

5.17 Identification of a New *Liberibacter* Species Associated with Diseases of Solanaceous Plants

Liefting L.W.¹, Sutherland P.W.², Ward L.I.¹, Weir B.S.¹, Kumarasinghe L.¹, Quinn B.D.¹, Clover G.R.G.¹

¹Plant Health and Environment Laboratory, MAF Biosecurity New Zealand, PO Box 2095, Auckland 1140, New Zealand; ²The Horticulture and Food Research Institute of New Zealand Ltd, Private Bag 92 169, Auckland 1142, New Zealand

In early 2008, a disease of glasshouse-grown tomato (*Solanum lycopersicum*) and pepper (*Capsicum annuum*) was observed in Auckland, New Zealand. Symptoms in tomato include spiky, chlorotic apical growth, general mottling of the leaves, curling of the midveins, overall stunting of the plants and in some cultivars, fruit deformation. In pepper, symptoms include chlorotic or pale green leaves, shortened internodes and overall stunting. Leaf cupping and sharp tapering of the leaf apex resulting in a spiky appearance may also occur in pepper. Extensive testing ruled out the presence of pathogenic fungi, culturable bacteria, viruses, viroids and phytoplasmas. The first breakthrough came when a phloem-limited bacterium-like organism (BLO) was observed in thin sections of symptomatic plant tissue by transmission electron microscopy. A range of universal and specific 16S rRNA PCR primers were used in different combinations on DNA extracted from healthy and symptomatic plants. Most of the primer combinations produced the same size fragments from both healthy and symptomatic plants. One of the primer combinations produced a unique product from symptomatic plants only. Sequence analysis of this PCR product revealed that it covered about two-thirds of the 16S rRNA gene and shared high identity with ‘*Candidatus Liberibacter*’ species (1). The remainder of the 16S rRNA gene was sequenced as well as the 16S/23S rRNA spacer region, and a 1.7-kb fragment of the *rplKAJL-rpoBC* operon. Phylogenetic analysis of these three genomic regions showed that the bacterium is clearly a member of the genus ‘*Candidatus Liberibacter*’ but is distinct from the currently described species and strains (Figure 1). Subsequently, with the development of a specific PCR diagnostic method, this new liberibacter was also detected in four additional solanaceous hosts, potato (*Solanum tuberosum*), tamarillo (*Solanum betaceum*), cape gooseberry (*Physalis peruviana*) (2, 3), and chilli (*Capsicum* sp.). Symptoms in potato resemble those of the “zebra chip” disease; a new disease of potato observed in Mexico, Guatemala, and the United States. The tubers have necrotic flecking and streaking that became marked when the potatoes are fried. Affected plants generally senesce early, the mean yield was approximately 60% less than expected, and harvested tubers have less dry matter. No symptoms have yet been observed in tamarillo, cape gooseberry, and chilli plants infected with the liberibacter. It is unknown if the symptoms in these hosts are seasonal, or if they act as symptomless reservoirs of the pathogen. The tomato/potato psyllid, *Bactericera cockerelli*, has been confirmed to be the vector of this new liberibacter species (unpublished data). *B. cockerelli* was first discovered in an Auckland glasshouse tomato crop in May 2006, and is now established throughout the North Island and the top half of the South Island of New Zealand. A national survey of glasshouse-grown tomato and pepper, and packhouse-stored potato tubers determined that the liberibacter follows the same distribution in New Zealand as *B. cockerelli*. This new liberibacter species of solanaceous plants has been named ‘*Candidatus Liberibacter solanacearum*’ (4).

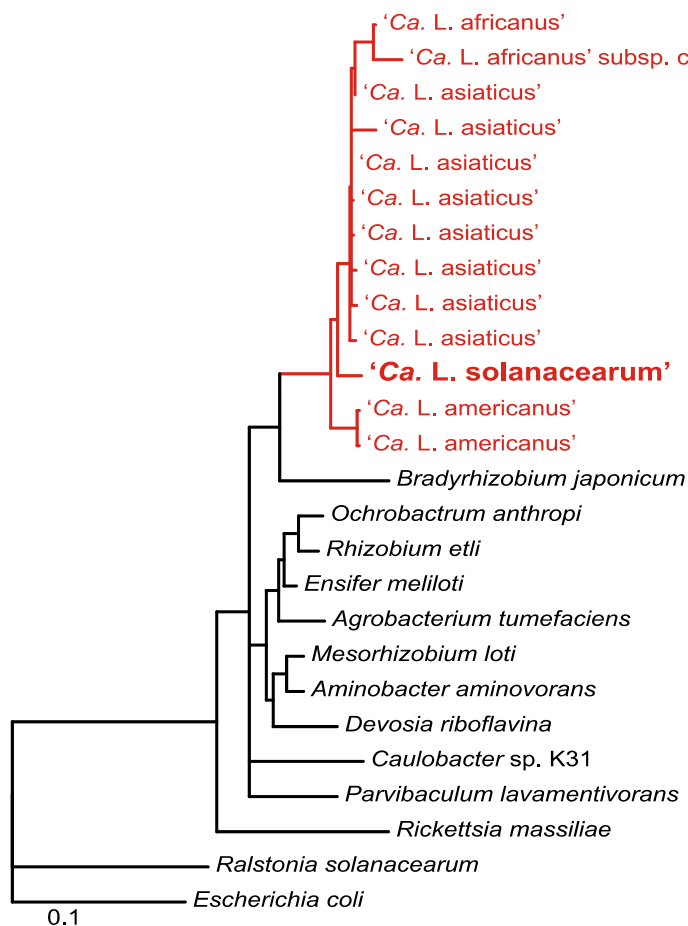


Figure 1. Phylogenetic tree based on 16S rRNA sequences showing the relationships of the four 'Candidatus Liberibacter' species (red font) and representatives of the alpha subdivision of the *Proteobacteria* (black font). *E. coli* was used as an outgroup.

Literature cited:

- Liefting LW, Sutherland PW, Ward LI, Paice KL, Weir BS, Clover GRG. 2009. A new 'Candidatus Liberibacter' species associated with diseases of solanaceous crops. *Plant Dis.* 93:208-214.
- Liefting LW, Perez-Egusquiz ZC, Clover GRG, Anderson JAD. 2008. A new 'Candidatus Liberibacter' species in *Solanum tuberosum* in New Zealand. *Plant Dis.* 92: 1474.
- Liefting LW, Ward LI, Shiller JB, Clover GRG. 2008. A new 'Candidatus Liberibacter' species in *Solanum betaceum* (tamarillo) and *Physalis peruviana* (cape gooseberry) in New Zealand. *Plant Dis.* 92: 1588.
- Liefting LW., Weir BS, Pennycook SR, Clover GRG. 2009. 'Candidatus Liberibacter solanacearum', a liberibacter associated with plants in the family Solanaceae. *Int. J. Syst. Evol. Microbiol.* (in press).