IRCHLB - FRIDAY, MARCH 15, 2019

TIME	LOCATION	SESSION	EVENT	SPEAKER
1:50PM	Exhibit Hall B	IRCHLB-06b-06	Insight into the mechanism of the citrus Huanglongbing pathosystem and its implications in disease control	Wang, Nian
2:00PM	Exhibit Hall B	IRCHLB-6b-Panel Discussion	Molecular Plant Manipulations for the Future Panel Discussion	
2:30PM	Upper Concourse	Break	**Afternoon Break**	
2:55PM Concurrent Session-7a	Exhbit Hall A	**IRCHLB-13: Bacteriocides and Plant Defenses**	**Bacteriocides and Plant Defenses** - Moderators: John Hartung and Mike Irey	
3:00PM	Exhbit Hall A	IRCHLB-07a-01	Characterization of a novel virus-like RNA that accumulates to near rRNA levels in phloem and systemically infects all commercial varieties of citrus with limited or no symptoms for use as expression vector in anti-Huanglongbing management programs	Simon, Anne
3:10PM	Exhbit Hall A	IRCHLB-07a-02	Antisense Oligonucleotides Targeting HLB in its Vector and Host	Sandoval-Mojica, Andres
3:20PM	Exhbit Hall A	IRCHLB-07a-03	Use of dsRNA spray treatments to activate native citrus defenses and suppress Las metabolic activity	Strauss, Tina

IRCHLB - FRIDAY, MARCH 15, 2019

TIME	LOCATION	SESSION	EVENT	SPEAKER
3:30PM	Exhbit Hall A	IRCHLB-07a-04	Ca. Liberibacter asiaticus peroxiredoxin (LasBCP) suppresses oxylipin-mediated defense responses in citrus host, providing a potential target for chemical control of HLB	Jain, Mukesh
3:40PM	Exhbit Hall A	IRCHLB-07a-05	Molecular modeling and high throughput antimicrobial screening approaches to identify novel CLas inhibitors	Mandadi, Kranthi
3:50PM	Exhbit Hall A	IRCHLB-07a-06	HLB treatment: engineering of novel citrus innate immunity	Gupta, Goutam
4:00PM	Exhbit Hall A	IRCHLB-7a-Panel Discussion	Bacteriocides and Plant Defenses Panel Discussion	
2:55PM Concurrent Session-7b	Exhibit Hall B	**IRCHLB-14: Host Responses to Infection**	**Host Responses to Infection** - Moderators: Xuefeng Wang and Mike Roose	
3:00PM	Exhibit Hall B	IRCHLB-07b-01	Microbial Community Shifts Associated with Citrus Huanglongbing Severity	Ginnan, Nichole
3:10PM	Exhibit Hall B	IRCHLB-07b-02	Spatial Chemistry of Huanglongbing in Citrus	Roper, Caroline
3:20PM	Exhibit Hall B	IRCHLB-07b-03	Rootstock influences on tree health and growth in response to Candidatus Liberibacter asiaticus in grafted sweet orange trees	Bowman, Kim

IRCHLB - FRIDAY, MARCH 15, 2019				
TIME	**LOCATION**	**SESSION**	**EVENT**	**SPEAKER**
3:30PM	Exhibit Hall B	IRCHLB-07b-04	Rootstock influences leaf and root metabolic response to Candidatus Liberibacter asiaticus in grafted sweet orange trees	Albrecht, Ute
3:40PM	Exhibit Hall B	IRCHLB-07b-05	Responses of citrus scion and rootstock combinations to artificial inoculation with Candidatus Liberibacter asiaticus	Carvalho, Everton - IOCV-IRCHLB Scholarship Recipient
3:50PM	Exhibit Hall B	IRCHLB-07b-06	Off-flavor compounds in huanglongbing-affected orange juice and their mitigation using natural citrus non-volatile compounds	Baldwin, Elizabeth
4:00PM	Exhibit Hall B	IRCHLB-7b-Panel Discussion	Host Responses to Infection Panel Discussion	
4:30PM	Exhibit Hall C & D	Poster Session	**Poster Presentation Session**	See page 56 for poster titles
IRCHLB-11: Economics and Management IRCHLB-12: Molecular Plant Manipulations for the Future IRCHLB-13: Bacteriocides & Plant Defenses IRCHLB-14: Host Responses to Infection				
7:00PM	Raincross Ballroom	Meal	**IRCHLB Banquet** Entertainment by The Johnny Cash Tribute Show	

IRCHLB - SATURDAY, MARCH 16, 2019				
TIME	**LOCATION**	**SESSION**	**EVENT**	**SPEAKER**
8:00AM		Tour	**IOCV-IRCHLB Post-Conference Tour** Begins (Pick-up at Riverside Convention Center)	

KEYNOTE SPEAKER BIOGRAPHY'S

KEYNOTE SPEAKERS - SUNDAY, MARCH 10, 2019		
12:45PM	Raincross Ballroom	**Bryce Falk**: Viruses are your friends

Bryce Falk was born long ago in southern California. He attended Cal Poly SLO for his BS in Biological Sciences, and UC Berkeley for graduate school in Plant Pathology, receiving his PhD in 1978. He was a postdoc at UC Riverside with Professor Lewis G. Weathers from 1978 – 1980, where he first also had the privilege to work with Professor W. O. Dawson. He was an Assistant Professor at the University of Florida Everglades Research and Education Center from 1980 – 1985, and moved to the Department of Plant Pathology at UC Davis in 1985. His lab works mostly with plant viruses and more recently with insect-specific viruses.

KEYNOTE SPEAKERS - SUNDAY, MARCH 10, 2019

7:30PM	Raincross Ballroom	**Anne Simon**: Novel insights into RNA viruses revealed through examination of their genome's structure

Anne Simon received her BA in Biology from the University of California San Diego and her Ph.D. in Genetics from Indiana University. After two postdoctoral research positions at Indiana University and UCSD, she began her career as a faculty member at the University of Massachusetts Amherst working on RNA recombination and plant virus satellite RNAs. Thirteen years later, Dr. Simon moved to the Department of Cell Biology and Molecular Genetics at the University of Maryland College Park where she continues her research on virus replication, translation, and RNA structure/function of carmoviruses and umbraviruses currently funded by the NSF and USDA. She has published over 100 peer reviewed papers and is a frequent presenter at National and International meetings. Dr. Simon is the founder and director of the University of Maryland Virology Program and principal investigator on the program's NIAID T32 Training Grant. She has been a senior editor of the Journal of Virology for the past 12 years and served previously for 10 years as a senior editor for Virology and as Editor-in-Chief of Frontiers in Virology. Dr. Simon was the Plant Virus Councilor for the American Society of Virology and twice hosted the ASV Annual Meeting. In 2002, Dr. Simon received the Francki Prize for Distinguished research in Plant Virology. In 2014, she was elected a fellow of the American Academy of Microbiology and in 2018 was awarded the University of Maryland Distinguished Scholar Teaching Award.

