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Article in *Plant Disease* · February 2020

DOI: 10.1094/PDIS-11-19-2390-PDN

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Fig. S1 A. Leaf symptoms; vein clearing and mosaic symptoms on common bean (*Phaseolus vulgaris* L.) from which Southern bean mosaic virus (SBMV) was amplified.

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Fig. S1 B. Leaf symptoms; vein clearing and mosaic symptoms on common bean (*Phaseolus vulgaris* L.) from which Southern bean mosaic virus (SBMV) was amplified.

685x914mm (72 x 72 DPI)

First Report of *Southern bean mosaic virus* infecting common bean in Zambia

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Keywords: Common bean, viruses, *Southern bean mosaic virus*, *Sobemovirus*, Epidemiology, Virus diagnosis, high-throughput sequencing

Southern bean mosaic virus (SBMV, genus *Sobemovirus*) is one of the causative agents of mosaic and mottle diseases in common bean (*Phaseolus vulgaris*) (Tremaine and Hamilton 1983). The ~4.2 kb (+)ssRNA genome of SBMV is encapsidated in isometric virions of about 30 nm in diameter (Tremaine and Hamilton 1983). During surveys conducted in the Eastern Province of Zambia in April 2018, several common bean plants were observed with virus-like symptoms such as vein clearing, leaf rolling, mosaic, and leaf narrowing. Incidence of symptomatic plants across 20 fields ranged from 23-100% averaging 67.5%. A total of 121 symptomatic leaf samples were collected from 20 farmers' fields and preserved dry on silica gel. Sixteen samples were randomly selected and pooled into one sample (Mse-1) for total nucleic acid (TNA) extraction as described (Djami-Tchatchou and Straker 2012). The TNA was preserved in RNASTable (Biomatrica, Japan) and shipped to Inqaba Biotechnical Industries (Pretoria, South Africa) for high-throughput sequencing (HTS). HTS was achieved via cDNA synthesis and library construction with the Illumina TruSeq RNA Library Prep Kit (Illumina, San Diego, CA). The cDNA library was sequenced on the Illumina MiSeq platform, generating 4.1 million single raw reads of ~300 nucleotide (nt) each. *De novo* assembly of 188,160 virus-aligned reads and their subsequent use to query the GenBank with BLASTn resulted in the

detection of SBMV, *Bean common mosaic necrosis virus*, *Bean common mosaic virus*, *Cowpea aphid-borne mosaic virus* and *Cucumber mosaic virus* in the sample. To confirm SBMV occurrence and also validate the HTS results, a pair of virus-specific primers, SBMV-1F: 5'-AGCTGGATTTCCTACCTTTGTG and SBMV-1R: 5'-GGCGTCATCTCCGTTTATCTT was designed to amplify a 873 bp fragment encompassing 32 bp of the 5'UTR, a 492 bp movement protein (ORF1) and a 353 bp partial P2a gene (ORF2) of SBMV by RT-PCR. Each of the 121 samples was screened for SBMV along with the other four viruses (Ha et al. 2008; Niimi et al. 2003). Twenty-five of the 121 samples (20.7%) tested positive only for SBMV while the remaining 96 samples had different combinations of the other four viruses (data not shown). The SBMV-positive samples had mosaic and vein clearing symptoms (Fig. S1). The purified PCR products from three samples (EP-88, Mse-13 and Mse-17) were directly Sanger-sequenced and deposited in GenBank (MN653952-54). Pairwise distance analysis revealed that the three Sanger-derived sequences shared 81 to 100% nt identities with each other. The 4,100 bp long near complete genome of SBMV was independently Sanger-sequenced from sample Mse-13 (MN326873) and determined to encode all the four predicted ORFs of the virus. In pairwise comparisons, the Mse-13 sequence shared the highest (97.2 %) and least (89.3%) nt sequence identities with the resistance-breaking strain SBMV-B(ARK) (AF055887) from Arkansas and isolate TZ (MG344643) from Tanzania, respectively. SBMV has been previously reported in common bean in many countries across several continents (Verhoeven et al. 2003). However, to the best of our knowledge, this is the first report of SBMV infecting common bean in Zambia. The result adds to the repertoire of viruses circulating in farmers' fields in Zambia and further confirms the complexity of probable viruses contributing to suboptimal common bean yields in the country.

References

- Djami-Tchatchou, A. T., and Straker, C. J. 2012. S. AFR. J. Bot. 78:44, <https://doi.org/10.1016/j.sajb.2011.04.009>
- Ha, C. et al., 2008. Arch. Virol. 153:25
- Niimi, Y. et al., 2003. Scientia Horticulturae. 97:57
- Tremaine, J. G., and Hamilton, R. I. 1983. CMI/AAB descriptions of plant viruses no. 274. Kew, Surrey: Commonwealth Mycological Institute; and Association of Applied Biologists, Wellesbourne, Warwick, England; <http://www.dpvweb.net/dpv/showdpv.php?dpvno=274>
- Verhoeven J. Th. J. et al., 2003. Eur. J. Plant Pathol. 109:935