Diseases Caused by Oomycetes

Plasmopara viticola Causing Downy Mildew on *Vitis davidii* in Korea

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Vitis davidii (Rom. Caill.) Foëx, commonly known as spine grape, is a deciduous climber native to China. Its fruits are consumed fresh or used to make wine in South and Central China. In recent years, spine grape has been cultivated in Korea. In July 2020, downy mildew was detected on spine grape vines in Jeongeup (35°42'17"N, 126°54'02"E), Korea, with a disease incidence of 70%. The symptoms appeared as yellowish, brownish, or reddish, vein-limited, poly-angular adaxial leaf spots, corresponding to dense, white downy growth abaxially. A representative specimen was deposited in the Kunsan National University Herbarium (KSNUH679). Sporangiophores were tree-like, hyaline, mostly straight, and monopodially branched in orders of three to six; they measured (219.4–) 273.2 to 435.1 (–546.6) × (4.8–) 6.7 to 9.0 (–10.0) µm (*n* = 50). Ultimate branchlets were bi or trifurcate, straight to slightly curved, with truncate or, rarely, a swollen tip, and measured 2.9 to 9.7 µm long and 0.8 to 2.5 µm wide at the base (*n* = 50). Sporangia were hyaline, ovoidal or lemon-shaped; they measured (16.8–) 20.0 to 28.8 (–34.2) × (11.4–) 13.1 to 17.0 (–20.1) µm with a length to width ratio of (1.28–) 1.46 to 1.78 (–2.07) (*n* = 50). This morphology was as described for *Plasmopara viticola* (Berk. & M. A. Curtis) Berl. & De Toni (Hall 1989). Genomic DNA was extracted directly from infected *V. davidii* leaves. Three regions were PCR-amplified and sequenced: *cox2* mtDNA with primers *cox2F* and *cox2-RC4* (Choi et al. 2015), *actin* with primers *pve04815-F* and *pve04815-R*, and *beta-tubulin* with primers *pvc389-F3*

and *pvc389-R4* (Rouxel et al. 2013). The resulting sequences were deposited in GenBank (accession nos. MT834527 for *cox2*, MT834525 for *actin*, and MT834526 for *beta-tubulin*). A BLASTn search revealed that the Korean sample was identical to *P. viticola* clade *aestivalis* originating from *Vitis* species: MK215072 for *cox2* sequence, KY933800 for *actin*, and MK358393 for *beta-tubulin*. In all phylogenetic analyses of the three genes, KSNUH679 came out as phylogenetically placed within *P. viticola* clade *aestivalis*, which has recently been reported on *V. coignetiae* (Kim et al. 2019) and *V. ficifolia* var. *sinuata* in Korea (Choi et al. 2017). A pathogenicity test was performed twice by inoculating the leaves of 10 healthy spine grape plants with a sporangial suspension (~1 × 10⁶ sporangia-ml⁻¹) and incubating them in a growth chamber at 25°C, 12-h day/night cycle, and 90% relative humidity; five noninoculated plants served as controls. After 2 weeks, all inoculated plants developed typical downy mildew symptoms, whereas the controls remained symptomless. Morphology and molecular features confirmed the identity of the pathogen of spine grape to be *P. viticola*. To the best of our knowledge, this is the first report of downy mildew caused by *P. viticola* on *V. davidii* in Korea. Recently, downy mildew outbreaks caused by *P. viticola* have been recorded in spine grape plantations in southern China (Yi et al. 2019). Considering the potential of spine grape as a novel crop for Korea, *P. viticola* appears to represent a significant threat to this industry.

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