7:20AM	Raincross Ballroom	**James Borneman**: Advances in Human Microbiome Research and How They Link to Diet and Agricultural Research

James Borneman is a Professor in the Department of Microbiology and Plant Pathology at UC Riverside. He has 24 years of experience developing and performing microbiome analyses in both agricultural and medical systems. One research area has involved the identification of a fungus (Dactylella oviparasitica) that dramatically reduces cyst nematode populations in soils cropped to members of the Brassicaceae, sugar beets, and soybeans. Current research is to develop cropping decision models that enable the creation and maintenance of soils that suppress cyst nematodes by managing indigenous populations of D. oviparasitica. Another research area has involved the identification of a bacterium (Lactobacillus johnsonii) that reduces systemic DNA damage in mice when it is orally administered. Current research is to determine if this bacterium will also reduce rates of cancers such as lymphoma.

KEYNOTE SPEAKERS - MONDAY, MARCH 11, 2019

12:45PM	Raincross Ballroom	**Tracy Kahn** and **Mikeal Roose**: Adventures with Citrus Germplasm

Tracy Kahn is the curator and Givaudan Citrus Variety Collection Endowed Chair for the University of California, Riverside (UCR) Citrus Variety Collection (http://www.citrusvariety.ucr). Tracy received her Bachelor's degree in Botany from the University of Michigan and her Ph.D. in Botany from the University of California – Riverside in 1987. In 2012, Tracy Kahn received the Award of Excellence from the California Citrus Industry for exceptional service to the California Citrus Industry. Tracy Kahn graduated from the California Agricultural Leadership Program in 2005. This intensive two-year leadership development course focuses on critical issues facing California agriculture, and leadership skills. Tracy Kahn and Mikeal Roose are co-principal investigators on a Citrus Research Board funded grant to conduct integrated citrus breeding and evaluation research for the California citrus industry. As part of her position in Botany and Plant Sciences at UCR, Tracy authors publications and provides presentations on commercial citrus varieties and citrus diversity for the industry and for the public. Tracy is also a member of the Department of Evolution, Ecology and Organismal Biology where she teaches the infamous ""Dirty 30"" (Biology 30), UCR's ""Human Reproduction and Sexual Behavior"" course two quarters a year for classes with an enrollment of up to 300 students per quarter."

Professor **Mikeal Roose** received his B.A. degree in Biology from Reed College (1973) and a Ph.D. in Genetics from UC Davis in 1979. He has been a UCR faculty member since 1982. He has authored more than 120 publications and served as Chair of the Department of Botany and Plant Sciences from 2010 to 2016. His research is focused on the genetics, genomics, breeding and evolution of crop plants, particularly citrus and asparagus. The citrus breeding program works to improve both rootstocks and scions. The program has released three rootstock varieties and eight scions, of which the most widely grown are Tango mandarin and Gold Nugget mandarin. His lab recently sequenced 30 citrus cultivars and developed SNP arrays that have been used to genetically characterize more than 1000 citrus varieties and several mapping populations for approximately 50,000 SNP loci. He is collaborating with other UCR faculty (Sue Wessler and Jason Stajich) to develop an improved reference genome of Fairchild mandarin using long-read sequencing, sequence from single pollen grains for haplotyping, and other new technologies. Research on HLB includes: 1) breeding for HLB tolerant rootstocks

and scions using conventional hybridization (with Kahn), 2) a study of citrus and CLas gene expression in infected trees (with Gupta and Stover), 3) application of SNP arrays to map resistance and tolerance in populations being exposed in the field in Florida (collaboration with Stover and Gmitter), 4) genetics of resistance from Eremocitrus and Microcitrus (with Ramadugu and others), and 5) application of CRISPR-CAS9 to develop tolerant or resistant citrus (with Wang and others).

KEYNOTE SPEAKERS - TUESDAY, MARCH 12, 2019		
7:20AM	Raincross Ballroom	**Norman Ellstrand**: Sex on the Kitchen Table

At age 4 **Norman Ellstrand's** parents helped him match a picture of a Scarlet Tanager to a living bird in the yard, starting his lifelong passion in biology. He earned a B.S. from the University of Illinois and a Ph.D. in evolutionary biology from the University of Texas at Austin (Ph.D. 1978). He now focuses on applied plant population genetics, specifically on the evolution of invasiveness in plants as well as the role of gene flow in the escape of engineered genes. He secretly wants to write a novel but has had fun doing science. Ellstrand's publication list is approaching 200, including two books. Ellstrand has presented his research to various audiences ranging from U. S. Congressional staff to Cuban biotechnologists. In recent decades, his primary undergraduate teaching effort has been non-majors courses because he believes that non-scientists should learn that science is important, interesting, and intuitive (and fun!). The 21 students who received a graduate degree under his guidance all have science-based careers in industry, the public sector, or academia. Norm's honors include a Fulbright Fellowship to Sweden and a Guggenheim Fellowship.

KEYNOTE SPEAKERS - WEDNESDAY, MARCH 13, 2019		
8:30AM	Exhibit Hall A & B	**Steve Lindow**: Detailed investigations of the interaction of the plant pathogen Xylella fastidiosa with host plants and insect vectors has revealed novel methods of disease control

A major focus of **Steve Lindow's** lab is the study of the ecology of epiphytic bacteria that colonize the surfaces of leaves and flowers. We study the release of bacteria from leaves into the air as well as factors determining the immigration of airborne bacteria to plants to better understand the metacommunity of bacteria surrounding plants, and thus the drivers of the composition of microbial communities on plant surfaces. Studies also focus on those features of epiphytic bacteria that make them uniquely capable of surviving in the stressful leaf surface habitat. Molecular genetic studies are being used to determine the contribution of particular traits such as the production of 3-indole acetic acid, biosurfactant production, N-acyl homoserine lactone quorum sensing signal molecules, and other factors to the epiphytic fitness of the plant pathogen Pseudomonas syringae, which also is an excellent leaf surface colonist. Global transcriptional analysis of this species under various conditions as well as while on leaves is being coupled with on-going high throughput transposon mutant sequencing-based methods to determine the contributions to epiphytic fitness and virulence by each of the genes in this pathogen. Another focus of the lab is the study of the interaction of the xylem-limited plant pathogenic bacterium Xylella fastidiosa with both grape as well as sharpshooter vectors. A focus of these studies has been to describe the fatty acid-based, cell density-dependent, gene regulatory system used by this pathogen to differentially control those traits required for plant virulence and insect transmission. Greenhouse and field studies have addressed the feasibility of controlling diseases caused by this bacterium by modulating such quorum sensing signals in plants. The induction of host resistance to X. fastidiosa in the presence of the beneficial bacterium Paraburkholderia phytofirmans is also actively being investigated.

