Diseases Caused by Viruses

First Report of Curly Top of *Coriandrum sativum* Caused by Beet curly top virus in the Columbia Basin of Washington State

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Two fields of coriander (*Coriandrum sativum* L.) seed crops of proprietary cultivars were observed in the Columbia Basin of Washington in July 2020 with 40 and 90% incidence of plants showing stunting and leaf and stem discoloration, sometimes with mild leaf curl. Foliar discoloration ranged from yellow to red and purple. Sweep-netting along the field edges collected one beet leafhopper (*Circulifer tenellus* Baker; BLH), the known vector of Beet curly top virus (BCTV), Beet leafhopper transmitted virescence agent (BLTVA) phytoplasma, and *Spiroplasma citri*, all of which affect Solanaceae and Apiaceae crops in Washington (Crosslin et al. 2006; Johnson and Martin 1998; Lee et al. 2006). Nucleic acids extracted from leaves and petioles of 12 coriander plants (eight from Field 1 and four from Field 2) using the Deltaport method, and from the BLH using the CTAB method (Crosslin et al. 2006), were subjected to PCR assays to detect the BLH-transmitted pathogens that cause yellow and purple discoloration in potato (*Solanum tuberosum* L.) and carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arc.) in this region. BLTVA was targeted using a species-specific nested PCR assay with primers P1 and P7, followed by primers FU5 and BLTVA-int (Crosslin et al. 2006); *S. citri* was targeted using primers P89-F and P89-R (Yokomi et al. 2008); and BCTV was targeted using curtovirus primers BCTV2-F and BCTV2-R (Strausbaugh et al. 2008). BLTVA and *S. citri* were not detected in the plants, but curtovirus was detected in 10 of the 12 plants. All three pathogens were detected from the single BLH. A 519-bp region of the

curtovirus capsid protein gene was amplified from seven plants (five from Field 1 and two from Field 2) and the BLH, and cloned into TOP10 *Escherichia coli* cells using the pCR-2.1 TOPO vector (Invitrogen, Carlsbad, CA). Three clones were sequenced from each sample. For each of six plant samples and the BLH, the three clones were identical and consensus sequences were generated (GenBank accessions MW234419 to MW234425). For the seventh plant, two clones were identical in sequence (MW234426) and the third contained 12 single nucleotide polymorphisms (MW234427). All sequences were subjected to an NCBI BLASTn analysis and showed 98.3 to 99.8% identity with BCTV sequences. Additional PCR assays with primers BMCTV-C1 2213F and BMCTV-C1 2609R (Strausbaugh et al. 2008), targeting the C1 gene of the Worland strain of BCTV, detected BCTV-Worland-like strains in all plants and the BLH, confirming that BCTV was present and indicating that the strain-specific primer pair was more sensitive than the universal curtovirus primers. Yield losses in the two fields were approximately 60%, with reduced seed size but not seed quality. BCTV infections in coriander crops have been observed in the Columbia Basin in 2002, 2005, 2008, and 2013, with yield losses ranging from 10 to 100% per field, though official reports were not made following the diagnoses (Crosslin, du Toit, and Frost, unpublished data). BCTV has caused millions of dollars of losses in the U.S. in crops such as sugar beet (*Beta vulgaris* subsp. *vulgaris* L.), tomato (*Solanum lycopersicum* L.), and pepper (*Solanum annuum* L.) (Johnson and Martin 1998). This is the first publication of BCTV affecting seed production of the specialty crop *C. sativum*. The observation of 90% incidence of symptoms in one field suggests that resistant cultivars and/or insect pest management practices are needed to prevent significant impacts of BCTV on coriander seed production in this semiarid region.

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