Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Fusarium incarnatum* Causing Fruit Rot of Litchi in China

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Litchi (*Litchi chinensis* Sonn.) is an indigenous tropical and subtropical fruit of southern China with an attractive appearance, delicious taste, and good nutritional value (Jiang et al. 2003). In March 2020, brown rots were observed on the nearly ripe litchi fruits (cv. Guihuaxiang) in an orchard of Lingshui county, Hainan province of China (18.615877° N, 109.948871° E). About 5% of fruits were symptomatic in the field, and the disease caused postharvest losses during storage. The initial infected fruits had no obvious symptoms on the outer pericarp surfaces, but there appeared irregular, brown to black-brown lesions on the inner pericarp surfaces at the pedicels. Then lesions expanded and caused brown rots. Small tissues (4 × 4 mm) of fruit pericarps were cut from symptomatic fruits, surface sterilized in 1% NaOCl for 3 min, rinsed in sterilized water three times, plated on potato dextrose agar (PDA) medium, and incubated at 28°C in the dark. Morphologically similar colonies were isolated from 85% of 20 samples after 4 days of incubation. Ten isolates were purified by the single-spore isolation method. The isolates grown on PDA had abundant, fluffy, whitish to yellowish aerial mycelia, and the reverse side of the Petri dish was pale brown. Morphological characteristics of conidia were further determined on carnation leaf-piece agar (Leslie and Summerell 2006). Macroconidia were straight to slightly curved, three- to five-septate, with a foot-shaped basal cell, tapered at the apex, 2.70 to 4.43 × 18.63 to 37.58 μm

(3.56 ± 0.36 × 28.68 ± 4.34 μm) (*n* = 100). Microconidia were fusoid to ovoid, zero- to one-septate, 2.10 to 3.57 × 8.18 to 18.20 μm (2.88 ± 0.34 × 11.71 ± 1.97 μm) (*n* = 100). Chlamydospores located in the hyphae singly or in chains were globose, subglobose, or ellipsoidal. Based on cultural features and morphological characteristics, the fungus was identified as *Fusarium* sp. (Leslie and Summerell 2006). To further confirm the pathogen, DNA was extracted from the 7-day-old aerial mycelia of three isolates (LZ-1, LZ-3, and LZ-5) (Chohan et al. 2019). The sequencing of the internal transcribed spacer region of rDNA (ITS), translation elongation factor-1 alpha (*tef1*) gene, and histone H3 (*his3*) gene were amplified using primers ITS1/ITS4, EF1-728F/EF1-986R, and CYLH3F/CYLH3R, respectively (Funnell-Harris et al. 2017). The nucleotide sequences were all deposited in GenBank (ITS: 515 bp, MW029882, 533 bp, MW092186, and 465 bp, MW092187; *tef1*: 292 bp, MW034437, 262 bp, MW159143, and 292 bp, MW159141; *his3*: 489 bp, MW034438, 477 bp, MW159142, and 474 bp, MW159140). The ITS, *tef1*, and *his3* genes showed 99 to 100% similarity with the ITS (MH979697), *tef1* (MH979698), and *his3* (MH979696) genes of *Fusarium incarnatum* (TG0520) from muskmelon fruit, respectively. The phylogenetic analysis of the *tef1* and *his3* gene sequences showed that the three isolates clustered with *F. incarnatum*. Pathogenicity tests were conducted by spraying the conidial suspension (1 × 10⁶ conidia/ml) on wounded young fruits in the orchard. Negative controls were sprayed with sterilized water. Fruits were bagged with polythene bags for 24 h and then unbagged for 10 days. Each treatment had 30 fruits. The inoculated fruits developed symptoms similar to those observed in the orchard and showed light brown on the outer pericarp surfaces with irregular brown to black-brown lesions on the inner pericarp surfaces, whereas the fruits of the negative control remained symptomless. The same fungus was successfully recovered from symptomatic fruits and completed Koch's postulates. *F. semitectum* (synonym: *F. incarnatum*) (Saha et al. 2005), *F. oxysporum* (Bashar et al. 2012), and *F. moniliforme* (Rashid et al. 2015) have been previously reported as pathogens causing litchi fruit rots in India and Bangladesh. To our knowledge, this is the first report of *F. incarnatum* causing litchi fruit rot in China.

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