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# plant disease

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## Disease Notes

### First Report of the Detection of '*Candidatus Liberibacter*' Species in Zebra Chip Disease-Infected Potato Plants in the United States

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Zebra chip (ZC), an emerging disease causing economic losses to the potato chip industry, has been reported since the early 1990s in Central America and Mexico and in Texas during 2000 (4). ZC was subsequently found in Nebraska, Colorado, New Mexico, Arizona, Nevada, California, and Kansas (3). Severe losses to potato crops were reported in the last few years in Mexico, Guatemala, and Texas (4). Foliar symptoms include purple top, shortened internodes, small leaves, enlargement of the stems, swollen axillary buds, and aerial tubers. Chips made from infected tubers exhibit dark stripes that become markedly more visible upon frying, and hence, are unacceptable to manufacturers. Infected tubers may or may not produce plants when planted. The causal agent of ZC is not known and has been the subject of increased investigation. The pathogen is believed to be transmitted by the potato psyllid, *Bactericera cockerelli*, and the association of the vector with the disease is well documented (3). Following the report of a potential new liberibacter species in solanaceous crops in New Zealand, we sought to identify this liberibacter species in plants with symptoms of the ZC disease. Six potato plants (cv. Russet Norkota) exhibiting typical ZC symptoms were collected in Olton, TX in June of 2008. DNA was extracted from roots, stems, midribs, and petioles of the infected plants using a FastDNA Spin Kit and the FastPrep Instrument (Qbiogene, Inc., Carlsbad, CA). Negative controls from known healthy potato plants were included. PCR amplification was carried out with '*Candidatus L. asiaticus*' omp primers (1), 16S rDNA primers specific for '*Ca. L. asiaticus*', '*Ca. L. africanus*', and '*Ca. L. americanus*' (1), and 16S rDNA primers OAZ2 (*Ca. L. asiaticus* No. EU924120) and OAZ3 (*Ca. L. asiaticus* No. EU924121).

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(GenBank Accession No. EU834130) and OI2C (2). Amplicons from 12 samples were directly sequenced in both orientations (McLab, San Francisco CA). PCR amplifications using species-specific primers for the citrus huanglongbing liberibacter were negative. However, 1.1- and 1.8-kb amplicons were obtained with the OA2/OI2C and *omp* primers, respectively. The sequences for the rDNA were submitted to NCBI GenBank (Accession Nos. EU884128 and EU884129). BLASTN alignment of the 16S rDNA sequences obtained with primers OA2 and OI2c revealed 99.7% identity with a new species of 'Ca. Liberibacter' identified in New Zealand affecting potato (GenBank Accession No. EU849020) and tomato (GenBank Accession No. EU834130), 97% identity with 'Ca. L. asiaticus', and 94% with 'Ca. L. africanus' and 'Ca. L. americanus'. The neighbor-joining phylogenetic tree constructed using the 16S rDNA fragments delineated four clusters corresponding to each of the liberibacter species. These results confirm that 'Ca. Liberibacter' spp. DNA sequences were obtained from potatoes showing ZC-like symptoms, suggesting that a new species of this genus may be involved in causing ZC disease. To our knowledge, this is the first report of the detection of 'Ca. Liberibacter' spp. in potatoes showing ZC disease in the United States.

*References:* (1) C. Bastianel et al. *Appl. Environ. Microbiol.* 71:6473, 2005. (2) S. Jagoueix et al. *Mol. Cell. Probes* 10:43, 1996. (3) J. E. Munyaneza et al. *J. Econ. Entomol.* 100:656, 2007. (4) G. A. Secor and V. V. Rivera-Varas. *Rev. Latinoamericana de la Papa (suppl.)*1:1, 2004.

#### Cited by

##### **Assessments of the Edge Effect in Intensity of Potato Zebra Chip Disease**

F. Workneh, D. C. Henne, A. C. Childers, L. Paetzold, and C. M. Rush

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##### **Zebra chip-diseased potato tubers are characterized by increased levels of host phenolics, amino acids, and defense-related proteins**

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*Physiological and Molecular Plant Pathology* Apr 2012, Volume 78: 66-72

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##### **Identification and Location of Symbionts Associated with Potato Psyllid ( *Bactericera cockerelli* ) Lifestages**

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##### **Effect of 'Candidatus Liberibacter solanacearum' on Fitness of Its Insect Vector, *Bactericera cockerelli* (Hemiptera:**

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##### **Chemical Compounds Effective Against the Citrus Huanglongbing Bacterium 'Candidatus Liberibacter asiaticus' In Planta**

