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DISEASE NOTES

First Report of '*Candidatus* Liberibacter solanacearum' Associated With the Psyllid *Bactericera trigonica* Hodkinson on Carrots in Northern Africa

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ABSTRACT

Carrot (*Daucus carota* L. var. Mascot) plants exhibiting symptoms of yellowing, purpling, and curling of leaves, proliferation of shoots, formation of hairy secondary roots, and plant decline were observed in March 2014 and February 2015 in commercial fields in the Gharb Region of Morocco. The symptoms resembled those caused by '*Candidatus* Liberibacter solanacearum' infections (Munyaneza et al. 2010; Tahzima et al. 2014). About 30% of the plants in each field were symptomatic and were infested with an important population of psyllids identified as *Bactericera trigonica* Hodkinson, reported here for the first time from Morocco (Ouvrard 2016). No other psyllid species have been observed in the field. Samplings were conducted to investigate whether '*Ca*. L. solanacearum' and the psyllid *B.*

trigonica were associated with the observed symptoms on carrot in Morocco. A total of 100 psyllids were collected from three fields. Total DNA was extracted from individual insects using the DNeasy Blood and Tissue kit (Qiagen, U.K.) and from plants using CTAB extraction method. DNA extracts were tested for '*Ca*. L. solanacearum' by PCR using specific primer pairs Lsof/OI2c (5′-GTCGAGCGCTTATTTTAATAGGA-3′/5′-GCCTCGCGACTTCGCAACCCAT-3′) and CL514F/R (5′-CTCTAAGATTTCGGTTGGTT-3′/5′-TATATCTATCGTTGCACCAG-3′) to amplify a partial fragment of the 16S rDNA and *rplJ/rplL* 50S rDNA ribosomal protein genes, respectively (Munyaneza et al. 2012). DNA samples from 35 psyllids out of 116 plants yielded specific bands; 1,168-bp for the 16S rDNA and 669-bp for rplJ/rplL. These results confirmed the presence of '*Ca*. L. solanacearum' in psyllids and carrot samples collected in the Gharb Region. DNA amplicons from psyllid populations (one population/field) for each primer pair were sequenced (Natural History Museum, U.K.). BLAST analysis of the consensus sequences for the 16S rDNA (GenBank accession nos. KX434610 and KX434611) showed 99% identity to '*Ca.* L. solanacearum' from Spain and Morocco (HQ454309 and KJ740160). The two consensus sequences for the 50S rDNA ribosomal protein (KX434608 and KX434609) showed 99% identity to '*Ca.* L. solanacearum' haplotype D from Spain and Canary Island, and 100% from Morocco (JX308305, HQ454321, and KJ754507, respectively). To our knowledge, this is the first report of '*Ca*. L. solanacearum' associated with its vector *B. trigonica* and carrot in Morocco and Africa. Like *Trioza apicalis* (Foerster) on carrot in northern Europe, *B. trigonica* has caused economic damages to carrot and celery crops in the Canary Islands and mainland Spain (Munyaneza et al. 2010). Another psyllid species, *B. cockerelli* (Šulc), has also caused millions of dollars in losses to potato and several other solanaceous crops in the United States, Central America, and New Zealand (Munyaneza et al. 2015). The presence of infested carrots and numerous economically important crops in Africa that serve as reservoirs of both '*Ca.* L. solanacearum' and this psyllid vector present a challenge in managing this disease and limiting the spread of the pathogen and vector.

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Citation