KEYNOTE SPEAKERS - WEDNESDAY, MARCH 13, 2019

12:45PM	Raincross Ballroom	**Robert Turgeon**: Home sweet home: CLas in the phloem

Robert Turgeon was born in Toronto, Ontario and attended the University of New Brunswick (BSc, 1969) and Carleton University (PhD; 1973) in Ottawa, Ontario. Following a post-doctoral position at The Rockefeller University in New York City, he joined the faculty of the University of Dayton in 1977 and Cornell University in 1981. He is currently Professor of Plant Biology and a Faculty Fellow of Cornell's Atkinson Center for Sustainable Development. His expertise is in plant physiology, plant molecular biology and light- and electron-microscopy. During his career, he has focused primarily on different aspects of phloem transport, especially phloem loading in leaves, and also on leaf development, synthesis of the flowering regulator, C4 photosynthesis, virus transport, plasmodesmatal biology, crop yield and, lately, the citrus greening disease. In 2013, he was awarded the Charles Reid Barnes Award, the lifetime achievement award from the American Society of Plant Biologists.

8:00PM	Raincross Ballroom	**Vivian Irish**: Engineering citrus using recent advances in gene editing technologies

Vivian Irish is Professor and Chair of Molecular, Cellular and Developmental Biology, and Professor of Ecology and Evolutionary Biology, at Yale University. As a graduate student at Harvard University she focused on characterizing the developmental genetic mechanisms specifying dorsal-ventral polarity in Drosophila. She continued to pursue these interests in developmental patterning processes as a Jane Coffin Childs postdoctoral fellow at the University of Cambridge with Michael Akam. As a National Science Foundation postdoctoral fellow at Yale University with Ian Sussex, she turned her attention to exploring patterning processes in plants. Now a faculty member at Yale, her research centers on a dissection of plant organogenesis and plant development. Using a variety of molecular, biochemical, genetic and quantitative approaches, her group is investigating Arabidopsis flower development. The Irish group is also developing biotechnological approaches to manipulating Citrus, one of the economically most important fruit crops in the U.S. In addition to being Chair, Irish has held a several other administrative roles at Yale, including Director of Undergraduate Studies in Biology (2001-2006), overseeing the progress of approximately 300 majors each year. She is also a past-president of the Society for Developmental Biology (2012-13) and was a visiting professor at the École Normale Supérieure, Lyon, France (2011).

KEYNOTE SPEAKERS - THURSDAY, MARCH 14, 2019

8:00AM	Raincross Ballroom	**Bruce Hay**: Gene drive, psyllids, and HLB: Are we in the tunnel yet?

Bruce A. Hay has been a professor of Biology and Biological Engineering at Caltech since 1996. His lab works on a number of topics, including cell death and neurodegeneration, mitochondrial DNA quality control, vectored approaches to population control of wild and feral mammals, and transgene-based methods of manipulating the fate and composition of wild insect populations. With respect to this last topic lab goals are to engineer the genetics of invasive or pest insect populations so that they drive themselves to local extinction, and/or to drive genes into populations (population replacement/alteration) such that all individuals express a beneficial trait of interest. His lab developed the first synthetic selfish genetic element/gene drive method (Medea elements in Drosophila) in any organism able to spread itself and linked cargo genes into a population, in 2007. They have continued over subsequent years to develop gene drive approaches for both local and reversible, and more global approaches to manipulating populations. Despite having fallen into the gene drive rabbit hole more than a decade ago, the lab perseveres in its efforts to build something useful.

1:15PM	Raincross Ballroom	**Robert Jackson**: Approaches for using biocontrol agents to control bacterial diseases and aphid pests

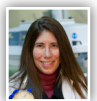
Robert Jackson is a Professor in the School of Biological Sciences at the University of Reading and is currently the Head of School of Biological Sciences. He has more than 25 years' experience working on plant pathology problems. He studied plasmids and type III secretion for his PhD research, discovering a major bacterial pathogenicity gene that can epistatically suppress the effects of avirulence effectors. Since then, his research topics include the study of bacterial pathogenesis, most recently in tree pathology studying Horse Chestnut, Oak and Cherry; gene regulation and regulatory networks in plant growth-promoting bacteria; the role of surfactants in bacterial motility and biocontrol; the identification and characterisation of bacteriophage for biocontrol; microbiome analyses of invasive alien plant species; and analysis of how bacteria can kill aphids. He collaborates widely in both the UK and globally, and has delivered teaching and research seminars in diverse locations abroad. He has previously served as an elected board member for the British Society for Plant Pathology in 2010-2013 and was involved in developing the Outreach Officer role for the society. He has joined the board again in 2019 as Publicity Champion. He is also a member of the American Phytopathology Society and served as Senior Editor for Phytopathology between 2012-2014. He has served as a Senior Editor for Molecular Plant Pathology since 2015. He currently sits on the Action Oak Research & Monitoring sub-committee and he is an Adjunct Professor at the University of Akureyri, Iceland.

KEYNOTE SPEAKERS - FRIDAY, MARCH 15, 2019

8:00AM	Raincross Ballroom	**Bruce Babcock**: What's an Orange Worth? The Value of Saving Citrus from HLB

Bruce Babcock is an agricultural economist and professor in the School of Public Policy at the University of California where he teaches courses in economics and public policy and conducts research on the economics of citrus in California. His research expertise includes understanding how price and production risk impacts grower decisions and the impacts of food and agricultural policies on growers, consumers, and taxpayers. He has developed innovative decision models to better understand how information, risk, and grower objectives impact adoption of technologies and farm input decisions. Professor Babcock is a Fellow of the Agricultural and Applied Economics Association. His research and outreach efforts led to several invitations from Congressional committees to provide testimony regarding the impacts of policy on the agricultural and biofuels sectors. Before joining UC Riverside, he was a Professor of Economics at Iowa State University where he directed the Center for Agricultural and Rural Development from 1998 to 2011 and the Biobased Industry Center from 2012 to 2017. Professor Babcock received his PhD in Agricultural and Resource Economics from UC Berkeley and MS and BS degrees from UC Davis.