Muqing Zhang, Charles A. Powell, Lijuan Zhou, Zhenli He, Ed Stover, and Yongping Duan

*Phytopathology* Sep 2011, Volume 101, Number 9: 1097-1103

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##### **Diversity of Endosymbionts in the Potato Psyllid, *Bactericera cockerelli* (Hemiptera: Triozidae), Vector of Zebra Chip Disease of Potato**

Punya Nachappa, Julien Levy, Elizabeth Pierson, and Cecilia Tamborindeguy

*Current Microbiology* Feb 2011

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**'Candidatus Liberibacter europaeus' sp. nov. that is associated with and transmitted by the psyllid Cacopsylla pyri apparently behaves as an endophyte rather than a pathogen**

Noura Raddadi, Elena Gonella, Caterina Camerota, Alan Pizzinat, Rosemarie Tedeschi, Elena Crotti, Mauro Mandrioli, Piero Attilio Bianco, Daniele Daffonchio, and Alberto Alma  
*Environmental Microbiology* Feb 2011, Volume 13, Number 2: 414-426

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**Haplotypes of "Candidatus Liberibacter solanacearum" suggest long-standing separation**

Warrick R. Nelson, Tonja W. Fisher, and Joseph E. Munyaneza  
*European Journal of Plant Pathology* Jan 2011

[CrossRef](#)

**Association of "Candidatus Liberibacter solanacearum" with the Psyllid, *Trioza apicalis* (Hemiptera: Triozidae) in Europe**

Joseph E. Munyaneza, Tonja W. Fisher, Venkatesan G. Sengoda, Stephen F. Garczynski, Anne Nissinen, and Anne Lemmetty  
*Journal of Economic Entomology* Aug 2010, Volume 103, Number 4: 1060-1070

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**Genetic Diversity and Geographical Distribution of Phytoplasmas Associated with Potato Purple Top Disease in Mexico**

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**Screening Molecules for Control of Citrus Huanglongbing Using an Optimized Regeneration System for 'Candidatus Liberibacter asiaticus'-Infected Periwinkle (*Catharanthus roseus*) Cuttings**

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**Phenotypic and Etiological Differences Between Psyllid Yellows and Zebra Chip Diseases of Potato**

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*American Journal of Potato Research* Feb 2010, Volume 87, Number 1: 41-49

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**Detection, Distribution, and Genetic Variability of 'Candidatus Liberibacter' Species Associated with Zebra Complex Disease of Potato in North America**

A. Wen, I. Mallik, V. Y. Alvarado, J. S. Pasche, X. Wang, W. Li, L. Levy, H. Lin, H. B. Scholthof, T. E. Mirkov, C. M. Rush, and N. C. Gudmestad  
*Plant Disease* Nov 2009, Volume 93, Number 11: 1102-1115  
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**Seasonal Occurrence and Abundance of the Potato Psyllid, *Bactericera cockerelli*, in South Central Washington**

Joseph E. Munyaneza, James M. Crosslin, and Jeremy L. Buchman  
*American Journal of Potato Research* Nov 2009, Volume 86, Number 6: 513-518

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**Impact of Zebra Chip Disease on the Mineral Content of Potato Tubers**

Godfrey P. Miles, Jeremy L. Buchman, and Joseph E. Munyaneza  
*American Journal of Potato Research* Nov 2009, Volume 86, Number 6: 481-489

[CrossRef](#)**Multiplex real-time PCR for detection, identification and quantification of 'Candidatus Liberibacter solanacearum' in potato plants with zebra chip**

Wenbin Li, Jorge A. Abad, Ronald D. French-Monar, John Rascoe, Aimin Wen, Neil C. Gudmestad, Gary A. Secor, Inq-Ming Lee, Yongping Duan, and Laurene Levy

*Journal of Microbiological Methods* Jul 2009, Volume 78, Number 1: 59-65

[CrossRef](#)**Association of 'Candidatus Liberibacter solanacearum' with Zebra Chip Disease of Potato Established by Graft and Psyllid Transmission, Electron Microscopy, and PCR**

G. A. Secor, V. V. Rivera, J. A. Abad, I.-M. Lee, G. R. G. Clover, L. W. Liefiting, X. Li, and S. H. De Boer

*Plant Disease* Jun 2009, Volume 93, Number 6: 574-583

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**A New 'Candidatus Liberibacter' Species Associated with Diseases of Solanaceous Crops**

Lia W. Liefiting, Paul W. Sutherland, Lisa I. Ward, Kerry L. Paice, Bevan S. Weir, and Gerard R. G. Clover

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