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Detection of "*Candidatus* Liberibacter solanacearum" in tomato on Norfolk Island, Australia

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Abstract
In June 2103, "*Candidatus* Liberibacter solanacearum" (CLso) (haplotype A) was detected in tomato plants (*Solanum lycopersicon*) with yellowing symptoms growing on Norfolk Island, non-self-governing external Australian Territory in the western Pacific Ocean. This appears to be only the second record, after New Zealand, of CLso haplotype A outside North America.

Keywords *Solanum lycopersicon* · haplotype A

"*Candidatus* Liberibacter solanacearum" (CLso) haplotypes A and B cause economically serious diseases in potato (zebra chip) and other solanaceous crops, including tomato and capsicum (bell pepper, chilli). The haplotype A of this pathogen was first reported from Mexico, and is now widely distributed elsewhere in Central America, as well as in the USA and New Zealand (Brown et al. 2016; Haapalainen 2014). Haplotypes C, D and E infect members of the *Apiaceae* and are found in Europe and the Mediterranean region (Alfaro-Fernández et al. 2017).Norfolk Island is a non-self-governing external Australian Territory, remotely located in the western Pacific Ocean almost equidistant between New Zealand and New Caledonia, and largely self-sufficient in fresh vegetable production. During quarantine surveys, small numbers of tomato plants (*Solanum lycopersicon*) with yellowing symptoms were noted in June 2013, and two samples (Accessions Q4978 and Q6005, Queensland Department of Agriculture and Fisheries Plant Virus and Bacteria Collection), both displaying interveinal chlorosis and upward leaf curling (Fig. 1), were collected in February 2014 for analysis. Simultaneously, small numbers of tomato-potato psyllid (*Bactericera cockerelli*), morphologically identified, were collected from yellow pan traps that were set for routine aphid surveillance (Anon. 2015). DNA extractions of plant tissue were done from freeze-dried tissue using the Bioline ISOLATE II Plant DNA kit. Both samples gave positive PCR amplifications with CLso-specific primers OI2C/OA2 (Liefting et al. 2009), with or without the generic nested primers Lib16S01F/ Lib16S01R (Beard et al. 2013), and also with the specific primers LP1611F/LP480R (Hansen et al. 2008). Sequencing of the former two PCR products from isolates Q4978 (GenBank MG589915) and Q6005 (GenBank MG589916) gave a consensus sequences of 1073 nt from the 16S rRNA gene. In BLASTn analysis, these were shown to share 100% identity with CLso isolate NZ08226 from tomato in New Zealand (EU834130) and nine other haplotype A CLso sequences from New Zealand and the USA. There were one to five nucleotide polymorphisms in this region compared with isolates of all other CLso haplotypes (B, C, D and E) examined.

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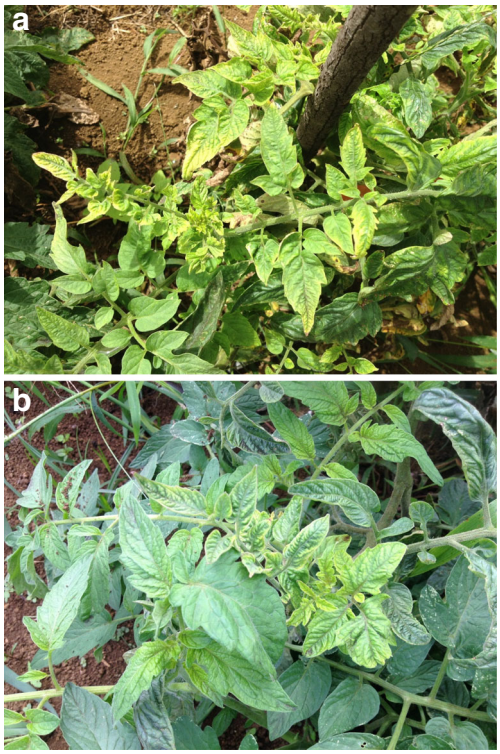

Fig. 1 Field tomato plants infected with **a** CLso isolate Q4895 and **b** isolate Q6005

This is the first record of CLso from Norfolk Island, an Australian off-shore territory, and to our knowledge, the first record of CLso haplotype A from outside North America and New Zealand.

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