Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Fusarium avenaceum* Causing Canker Disease on Kiwi Tree in China

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In May 2021, canker symptoms were detected on 'Xuxiang' kiwi trees in southwestern Shaanxi (Hanzhong municipality; 33.23° N, 107.27° E) in China. Seven-year-old trees exhibited black necrotic lesions and cracked areas in the trunk. The symptoms were observed in approximately 10% of the trees in six orchards (31 ha in total). Application of commercial fungicides did not control the advancement of the pathogen, and infected trees were removed to control the spread. Three samples, approximately 1 cm² in size, of symptomatic tissue were collected, surface sterilized in 2% NaOCl for 1 min, and washed with sterile ddH₂O. Four isolates showing white mycelium with yellow pigmentation were obtained after 4 days of incubation on PDA, containing chloramphenicol (50 µg/ml), at 28°C. The pathogen was isolated from all collected samples. *ITS*, *EF1-α*, *TUB2*, *RPB1*, and *RPB2* genes were amplified using *ITS1/ITS4*, *EF1-728F/EF1-986R*, *T1/T22*, *RPB1-5F/RPB1-8R*, and *RPB2-5F/RPB2-7cR* (strain NJC06) or *RPB2-c7F/RPB2-11aR* (strains NJC07 and NJC08) primers, respectively. Two isolates shared the same sequences (strain NJC08). Obtained sequences were submitted to GenBank under accession numbers MZ669205 and OL347898 to OL347899 (*ITS*), OL439731 to OL439733 (*EF1-α*), OL439734 to OL439736 (*TUB2*), OL439737 to OL439739 (*RPB1*), and OL439740 to OL439742 (*RPB2*). The sequences shared >99% (*ITS*; *F. avenaceum* CBS 128538, MH864972), >99% (*EF1-α*; *F. avenaceum* 55-2, MN473124), 100% (*TUB2*; *F. avenaceum* SICAUCC 18-0001, MK253102), >98% (*RPB1*; *F. avenaceum* NRRL 26911, MG282372), and >98% (*RPB2*; *F. avenaceum* SICAUCC 18-0001, MK396098; or *F. avenaceum* FRC R-09495, CQ915486) homology to multiple *F. avenaceum* strains. A molecular phylogenetic tree was constructed using MEGA7 with *Fusarium* strains found causing rot in various hosts (Wang et al. 2015), and other fungal

species, such as *Cadophora malorum*, *Diaporthe ambigua*, *D. australafri-cana*, and *Neofusicoccum parvum*, which were reported to cause cord on kiwi tree in Chile (Diaz et al. 2021). Microscope observations after cultivation of all isolates on barley-honey-tryptone medium (Song et al. 2020) showed the presence of septate mycelium, fusiform microconidia (8 to 15 µm in length, containing 0 to 3 septa; *n* = 77) and chlamydospores (*n* = 21), and agree with the morphology of *F. avenaceum* (Zhao et al. 2020). To confirm pathogenicity, a sterilized spatula was used to make wounds (3 mm diameter, 1 mm depth) on the trunk of 3-month-old Xuxiang kiwi trees. Solutions containing 1 × 10⁶ spores/ml (20 µl) of the isolates were injected in the wounds. Sterile ddH₂O was used for the control experiment. Inoculated plants were maintained in a growth chamber at 28°C and 80% relative humidity for 4 days. The pathogen was recovered from the canker lesions, which were similar to those observed in the orchards, and its identity was confirmed by sequence analysis. The pathogen only infected wounded trees, and probably invaded the orchards during pruning in February 2021. *F. avenaceum* has been reported to cause canker on almond tree (Stack et al. 2020), stem rot on *Anthoxanthum aristatum* and *Polygonatum cyrtoneura* (Pieczul et al. 2019; Xu et al. 2019), and root rot on carrot, *Coptis chinensis*, and wheat (Le Moullec-Rieu et al. 2020; Mei et al. 2021; Ozer et al. 2020). Recently, *F. avenaceum* was found causing fruit blotch in kiwi fruit in Anhui, China (Zhao et al. 2020). Here, *F. avenaceum* was found causing canker disease in kiwi tree, demonstrating the host and tissue promiscuity of this pathogen. Kiwi is an important crop in China with nearly 1.5 million metric tons produced in 2019. This report will help to better understand the pathogens reducing kiwi production in China.

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The author(s) declare no conflict of interest.

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