12:15PM	Raincross Ballroom	**Ellen Jorgensen**: Biohacking and Other Disruptive Trends



Ellen Jorgensen is Chief Science Officer at Carverr Inc., a biotech start up in Brooklyn, New York that has a platform for encoding information into DNA. In 2017, Fast Company magazine named her one of their Most Creative Leaders in Business. She holds a Ph.D. in Cell & Molecular Biology from New York University, spent over 30 years in the biotechnology industry, and is currently adjunct faculty at The Cooper Union. Dr. Jorgensen is passionate about increasing science literacy in both student and adult populations, particularly in the areas of molecular and synthetic biology. In 2009 she co-founded Genspace, a community biolab in Brooklyn that was named one of the World's Top 10 Innovative Companies in Education. She is a SynbioLEAP fellow, an alumni of the Amsterdam School of Creative Leadership THNK, and a member of the GP-write consortium to construct a human genome. She recently founded the nonprofit Biotech Without Borders to help provide access to biotech education to all. Her TED talks, "Biohacking: You Can Do It Too" and "What You Need to Know About CRISPR" have each had over a million views.

IOCV - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IOCV-01: IOCV History and Citrus Programs		
IOCV-P1-01	Finding an alternative to CF-11 cellulose for dsRNA and viroid extraction in citrus	Rodriguez, Esteban
IOCV-P1-02	Import of Citrus into the European Union: a French quarantine to control the health risks	Calado, Grégory
IOCV-P1-03	Propagation System of Virus-free Citrus Nursery Tree in Guangxi, P. R. China	Deng, Chongling
IOCV-P1-04	Streamlining Citrus Clonal Protection Program (CCPP) citrus diagnostics using multiplex qPCR	Osman, Fatima
IOCV-P1-05	The Texas certified virus-free budwood program – 20 years on	Da Graça, John
IOCV-02: De novo Discovery of Citrus Viruses		
IOCV-P2-06	Molecular characterization of a novel citrivirus infecting citrus using next-generation sequencing	Cao, Mengji
IOCV-P2-07	Studies on a novel virus-like disease affecting pummelo in Hawaii	Olmedo-Velarde, Alejandro

IOCV - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IOCV-03: Citrus Leprosis		
IOCV-P3-08	Citrus leprosis virus C in the Americas: an insight into the genetic diversity of its population	Chabi-Jesus, Camila - IOCV-IRCHLB Scholarship Recipient
IOCV-P3-9	Development and validation of molecular assays for detection of Citrus leprosis viruses	Wei, Gang
IOCV-P3-10	Prospecting of genes related to the RNAi pathway in Brevipalpus yothersi, a vector of citrus leprosis virus C	Novelli, Valdenice
IOCV-04: Citrus Viroids		
IOCV-P4-11	Detection and Mechanical Transmission of Citrus Bent Leaf Viroid From Citrus Varieties in Malaysia	Iftikhar, Yasir
IOCV-P4-12	Transcriptome sequencing reveals novel Citrus bark cracking viroid (CBCVd) variants from citrus and their molecular characterization	Cao, Mengji
IOCV-05: Citrus Tristeza		
IOCV-P5-13	A survey of Citrus tristeza virus RB strainin Gannan district of Jiangxi province, China	Huang, Aijun and Yi, Long
IOCV-P5-14	Aggressiveness and genetic diversity of the Citrus tristeza virus population in single Uruguayan isolates segregated after single aphid transmission	Hernández-Rodríguez, Lester - IOCV-IRCHLB Scholarship Recipient

IOCV - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IOCV-05: Citrus Tristeza (Continued)		
IOCV-P5-15	Applying Citrus tristeza virus clones to understand stem pitting development in citrus	Aldrich, Dirk - IOCV-IRCHLB Scholarship Recipient
IOCV-P5-16	Biological characterization of the first RB (resistance breaking) isolate of citrus tristeza virus identified in Uruguay	Rubio, Leticia
IOCV-P5-17	Molecular characterisation of aphid vectors associated with Citrus tristeza virus–infected sweet oranges in Nigeria	Essien, Idara - IOCV-IRCHLB Scholarship Recipient
IOCV-P5-18	Overexpression of miR171b and pre-ctr-miR171b-based artificial microRNA targeting the CTV p23 gene confers stable CTV resistance in Citrus maxima	Zhong, Yun
IOCV-P5-19	Variation of Citrus tristeza virus genotype after sweet orange chip-budding on Mexican lime, and possible role of genotype T30 in virus transmission by Aphis gossypii	Besoain, Ximena
IOCV-P5-20	Wide segregation of Stem Pitting and other CTV symptoms in a hybrid population derived from West Indian lime	Smith, Malcolm

IOCV - POSTER PRESENTATIONS		
POSTER NUMBER	TITLE	PRESENTER
IOCV-06: Citrus Yellow Vein Clearing		
IOCV-P6-21	Development of a sensitive and reliable reverse transcription-droplet digital PCR assay for the detection of Citrus yellow vein clearing virus	Wang, Qin
IOCV-07: Other Citrus Viruses and Diagnostics		
IOCV-P7-22	Coat protein and movement protein of Citrus tatter leaf virus possess RNA silencing suppression activity to suppress host antiviral RNA silencing	Tan, Shih-hua
IOCV-P7-23	Complete genome sequences and recombination analysis of two citrus mosaic virus isolates	Cao, Mengji
IOCV-P7-24	Development of new tools for on-site detection of Spiroplasma citri, causal agent of citrus stubborn disease	Drais, Mounira Inas - IOCV-IRCHLB Scholarship Recipient
IOCV-P7-25	Diagnosis of citrus psorosis by real time RT-PCR in Argentina	Simeone, Melina
IOCV-P7-26	Incidence of the "Psorosis complex" diseases in seed source mother trees in Northwestern Argentina	Figueroa, Julia
IOCV-P7-27	Molecular identification and characterization of Citrus psorosis virus in China	Cao, Mengji
IOCV-P7-28	Use of young plants (mini-plants) for biological indexing for citrus graft transmissible pathogens	Lee, Richard

IOCV - POSTER PRESENTATIONS		
POSTER NUMBER	TITLE	PRESENTER
IOCV-08: Topics in Citrus Pathology		
IOCV-P8-29	Leaf and fruit reactions of sweet orange and hybrids varieties under endemic conditions of citrus canker	de Carvalho, Sérgio Alves
IOCV-P8-30	Prevalence of citrus viruses and viroids: a snapshot of the Uruguayan citrus industry	Benítez-Galeano, María José - IOCV-IRCHLB Scholarship Recipient
IOCV-P8-31	Serological-and-molecular-based detection of graft-transmissible pathogens associated with citrus from non-core areas of Pakistan	Naqvi, Syed

