Diseases Caused by Viruses

First Report of Beet curly top virus Infecting Industrial Hemp (*Cannabis sativa*) in Arizona

Jiahuai Hu,^{1,†} Robert Masson,² and Laura Dickey¹

¹ School of Plant Sciences, University of Arizona, Tucson, AZ

² Yuma County Cooperative Extension, University of Arizona, Yuma, AZ

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Industrial hemp (*Cannabis sativa*) is an emerging crop in Arizona, with many uses, including fiber, cosmetic products, and health food. In 2020, severe curly top disease outbreaks were observed in several hemp fields in Yuma and Graham Counties, Arizona, where disease incidence and severity were considerably high, up to 100% crop loss occurring in some fields. A wide range of symptoms have been observed at different infection stages and plant growth stages at the time of infection. Early-stage symptoms manifest as light green-to-yellowing of new growth, similar to sulfur or micronutrient deficiency, usually combined with older leaves with dark green “blotchy” mosaic mottling overlaying light green chlorosis. Mosaic mottling of older leaves continues into mid-growth stage and is coupled with more severe yellowing and witch’s broom (stunted leaves and shortened internode length of stem) of apical meristematic tissue. Curling and twisting of new leaves have also been observed. Symptoms often appear to be isolated to individual branches, with other branches showing no visual symptoms, often outgrowing and covering affected branches until harvest. Late-stage symptoms include severe leaf curling with or without twisting, continued stunting, and necrosis of yellow leaves, resulting in significant yield reduction. Severely affected plants dwarfed by the virus experienced high mortality rates later into the season, most likely attributed to reduced ability to overcome abiotic stress conditions. These symptoms indicated the likelihood of curly top caused by beet curly top virus (BCTV), which has been recently reported in Colorado (Giladi et al. 2020). Shoots were collected from 38 symptomatic and nine asymptomatic hemp plants from July to August 2020. Leaves were also collected as a positive control

from four chili pepper plants with or without curly top symptoms in Cochise County. Genomic DNA was extracted using a DNeasy Plant Pro Kit (Qiagen, Valencia, CA) according to the manufacturer’s instructions. BCTV-specific primers BCTV1 and BCTV2 were used to detect BCTV following a method by Rondon (Rondon et al. 2016). A 500-bp DNA fragment, indicative of BCTV, was amplified from all symptomatic hemp and chili pepper samples but not from asymptomatic samples. Sequence analysis of this 500-bp DNA fragment revealed 98.99% identity with GenBank accession MK803280, which is a BCTV isolate from hemp identified in Western Colorado (Giladi et al. 2020). The full-length genomes of BCTV isolates from hemp and chili peppers were generated with additional primers 328F/945R (620 bp), 455F/945R (490 bp), OutR/2213F (1,190 bp), 2609R/1278R (1,340 bp), and BCTV2/2609R (1,890 bp) (Rondon et al. 2016; Strausbaugh et al. 2017). The complete nucleotide sequence (MW182244) from hemp was 2,929 bp and had 99.35% sequence identity with GenBank accession KX867055, which was a Worland strain of BCTV isolated from an Idaho sugar beet plant (Strausbaugh et al. 2017). Our hemp BCTV genome sequences shared 96.08% identity with the hemp strain of BCTV from Colorado (MK803280) and 99.50% identity with the BCTV isolate (MW188519) from chili pepper identified in this study. BCTV was reported on outdoor hemp in Western Colorado, in 2020 (Giladi et al. 2020). This is the first report of BCTV in Arizona causing curly top of industrial hemp in the field. In Arizona, BCTV is widespread on many agronomic crops including chili peppers and spread primarily by the phloem-feeding beet leafhoppers: *Circulifer tenellus* (Hemiptera: Cicadellidae) (Bennett 1967). Due to the wide distribution of beet leafhoppers and abundant range of host plants for the virus, BCTV may become one of the most yield-limiting factors affecting the emerging industrial hemp production systems in Arizona.

References:

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[†]Indicates the corresponding author.
E-mail: epp@email.arizona.edu (J.H.)