Diseases Caused by Oomycetes

First Report of *Phytophthora* Root Rot Caused by *Phytophthora cryptogea* on Field-Grown Lettuce in California

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Plant Dis. 105:2257, 2021; published online as <https://doi.org/10.1094/PDIS-01-21-0076-PDN>. Accepted for publication 22 February 2021

In 2019, commercial field grown lettuce (*Lactuca sativa*) in Monterey County, CA, showed symptoms of a soilborne disease. Plants were stunted with chlorotic outer leaves. Outer leaves later wilted, turned brown, and collapsed. Taproots and small feeder roots were brown and decayed, but crowns were not necrotic. To test for pathogens, roots were surface sterilized in 0.001% NaOCl for 10 s and plated on corn meal agar (CMA) amended with 2 ml of 25% lactic acid/liter (LA-CMA), and CMA amended with pimaricin, ampicillin, rifampicin, and pentachloronitrobenzene (PARP) (Kannwischer et al. 1978). After 3 to 4 days, slow-growing, coenocytic, white fluffy mycelium emerged on PARP. No fungi were recovered on LA-CMA. Isolates grown on V8 medium and transferred to filtered (0.20-µm) soil extract solution (Erwin and Ribeiro 1996) developed sporangia that were pyriform, non-papillate, with rounded bases. Sporangiophores proliferated internally through empty sporangia. On CMA, isolates formed hyphal swellings but not oospores or chlamydospores. To test pathogenicity, inocula of two isolates were prepared separately by incubating colonized V8 medium plugs in filtered soil extract solution to induce formation of sporangia and zoospores. For each isolate, 2 ml of inoculum (1×10^3 zoospores/ml) were poured around the bases of 20 potted lettuce (cv. El Guapo) plants. Plants were then maintained for 6 h at 22 to 24°C in trays of water to create saturated soil conditions. Within 7 days, all inoculated plants were chlorotic, wilted, and had necrotic roots. Roots plated on PARP resulted in colonies that morphologically were identical to the original isolates. Control plants, inoculated with sterile water, developed no root or foliar symptoms. To confirm identification of the isolates, DNA was extracted from mycelium pre- and postinoculation and amplified

by PCR using the ITS1/ITS4 primers to amplify the internal transcribed spacer (ITS) region (White et al. 1990) and the COI primers to amplify the cytochrome c oxidase subunit (Robideau et al. 2011). The ITS locus from the preinoculation isolate (GenBank no. MW397014) matched *Phytophthora cryptogea* with 100% identity and with 657/657 base pairs, matching the isolate with sequence ID KF234765.1. From the postinoculation isolate (MW397015), the ITS sequence perfectly matched 639/639 base pairs of *P. cryptogea* (MK789592.1). The COI loci from both the preinoculation isolate (MW421635) and the postinoculation isolate (MW421636) matched *P. cryptogea* (MG817500.1) with 100% query cover and 100% identity with 525 and 526 bp matching *P. cryptogea*, respectively. Based on these molecular and morphological data, the isolates were identified as *P. cryptogea* Pethybr. & Laff. (Martin et al. 2014; Safaiefarahani et al. 2015). This is the first report of *P. cryptogea* infecting field-grown lettuce in California. Previously on lettuce, *P. cryptogea* was reported only on a hydroponic crop (Linde et al. 1990). This new detection of a *Phytophthora* disease on field-grown lettuce was found at two sites in the main part of the Salinas Valley, the main lettuce-producing region of the country. In addition to being a new potential problem on field-grown lettuce, the *Phytophthora* root rot symptoms are very similar to those of Pythium wilt disease caused by *Pythium uncinulatum* (Davis et al. 1995), which is already widespread in the Salinas Valley. Differentiating between these two oomycete diseases in the field will create a diagnostic challenge for growers and field personnel.

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The author(s) declare no conflict of interest.

Keywords: oomycetes, vegetables, etiology

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