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-01: Pathogen Genome Analysis		
IRCHLB-P1- 01	A new genomic organization for prophages SC1 and SC2-like in Candidatus Liberibacter asiaticus from Brazil	Silva, Priscila
IRCHLB-P1- 02	C2-like repressor may be involved in the Candidatus Liberibacter asiaticus SC1 bacteriophage regulation	Munoz-Bodnar, Alejandra
IRCHLB-P1- 03	Contextualization of CLas Expression Data using Metabolic Models to Obtain a Deeper Understanding of HLB Pathology	Peacock, Beth
IRCHLB-02: Cultural Control		
IRCHLB-P2-04	Anaerobic soil disinfestation impacts the soil microbiome and growth of citrus trees infected with Candidatus Liberibacter asiaticus	McCollum, Greg
IRCHLB-P2-05	Assessing CLas viability to determine the efficacy of steam-generated thermotherapy	Thapa, Naweena - IOCV-IRCHLB Scholarship Recipient
IRCHLB-P2-06	Benefits of biochar on HLB-affected citrus in sandy soils	Strauss, Sarah
IRCHLB-P2-07	Can negative effects of HLB be mitigated by calcium and magnesium fertilizations in citrus trees?	Mattos Jr., Dirceu
IRCHLB-P2-08	Citrus nutrient uptake, biomass accumulation and root density patterns as influenced by citrus greening and regulated deficit irrigation under greenhouse conditions	Kadyampakeni, Davie
IRCHLB-P2-09	Development of a predictive screening process including field assessment for identification of potential commercial therapies for HLB	Manker, Denise

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-02: Cultural Control		
IRCHLB-P2-10	Droplet deposition and control efficacy of pyriproxyfen sprayed with an unmanned aerial vehicle against citrus psyllid Diaphorina citri	Cui, Li
IRCHLB-P2-11	Effect of soil and irrigation water pH on physiology of Huanglongbing-affected sweet oranges	Vashisth, Tripti
IRCHLB-P2-12	Effects of Huanglongbing Disease on Mature Fruit Detachment Force and Expression of Genes Related to Fruit Abscission in 'Valencia' Sweet Orange	Vashisth, Tripti
IRCHLB-P2-13	Field evaluation of integrated management for mitigating citrus huanglongbing in Florida	Powell, Charles
IRCHLB-P2-14	Flush Phenology Manipulation by Naphthalene Acetic Acid and Gibberellic Acid Application in Sweet Orange (Citrus sinensis L. Osbeck).	Li, Sheng-yang
IRCHLB-P2-15	Fruit quality of orange trees, cultivar Valencia, infected with HLB submitted to different nutritional treatments	Creste, Andre
IRCHLB-P2-16	Getting Out of the HLB Jar of Pickles – A Texas Model	Skaria, Mani
IRCHLB-P2-17	HLB differential response of 'Valencia' sweet orange grafted on several citrus rootstocks in a endemic area	Stuchi, Eduardo
IRCHLB-P2-18	Huanglongbing severity and AUDPC in mandarin genotypes grafted onto three rootstocks and grown under field conditions in Isabela, Puerto Rico	de Jensen, Consuelo
IRCHLB-P2-19	Molecular Therapy Targets for Huanglongbing	Li, Hong

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-02: Cultural Control (Continued)		
IRCHLB-P2-20	Nutrition programs featuring soil-applied controlled release fertilizer (CRF) containing enhanced micronutrient packages can reduce CLas populations and improve the health, growth and productivity of HLB-infected trees	Grosser, Jude
IRCHLB-P2-21	Phenology driven management: a useful tool for citrus management in the tropics.	Castillo, Andres
IRCHLB-P2-22	Physiological effects of oak bioactive compounds on Florida citrus when applied to contain and suppress HLB disease	Pitino, Marco
IRCHLB-P2-23	Protecting the UCR Citrus Variety Collection from the citrus disease Huanglongbing.	Kahn, Tracy
IRCHLB-P2-24	The effects of N-acetylcysteine on oxidative stress of sweet orange plants infected with Candidatus Liberibacter asiaticus	Bergamo, Henrique
IRCHLB-P2-25	TsnRNA-IIIb reduces citrus apical shoot growth and overall canopy size. Can it help citrus growers in the HLB management?	Lavagi, Irene
IRCHLB-P2-26	Use of Engineered Solar Energy Thermotherapy to Treat HLB Infected Citrus Trees	Aiken, Geoff
IRCHLB-03: Vector Function		
IRCHLB-P3-27	Citrus hosts drive the genetic differentiation of Diaphorina citri Kuwayama (Hemiptera: Liviidae) in China	Zhang, Zhen-yu and Yao, Zhichao
IRCHLB-P3-28	DcitOBP3 may work as a potential essential olfactory protein in the volatile recognition system of psyllid-citrus	Yao, Runxian - IOCV-IRCHLB Scholarship Recipient

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-03: Vector Function (Continued)		
IRCHLB-P3-29	Differential expression analysis and validation of lncRNA between Asian citrus psyllid and Candidatus Liberibacter interaction	Xiao, Huamei
IRCHLB-P3-30	Effect of host switch between Murraya and citrus plants on acquisition and transmission of huanglongbing (citrus greening) bacterium by the Asian citrus psyllid Diaphorina citri	Ammar, El-Desouky
IRCHLB-P3-31	Hot Spot Cluster Analysis of Asian Citrus Psyllid Samples in Texas and California	Bartels, David
IRCHLB-P3-32	Impact of Candidatus Liberibacter asiaticus on Adaptability of Asian Citrus Psyllid (Diaphorina citri Kuwayana)	Ran, Chun
IRCHLB-P3-33	Interactive digital video animation promotes accessibility of complex ACP anatomy to cytological and molecular audiences in pursuit of solving the citrus greening problem	Cicero, Joseph
IRCHLB-P3-34	Localization of Candidatus Liberibacter asiaticus in Diaphorina citri at the ultrastructural level	Levy, Amit
IRCHLB-P3-35	Lower reproduction rates of Diaphorina citri on 'Tahiti' acid lime than 'Valencia' sweet orange	Lopes, Silvio
IRCHLB-P3-36	Peptidomics-driven insights into Diaphorina citri physiology and response to 'Candidatus Liberibacter asiaticus'.	Fleites, Laura
IRCHLB-P3-37	Phylogeography of Diaphorina citri and its primary endosymbiont, 'Candidatus Carsonella ruddii' : an evolutionary approach to host-endosymbiont interaction	Cen, Yijing
IRCHLB-P3-38	Effect of agriculturally common metals on Asian citrus psyllid sheath morphology and transmission of Candidatus Liberibacter asiaticus	Heck, Michelle

