Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Dragon Fruit (*Hylocereus undatus*) Stem Rot Caused by *Diaporthe ueckerae* in Taiwan

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Dragon fruit (*Hylocereus polyrhizus* and *H. undatus*) is a rapidly growing commodity in Taiwan. Production acreage has tripled since 2011, with an estimated over 2,800 ha in 2019. During a July 2020 disease survey, reddish-orange to blackish-brown lesions similar to stem canker caused by *Neoscytalidium dimidiatum* were observed on dragon fruit cladodes in two orchards in Central Taiwan. In the lab, diseased cladodes were surface disinfested with 70% ethanol for 15 to 30 s and blotted dry with a paper towel. Small pieces (~3 × 3 mm) of necrotic spots were excised, put on 2% water agar (WA) plates, and incubated with 12 h photoperiod at 28 ± 2°C for 3 days. Of the isolates from necrotic spots, 21 were *N. dimidiatum*, and 3 from other spots were unknown. Single hyphal tips of the three unknown fungal colonies with similar morphology were transferred on potato dextrose agar (PDA). Brownish- to grayish-white colonies with fluffy aerial mycelium were observed on PDA after 8 days of incubation. To induce sporulation, all the isolates were cultivated on autoclaved cowpea pods on 2% WA plates with 12 h photoperiod at 25 ± 2°C for 3 weeks. Black pycnidia embedded in cowpea tissues and creamy yellowish exudates with pycnidiospores extruding from the ostiole were observed. Alpha-conidia were aseptate, hyaline, smooth, ellipsoidal or fusiform, often biguttulate, and ~6.0 to 6.5 × 2.0 to 2.3 µm (*n* = 50 per isolate). Beta-conidia were not observed. Morphological characteristics resembled *Diaporthe* spp. described by Udayanga et al. (2015). For further identification, the internal transcribed spacer (ITS), β-tubulin (TUB), and translation elongation factor 1-α (EF1-α) regions were amplified using primer pairs ITS1/ITS4 (White et al. 1990), Bt2a/Bt2b (Glass and Donaldson 1995), and EF1-728F/

EF1-986R (Carbone and Kohn 1999), respectively. BLAST analysis of isolates CH0720-010 (ITS: OK067377; TUB: OK149767; EF1-α: OK149764), CH0720-013 (ITS: OK067378; TUB: OK149768; EF1-α: OK149765), and TC0720-016 (ITS: OK067379; TUB: OK149769; EF1-α: OK149766) showed 99.78 to 100% of ITS identity, 98.8 to 99.2% of TUB identity, and 100% of EF1-α identity with *Diaporthe ueckerae* (ITS: KY565426; TUB: KY569384; EF1-α: KY569388). Phylogenetic trees were constructed using concatenated ITS, TUB, and EF1-α sequences based on maximum likelihood with the HKY+G model, maximum parsimony, and Bayesian inference method in MEGA X and Geneious Prime 2020.2.4. All isolates were clustered in *D. ueckerae* with similar topology based on these methods, so the phylogram of maximum likelihood was presented. To confirm pathogenicity, detached dragon fruit (*H. polyrhizus* and *H. undatus*) cladodes (20- to 30-cm long) were surface disinfested, wounded with a sterilized syringe (~2-mm depth), and inoculated with mycelial plugs (6-mm diameter) from 5-day-old colonies on PDA. Each isolate had three mycelial plugs. PDA plugs without mycelium were inoculated as a negative control. Inoculated cladodes were incubated in a moisture chamber at 30 ± 2°C and a 12 h photoperiod. Two days after inoculation (DAI), plugs were removed, and symptom development was photographed every 2 days. The experiment was repeated twice. At 6 DAI, round to irregular, dark-brown, water-soaking lesions were observed on the cladodes of both species inoculated with the three *D. ueckerae* isolates, and all negative controls were asymptomatic. Morphologically identical fungi were reisolated from inoculated cladodes, fulfilling Koch's postulates. Several *Diaporthe* species have been reported infecting dragon fruit in southeastern Asian countries such as Thailand, Bangladesh, and Malaysia (Huda-Shakirah et al. 2021; Karim et al. 2019; Udayanga et al. 2012). To our knowledge, this is the first report of stem rot caused by *D. ueckerae* in Taiwan. Since the field symptoms may be easily confused with those caused by *N. dimidiatum*, the potential threat of *Diaporthe* species complex on dragon fruit should be raised and may warrant further study.

References:

- Carbone, I., and Kohn, L. M. 1999. Mycologia 91:553.
- Glass, N. L., and Donaldson, G. C. 1995. Appl. Environ. Microbiol. 61:1323.
- Huda-Shakirah, A. R., et al. 2021. Sci. Rep. 11:3907.
- Karim, M. M., et al. 2019. Indian Phytopathol. 72:545.
- Udayanga, D., et al. 2015. Fungal Biol. 119:383.
- Udayanga, D., et al. 2012. Fungal Divers. 56:157.
- White, T. J., et al. 1990. Page 315 in: PCR Protocols: A Guide to Methods and Applications. Academic Press, San Diego, CA.

The author(s) declare no conflict of interest.

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