for the causal pathogen (Cho and Shin 2004). Given its high occurrence and severe damage, this disease could be a potential threat to the cultivation of *C. patens*.

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[†]Indicates the corresponding author.
Y. J. Choi; yjchoi@kunsan.ac.kr