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-04: Pathogen Detection and Culturing		
IRCHLB-P4-39	A new real-time PCR method for the detection of Candidatus Liberibacter africanus (CLaf) in citrus root tissue	Kunta, Madhurababu
IRCHLB-P4-40	Antibody-based detection of Huanglongbing (HLB)-associated pathogen	De Francesco, Agustina
IRCHLB-P4-41	Biochemical characterization of Liberibacter crescens lipopolysaccharide (LPS)	Jain, Mukesh
IRCHLB-P4-42	Closer to a culture: creation of a minimal media in Liberibacter crescens reveals essential growth requirements	Triplett, Eric
IRCHLB-P4-43	Detection of huanglongbing (HLB)-associated bacterium, Candidatus Liberibacter asiaticus (CLas) in citrus seedlings	Choi, Cheol
IRCHLB-P4-44	Developing strategies and protocols for efficient testing of field trees for HLB	Polek, MaryLou
IRCHLB-P4-45	Development of a tandem repeat-based polymerase chain displacement reaction method for sensitive detection of 'Candidatus Liberibacter asiaticus'	Lou, Binghai
IRCHLB-P4-46	Development specific markers for Psy62, Gxpsy and Ishi-1 strains huanglongbing (HLB)-associated bacterium Candidatus Liberibacter asiaticus.	Choi, Cheol
IRCHLB-P4-47	Duplex droplet digital PCR for detection of Candidatus Liberibacter asiaticus using 16S rRNA and ribonucleotide reductase genes	Yokomi, Raymond
IRCHLB-P4-48	Enhancing PCR capacity in early detection of "Candidatus Liberibacter asiaticus" utilizing whole genome sequence information	Bao, Minli

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-P4-49	Evidence for natural transformation in Liberibacter crescens strain BT-1	Gabriel, Dean
IRCHLB-P4-50	How early is "early detection"?	McCollum, Greg
IRCHLB-P4-51	Isolation of CLas specific monoclonal antibodies (mAbs) for development of immunological tools for early detection of HLB pathogen	Ramadugu, Chandrika
IRCHLB-P4-52	Liberibacter crescens exhibits both flagellar swimming and Type IV pili-mediated twitching motility in culture	Gabriel, Dean
IRCHLB-P4-53	Loop-mediated isothermal amplification (LAMP) assay for detection of Candidatus Liberibacter asiaticus (CLas), the bacterium associated with citrus huanglongbing (HLB)	Choi, Cheol
IRCHLB-P4-54	Multiplex qPCR detection of three Candidatus liberibacter species	Osman, Fatima
IRCHLB-P4-55	Optimization of grapefruit fruit juice for culturing of 'Candidatus Liberibacter asiaticus'	Merfa, Marcus - IOCV-IRCHLB Scholarship Recipient
IRCHLB-P4-56	Optimization of Liberibacter crescens growth suggests ammonium and phosphate as important factors in the plant-host interface	Petrone, Joseph
IRCHLB-P4-57	Progress on the development of a field-use optical sensor for screening of citrus pathogens in California	Edwards, Perry
IRCHLB-P4-58	Targeted early detection of citrus Huanglongbing causal agent 'Candidatus Liberibacter asiaticus' before the symptoms appear	Pandey, Sheo

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-04: Pathogen Detection and Culturing (Continued)		
IRCHLB-P4-59	Universal detection system for Liberibacters	Lee, Richard
IRCHLB-05: Epidemiology		
IRCHLB-P5-60	Analyzing the impact of sampling on PCR efficiency from field studies under HLB epidemic development in FL	Posny, Drew
IRCHLB-P5-61	High-risk based field survey and high-throughput qPCR detection system for Huanglongbing-associated bacteria in commercial groves of California	Hajeri, Subhas
IRCHLB-P5-62	Rates of disease progress in peripheral and internal citrus blocks emphasize role of primary spread in Huanglongbing epidemiology	Pazolini, Kelly
IRCHLB-P5-63	Risk based HLB survey extension: optimizing delimitation radius for cost-effective disease control	Luo, Weiqi
IRCHLB-P5-64	Spatial distribution and temporal progress of Huanglongbing are strongly influenced by vector control and neighbouring non-commercial Rutaceae plants	Belasque, José

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-06: Host Resistance and Tolerance		
IRCHLB-P6-65	CRISPR/Cas9 editing of candidate susceptibility genes to improve citrus resistance to Huanglongbing	Parajuli, Saroj
IRCHLB-P6-66	Development of HLB Resistant Citrus Varieties for California Using CRISPR-Cas9	von Mogel, Karl
IRCHLB-P6-67	Exploring Transient Expression of Cas9 Proteins and Heat Treatments for Increasing Gene Editing Efficiency in Citrus	Parajuli, Saroj
IRCHLB-P6-68	Overexpression of the Arabidopsis NPR1 protein in citrus confers robust tolerance to Huanglongbing	Mou, Zhonglin
IRCHLB-P6-69	Particle Bombardment for Transient Gene Expression in Citrus Plant Cells Using the Helios® Gene Gun.	Levy, Amit
IRCHLB-P6-70	Progress in the analysis of HLB tolerance in a segregating population	Moore, Gloria
IRCHLB-P6-71	Transgenic success-guided reproduction of Huanglongbing resistance/tolerance in citrus by gene editing	Mou, Zhonglin
IRCHLB-P6-72	Use of high-density genetic maps to detect QTLs associated with Huanglongbing tolerance in citrus	Qibin, Yu
IRCHLB-P6-73	Using Agrobacterium-mediated transient expression of Cas9 and sgRNA to produce transgene-free, gene-edited citrus plants	Li, Yi

