Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Fusarium proliferatum* on Date Palm (*Phoenix dactylifera*) in Jordan

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Plant Dis. 105:4159, 2021; published online as <https://doi.org/10.1094/PDIS-06-20-1219-PDN>. Accepted for publication 14 June 2021.

Date palm (*Phoenix dactylifera* L.) is one of the world's oldest cultivated fruit crops. In Jordan, farming started in the 1990s; the major planting areas are Jordan Valley, Aqaba, and Azraq (Al Antary et al. 2015); and 'Medjool' and 'Barhi' are major cultivars. In early 2018, some 18- to 24-month-old Medjool trees showed light brownish discoloration and dryness on the leaves and branches of infected trees at the Jordan University Agricultural Research Station (JUARS) at the Jordan Valley (GPS 32.086871, 35.597219). All leaf parts including leaf base, spines, and leaflets were wrinkled and malformed. Infection led to a loss of 1 to 2% of 1,100 Medjool trees. Similar symptoms were observed in many date palm farms in the Jordan Valley. Diseased samples from rachis tissue at JUARS were collected, surface sterilized with 5% NaOCl for 5 min, rinsed with distilled water three times, dried, and plated on PDA. Plates were incubated at 25°C for 7 days. Then, different colonies were purified using the hyphal-tip method. Mycelium of representative isolate FpDP2018JO-01 was harvested, DNA extracted using the CTAB protocol (Doyle and Doyle 1990), and amplified with three primers: ITS1/4 (White et al. 1990), β -tubulin, and the elongation factor 1-alpha (EF1-alpha) gene regions. Amplicons were sequenced at Macrogen, South Korea. Sequences were edited via MEGA 7 (Kumar et al. 2016) and BLASTn (<https://www.ncbi.nlm.nih.gov/>) to search for similar accessions. Sequences were submitted to GenBank, and accession numbers were received for ITS1/4 (MK522076), β -tubulin (MK720958), and EF1-alpha (MW533146). The sequences were further used at the *Fusarium* MLST (<https://fusarium.mycobank.org/>) for identity confirmation. ITS1/4 and β -tubulin could not discriminate the species *Fusarium proliferatum*, but EF1-alpha could. For morphological identification, four representative *F. proliferatum* isolates (FpDP2018JO-01 to

FpDP2018JO-04) were used. Mycelium was white to dark purple in color, macroconidia (20.5 to 44.5 $\times$ 3.3 to 7.5 μ m) were thin, slender, with three to five septa, and microconidia (4.3 to 12.1 $\times$ 2.5 to 4.3 μ m) were thin and aseptate. Koch's postulates were performed on 1-year-old seedlings according to the method of Abdalla et al. (2000) using FpDP2018JO-01. Five plants were inoculated by injecting 2 ml of inoculum into the crown area using a hypodermic needle and syringe. Inoculum was prepared according to the method of Abdalla et al. (2000). The control seedlings ($n = 5$) were injected with sterile distilled water. The experiment was arranged in a completely randomized design. Symptoms were evaluated 3 months after inoculation. On seedlings, yellowing of leaflets, discoloration of spines and rachis, and dryness of leaves were observed. Controls showed no symptoms. Reisolation from the detached leaves and infected seedlings was conducted. *Fusarium* sp. was confirmed to be *F. proliferatum* based on microscopic characteristics. To our knowledge, this is the first record of *F. proliferatum* on date palm in Jordan; Medjool especially is an important cash crop. *Fusarium* spp. are important pathogens that could cause huge losses on date palm and other crops. In Jordan, the pathogen has been isolated from samples from six farms so far, but detailed studies have not been conducted. It would be of importance to survey date palm farms for fungal diseases, test their pathogenicity using several isolates, and characterize them for proper management strategies. *F. proliferatum* was isolated from roots and leaves of declining date palm trees from many regions of Saudi Arabia and caused symptoms similar to those of *F. oxysporum* f. sp. *albedinis*, the causal agent of Bayoud disease (Abdalla et al. 2000; Saleh et al. 2016). Not only that, but *F. proliferatum* was found to have the highest colonization abilities on date palm leaflets and is becoming a serious pathogen on date palm (Saleh et al. 2016).

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The author(s) declare no conflict of interest.

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Keywords: *Fusarium proliferatum*, date palm, Medjool, Jordan

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