Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Fusarium proliferatum* Causing Necrotic Leaf Lesions and Bulb Rot on Storage Onion (*Allium cepa*) in Southwestern Idaho

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In September 2014, a high rate of bulb rot (5 to 15% depending on producer) was reported across all cultivars developing early in the storage season in the onion-producing region of southwestern Idaho. Spanish yellow onion bulbs cultivar Vaquero displaying tan to light brown necrotic rot were obtained. The bulb rot originated in the neck and spread to successive scales. In August 2015, onion cultivars Redwing and Vaquero were observed to have wet necrotic lesions developing on leaves in the field. Margins of necrotic tissue, 1 to 2 cm³, were excised, surface sterilized, plated on water agar medium, and incubated at 24°C. Hyphal growth was subcultured from eight strains (A to D in 2014; E to H in 2015) to fresh potato dextrose agar to obtain pure cultures. Cultures were characteristic of *Fusarium* species as described by Nelson et al. (1983), with the presence of microconidia formed on polyphialides with macroconidia present. Primers ITS4-A1 and ITS5 (White et al. 1990); EF-1 and EF-2 (O'Donnell et al. 1998); and fRPB2-5F and fRPB2-7cR (Liu et al. 1999) were used to amplify regions of the internal transcribed spacer, elongation factor 1- α , and the second largest subunit of DNA-directed RNA polymerase II. Amplicons were sequenced and analyzed using BLAST (<https://www.ncbi.nlm.nih.gov/>) and in combination using Pairwise DNA Alignment and Polyphasic Identification (<http://wi.knaw.nl/Fusarium/DefaultInfo.aspx?Page=Home>), as described by O'Donnell et al. (2015). Analysis indicated that these strains are *Fusarium proliferatum*, which is part of the *F. fujikuroi* species complex (O'Donnell et al. 1998). Similarity (99.5%) was observed in pairwise analyses and the polyphasic

identification clustering to representative *F. proliferatum* strain NRRL 22944 and others. Sequences were submitted to GenBank, and registered accession numbers are found in the supplementary materials. To complete Koch's postulates, cultivar Vaquero onion bulbs were surface sterilized and injected with 3×10^5 microconidia into the shoulder of each bulb. Five bulbs were inoculated for each isolate, placed in a mesh bag, and incubated at 30°C in the dark. Five bulbs injected with sterile water and five noninoculated bulbs served as controls. After 14 days, each bulb was sliced vertically down the center and inspected for rot. All eight strains induced tan to light brown necrotic rot symptoms in each inoculated bulb. No symptoms were observed for the water-inoculated and the noninoculated onion bulbs. A fungus was isolated from the necrotic tissue and confirmed to be *F. proliferatum* as described above. Aliquots (10 μ l) containing 1×10^5 microconidia of *F. proliferatum* strains (C, E to H) were applied to leaves in triplicate on 12-week-old onion plants (cv. Vaquero) wounded with a 21-gauge needle. Water controls were included. Within 3 days, lesions with light chlorosis began to form and quickly spread on the leaves. A fungus was isolated and confirmed to be *F. proliferatum* as described above. This is the first extensive description and identification of *F. proliferatum* causing bulb rot in storage in Idaho (Mohan et al. 1997). In addition, this is the first report of the fungus causing leaf infection in the field. These findings confirm *F. proliferatum* as the causal agent of the high incidence of bulb rot observed in 2014 and 2015. This bulb rot continues to occur in southwestern Idaho, and because the pathogen can cause leaf infections growers are encouraged to be vigilant for both leaf lesions during the growing season and bulb rot in storage.

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