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-07: Chemical and Biological Vector Management		
IRCHLB-P7-74	A novel methodology to produce and collect Tamarixia radiata and their release by Unmanned Aerial Vehicle or drones:	Kladt, Roberto
IRCHLB-P7-75	Advances in the evaluation of localized chemical control of Diaphorina citri on Valencia orange young trees in Mexico	López-Arroyo, Isabel
IRCHLB-P7-76	Assessing the impact of fungal pathogens for the integrated biological control of the Asian citrus psyllid in the Lower Rio Grande Valley of TX	Flores, Daniel
IRCHLB-P7-77	Biological control of Asian citrus psyllid: Conservation and augmentation for enhanced vector suppression	Qureshi, Jawwad
IRCHLB-P7-78	Biological Control of the Asian Citrus Psyllid, Diaphorina citri, in the Lower Rio Grande Valley of Texas Using the Ectoparasitoid, Tamarixia radiata	Flores, Daniel
IRCHLB-P7-79	Citrus psyllids around the world	Halbert, Susan
IRCHLB-P7-80	Comparison of the effectiveness of applying different pesticides to foliar spraying and soil-drench to control Diaphorina citri Kuwayama	Yao, Zhichao
IRCHLB-P7-81	Effect of horticultural mineral oil on the acquisition of Candidatus Liberibacter asiaticus by Asian citrus psyllid from Citrus	Yang, Qiongyu
IRCHLB-P7-82	Entomopathogenic fungus Isaria fumosorosea, deploy an array of effector proteins during infection of Candidatus Liberibacter asiaticus infected-Diaphorina citri.	Pitino, Marco
IRCHLB-P7-83	Frequency of processed kaolin applications to prevent Diaphorina citri infestation in flushing citrus trees	Tomaseto, Arthur

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-07: Chemical and Biological Vector Management (Continued)		
IRCHLB-P7-84	Implementing a resistance monitoring program for ACP in California citrus	Byrne, Frank
IRCHLB-P7-85	Integrated management of Asian citrus psyllid, vector of the associated pathogens of HLB	Qureshi, Jawwad
IRCHLB-P7-86	Regional Successes in Managing Asian Citrus Psyllid in Southern California	Grafton-Cardwell, Elizabeth
IRCHLB-P7-87	Surveys for Asian citrus psyllid (Diaphorina citri)-infecting viruses and their influence on Candidatus Liberibacter asiaticus (CLas) dispersal in Florida citrus groves	Britt, Kellee - IOCV-IRCHLB Scholarship Recipient
IRCHLB-P7-88	The Greening Management Program at Cambuhy	Ferracini, Cláudia
IRCHLB-08: Antimicrobials		
IRCHLB-P8-89	An in vitro protocol for rapidly assessing the effects of antimicrobial compounds on Candidatus Liberibacter asiaticus	Krystel, Joseph
IRCHLB-P8-90	Bacteriophage communities associated with citrus roots and rhizosphere	Fagen, Jennie
IRCHLB-P8-91	Demonstrating Topical Delivery of Antimicrobial Products as a Means of Controlling Citrus Greening.	Shatters, Robert
IRCHLB-P8-92	Develop effective protectants and therapies to manage citrus HLB using a novel class of citrus-derived antimicrobial peptides	Huang, Chienyu

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-08: Antimicrobials (Continued)		
IRCHLB-P8-93	Evaluation of the in planta minimum inhibitory concentration of oxytetracycline against Candidatus Liberibacter asiaticus	Li, Jinyun
IRCHLB-P8-94	Expression of snakin-1 antimicrobial peptide as a strategy for HLB resistance in citrus rootstocks	Gardella, Victoria
IRCHLB-P8-95	Identification, assessment and delivery of antimicrobial compounds for the management of citrus HLB	Duan, Yongping
IRCHLB-P8-96	In vitro antimicrobial activity and mode of action of ZinckicideTM against Liberibacter crescens, a surrogate of 'Candidatus Liberibacter asiaticus'	Naranjo, Eber
IRCHLB-P8-97	Novel antimicrobial peptides against Huanglongbing (HLB)	Velasquez Guzman, Jeanette
IRCHLB-P8-98	Physiological and mechanical constraints on bacteriophage therapy for the in planta treatment of Liberibacter asiaticus.	Lince, Kevin and Fagen, Jennie
IRCHLB-P8-99	Uptake, translocation and stability of the antibiotics, streptomycin and oxytetracycline in citrus trees	Killiny, Nabil
IRCHLB-P8-100	Zinkicide improved yield and fruit size on younger Huanglongbing-affected trees	Dewdney, Megan
IRCHLB-09: Molecular and Cultural Vector Management		
IRCHLB-P9-101	A high-quality reference genome for Diaphorina citri with manually curated genes in developmental, structural and immune related pathways	Hosmani, Prashant

IRCHLB - POSTER PRESENTATIONS

POSTER NUMBER	TITLE	PRESENTER
IRCHLB-09: Molecular and Cultural Vector Management (Continued)		
IRCHLB-P9-102	Attributes of color that affect attraction of the Asian Citrus Psyllid	Allan, Sandra
IRCHLB-P9-103	Capability of 'Photonic Fence' technology to detect, track, and control Asian citrus psyllid	Patt, Joseph
IRCHLB-P9-104	Could Brazilian native rutaceous support the Asian Citrus Psyllid?	Alves, Gustavo
IRCHLB-P9-105	Developing field detection systems and characterizing other Liberibacters associated with citrus HLB	Ramadugu, Chandrika
IRCHLB-P9-106	Effect of organic fertilizer on the biological characteristics of Asian citrus psyllid Diaphorina citri Kuwayama	Cen, Yijing
IRCHLB-P9-107	Evaluating lighting preferences to enhance trapping efficacy of Asian Citrus Psyllid	Jenkins, Daniel
IRCHLB-P9-108	Field Assays of 3D Printed Asian Citrus Psyllid (Diaphorina citri) Trapping Systems	Rohrig, Eric
IRCHLB-P9-109	Genetic manipulation of Asian Citrus Psyllid (ACP), Diaphorina citri, by CRISPR/Cas9 technology to mitigate the effects of Huanglongbing in Florida citrus	Killiny, Nabil
IRCHLB-P9-110	Host plant selection in the Asian citrus psyllid is affected by salinity stress in citrus plants	Fancelli, Marilene
IRCHLB-P9-111	Impact of transgenic grapefruit and orange plants expressing a Bt toxin gene on the Asian citrus psyllid	Orbović, Vladimir
IRCHLB-P9-112	Lower Asian Citrus Psyllid populations by timing sprays based on flush development	Albrigo, Gene

THANK YOU TO OUR SPONSORS

Putting tour lessons into practice to defend industry

Information gathered on a study tour to the USA by growers and other industry members in March will be utilised by the new Citrus Pest and Disease Prevention Committee in its work to minimise risk for a potential disease incursion in Australia.

Participants attended the Sixth International Research Conference on Huanglongbing (IRCHLB VI) in California and met with growers and researchers to gain a comprehensive understanding of the implications of Huanglongbing (HLB) and Citrus Canker in California and Florida, Citrus Canker in Florida.

