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First Evidence of a Binucleate *Rhizoctonia* as the Casual Agent of Dry Rot Canker of Sugar Beet in Nebraska

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Disease Notes

First Evidence of a Binucleate *Rhizoctonia* as the Causal Agent of Dry Rot Canker of Sugar Beet in Nebraska

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Sugar beet (*Beta vulgaris* L.) is the primary source of domestic sucrose in the United States. In 2011, a sugar beet field in Morrill County, NE, was noted with wilting and yellowing symptoms suggestive of Rhizoctonia root and crown rot (RRCR), an important disease of sugar beet primarily caused by *Rhizoctonia solani* anastomosis group 2-2 (4). While the foliar symptoms were consistent with RRCR, the symptoms on the root were not. Root symptoms consisted of localized, dry, sunken lesions covering brown spongy tissue penetrating deeply into taproots. The surface tissues of the cankers distinctively produced a series of concentric circles. These root symptoms are inconsistent with RRCR, but are suggestive of a rarely occurring disease known as dry rot canker (DRC). DRC was first identified from Utah in 1921 (1), and assumed at the time to be caused by an uncharacterized strain of *R. solani*. It has since been sporadically but empirically noted from most western sugar beet growing states (4), but little is known about the pathogen or disease due to its infrequent appearances. To investigate the etiology of this disease, necrotic lesion borders were excised from diseased taproots, surface disinfested in 1% (v/v) sodium hypochlorite for 90 s, rinsed with distilled water for 90 s, and after drying on sterile tissue paper, placed on half-strength potato dextrose agar (½PDA) and incubated at 25 to 27°C. After 24 to 36 h, *Rhizoctonia*-like fungal growth was readily observed emerging from tissue pieces. Resulting colonies were tan to light brown. The ITS region of the rDNA was amplified from 4 isolates obtained from 4 distinct lesions and roots using the ITS1 and ITS4 primers (3) with standard PCR conditions, and sequenced (GenBank KC842197 to KC842200). The ITS regions were 100% identical between the 4 isolates and 96% (E-value = 0.0) identical to binucleate *Rhizoctonia* and *Ceratobasidium* sp. AG-F (e.g.,

JF519832, FR734295, JF705217). Hyphal cells were observed to be binucleate after staining 48-h-old cultures with lactophenol blue. Therefore, these isolates were identified to be a binucleate *Rhizoctonia* group AG-F based on morphological and molecular characteristics. Although distinct from DRC, a similar phenomenon has been recently reported from China implicating binucleate *Rhizoctonia* species with seedling disease in sugar beets (2). To determine pathogenicity of DRC isolates, 1- and 2-month-old sugar beet plants grown in 10 cm pots (5 plants per pot with 4 replications per isolate) were inoculated with all 4 isolates by placing 3 mycelial plugs (8 mm diameter) taken from the leading edge of ½PDA plates onto the soil surface of each pot. PDA plugs were utilized as controls. After ~3 weeks, root lesions resembling DRC were observed and isolates were recovered and identified from diseased plants as described above. No symptoms developed on control plants. To our knowledge, this is the first formally confirmed report of DRC on sugar beets in more than 75 years from the Western Hemisphere. The original investigator suspected that the isolates he found inducing this disease were different from typical *R. solani* isolates based on different symptoms (1). Our results, based on different symptoms but also with distinct molecular, biological, and pathogenicity traits, validate those suspicions while also fulfilling Koch's postulates with binucleate Rhizoctonia AG-F pathogenic to sugar beet that is distinct from the more common *R. solani*.

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