Diseases Caused by Viruses

First Report of Cotton Leafroll Dwarf Virus in Cotton Plants Affected by Cotton Leafroll Dwarf Disease in North Carolina

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Plant Dis. 104:3275, 2020; published online as <https://doi.org/10.1094/PDIS-02-20-0335-PDN>. Accepted for publication 23 June 2020.

During the 2019 growing season, cotton (*Gossypium hirsutum* L.) plants in North Carolina were observed to have virus-like symptoms including leaf rugosity, leaf curling, and shortened upper internodes, consistent with cotton leafroll dwarf disease (CLRDD) associated with cotton leafroll dwarf virus (CLRDV, family *Luteoviridae*, genus *Polevirus*) (Avelar et al. 2020). Sentinel plots planted on June 17, 2019, at the Sandhills Research Station in Moore County, NC, exhibited CLRDD symptoms, and disease incidence was estimated at 75% on a 0.1-ha field. Cotton aphids (*Aphis gossypii* Glover), the reported vector of CLRDV (Heilsnis et al. 2020; McLaughlin et al. 2020; Michelotto and Busoli 2007), were detected on plants throughout the growing season. Samples ($n = 24$) were collected from sentinel plots on September 20, 2019, to test for CLRDV through reverse transcription PCR. Each sample represented five symptomatic plants collected from a single plot. Total RNA was extracted from the petiole tissue of each sample using a Qiagen RNeasy Plant Mini kit (Qiagen, Germantown, MD), following the manufacturer's recommendations. The cDNA was synthesized using a SuperScript IV first-strand synthesis system (ThermoFisher Scientific, Waltham, MA) and amplified with CLRDV-specific PCR primers CLR3675F/Pol3982R (Sharman et al. 2015) targeting a 310-bp genome segment of ORF3-5. Seven CLRDV-positive samples were further amplified with two additional primer sets specifically designed to detect CLRDV: AL674F/AL1407R

(Avelar et al. 2019), targeting a 733-bp portion of the ORF0-ORF1, and CLPOF/CLPOR (Cascardo et al. 2015), amplifying an 880-bp fragment spanning the ORF0. Nucleotide BLAST searches showed that the best matches for all sequences in this study were derived from CLRDV with a range of pairwise identity of 99.2 to 100% for all genome segments. From symptomatic samples ($n = 14$), the isolated virus was confirmed as CLRDV in several cotton varieties, including Deltapine 1646 B2XF (GenBank accessions MN958131 [ORF3-5], MN958147 [ORF0-ORF1], MN958138 [ORF0], MN958133 [ORF3-5], MN958145 [ORF0-ORF1], and MN958140 [ORF0]), Phytogen 480 W3FE (MN958134 [ORF3-5], MN958144 [ORF0-ORF1], and MN958141 [ORF0]), Stoneville 5471 GLTP (MN958135 [ORF3-5], MN958143 [ORF0-ORF1], and MN958142 [ORF0]), and Nextgen 5711 B3XF (MN958130 [ORF3-5], MN958148 [ORF0-ORF1], MN958137 [ORF0], MN958132 [ORF3-5], MN958146 [ORF0-ORF1], MN958139 [ORF0], and MN958136 [ORF3-5]). CLRDD is a newly named disease of cotton in the United States that was first reported in Alabama (Avelar et al. 2019), Georgia (Tabassum et al. 2019), Mississippi (Aboughanem-Sabanadzovic et al. 2019), and Texas (Alabi et al. 2020). Although the virus has been reported with variable impacts, losses can be extensive in some fields that are affected (Avelar et al. 2019). North Carolina produced over one million bales of cotton in 2019, and given reported losses among fields with high disease incidence, CLRDV has the potential to significantly reduce cotton yield and quality for the state if it becomes widespread.

References:

- Aboughanem-Sabanadzovic, N., et al. 2019. Plant Dis. 103:1798.
- Alabi, O. J., et al. 2020. Plant Dis. 104:998.
- Avelar, S., et al. 2019. Plant Dis. 103:592.
- Avelar, S., et al. 2020. Plant Dis. 104:780.
- Cascardo, R. S., et al. 2015. Virol. J. 12:123.
- Heilsnis, B., et al. 2020. Proc. Beltwide Cotton Conf., Austin, TX.
- McLaughlin, A. K., et al. 2020. Proc. Beltwide Cotton Conf., Austin, TX.
- Michelotto, M. D., and Busoli, A. C. 2007. Campinas 66:441.
- Sharman, M., et al. 2015. Australas. Plant Dis. Notes 10:24.
- Tabassum, A., et al. 2019. Plant Dis. 103:1803.

The author(s) declare no conflict of interest.

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Keywords: cotton leafroll dwarf virus, cotton, CLRDV, viruses and viroids

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