As well as growers, tour participants included pest scouts, and those in grower liaison and industry development.

National Citrus Surveillance Coordinator, Jeff Milne, said attending the conference highlighted the impacts HLB has had on citrus production worldwide and the amount of research effort that has occurred without a solution being developed.

The tour group was also invited to contribute to a meeting of the US Citrus Disease and Prevention Committee, the model on which Citrus Australia will build its own committee, chaired by grower and Citrus Australia deputy chair, Richard Byllaardt.

Other recommendations derived from the tour include:

- Prioritise surveillance in urban and peri-urban areas
- All citrus nurseries to be registered
- Additional resources for border security and Northern Australia Quarantine Strategy

At the conference, representatives of countries where the Asian Citrus Psyllid (ACP) and HLB are now endemic commented that in hindsight, their response was too little too late, and strongly recommended that Australia prepare all the necessary controls and regulations in anticipation of the pest arriving.

Key points

- Australian growers must be proactive
- Prevention cheaper than cure
- Report available now

"The Californian visit demonstrated the difficulties and expense of urban surveillance such as finding people at home, right to access, and the need to work outside regular hours," Mr Milne said.

"It also showed the value of a well-run awareness campaign to gain public support.

"In Florida, the orchards visited were infested with HLB and Citrus Canker, both are now considered endemic in the state."

The Florida citrus industry has been impacted by other factors including freezes, hurricanes, environmental issues, and declining returns that have also contributed to the reduction in citrus production.

Asian Citrus Psyllid

Propagation with pathogen free material in insect proof facilities is now mandatory in Florida, California, and Brazil.

Not only are all nurseries registered, but all trees are tagged and registered providing traceability all the way back to the nursery bench.

China and Brazil have strict surveillance protocols for HLB and infected trees are removed immediately and replaced with disease free nursery trees.

"The tour was invaluable for building personal relationships across the US citrus industry that will facilitate sharing of information and research and potentially the opportunity for Australian researchers to study in the USA," Mr Milne said.

You can download the full report - The Asian Citrus Psyllid, Huanglongbing, and Citrus Canker: Exotic threats to the Australian citrus industry - from the Citrus Australia website or call the office on (03) 5023 6333.

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Florida destruction wake-up call for growers

Having travelled previously to Florida in 1975, 1978, 1981 and 1985, and knowing what a dynamic industry citrus was then, despite their dramatic freeze-damaged seasons, I was amazed at the disastrous losses and devastation we saw recently.

It is my understanding that the industry in Florida has already received $US125 million to try and find a solution to the curse of Citrus Canker and HLB, and that a similar amount is in the pipeline.

Those who attended the HLB conference said California was spending around $US40 million per year on research and surveillance. They also spoke of the enormous spending to combat HLB in Brazil, Argentina, and China.

Clearly a cure for HLB is not on the horizon despite all the efforts to date If the solution is resistant varieties, then the availability of new material, the expense of replanting, and the time to planting to profitability will be beyond most of us.

During our discussions with Bill Roe, Noble Citrus near Okeechobee, Florida, he mentioned that his family had a juice factory, now closed. Bill was now leasing a citrus grove owned by Lykes Pasco, a large corporate group who had abandoned the citrus farm and shut their own juice factory.

I asked Bill what had happened to Caulkins Indian River Juice Company, a processor located nearby that had supplied our business at Leeton with specific high ratio citrus juice concentrate for blending with our low ratio early season juice.

He said it was closed and commented that only Coca-Cola (Minute Maid) and one other large juice processor remained along with a few small boutique operators. There had been dozens of juice processing plants scattered throughout Florida back in the 1970s and 80s.

Bill also said their pack house was not viable at current throughputs but as they were now focusing on fresh mandarins, they would hang on in the hope that new plantings would survive the disease issues and build pack house volumes again.

Bill is the third generation of a well-established citrus grower, packer, processor and marketer. He is concerned that his children will not be able to continue in the citrus business their great grandfather started in Florida in 1920.

When I explain to growers that Florida's production has fallen from about 300 million 90-pound boxes to 50 to 60 million boxes since 2005 due to a combination of HLB and Citrus Canker the reaction is generally its bad luck for them but good for us here in Australia.

If we sit on our hands as an industry and do nothing after seeing what HLB and Canker have done, especially in Florida, then we are stupid. We need to be proactive not reactive to these very real pending disease threats.

We currently have Canker in Australia and HLB is very close by in Timor Leste, Indonesia, and Papua New Guinea.

Florida is a stark lesson of the destruction HLB and Citrus Canker does to citrus orchards, family businesses, and regional economies that we must not ignore. I am fearful that like other countries, any efforts we make after a disease incursion will be too little too late.

I strongly urge all nurseries, growers, packers and juice processors to take the risk of this disease seriously before it is too late.

If HLB gets a foothold in any one or more of our citrus production regions, citrus businesses including packhouses and juice processors could become not only unprofitable but worse still unsaleable.

Financial institutions won't want to know the industry, meaning those who want to persevere will have great difficulty funding any existing and or expansion plans that they may have.

Citrus assets will lay idle and or be abandoned just like I saw in Florida. Neglected groves become a breeding ground for all sorts of pests and diseases, not only HLB and or Canker.

Most Australian citrus growers have been doing well recently because of our weak dollar, the benefits of the free trade agreements, the growth of Asian fresh fruit markets, particularly China, crop losses due to diseases in Florida and Brazil and our own clean and green image.

The financial sector is for once looking favourably upon our industry.

It is my belief that industry should immediately establish a fighting fund against HLB. Let's not wait until we find an incursion then have to run around with cap in hand trying to raise money after the horse has bolted.

I ask myself, what alternative horticultural crops could I switch to? Anyone got any bright ideas?

John Morris is a third generation Leeton citrus grower who attended the study tour to Florida and California. He has had hands on investments in a juice factory, a packhouse and large independent fruit and vegetable retail outlets in Sydney.

Exotic citrus pests - HLB/canker study tour

Murray Valley Regional Forum July 10th 2019

Jeff Milne

National Citrus Surveillance Coordinator, Citrus Australia

Citrus Australia

Acknowledgments

Australian Government
Department of Agriculture and Water Resources

This initiative is part of the Australian Government's *Agricultural Competitiveness White Paper,* the government's plan for stronger farmers and a stronger economy.

Hort Innovation
Strategic levy investment
CITRUS FUND

This project has been funded by Hort Innovation using the citrus research and development levy and funds from the Australian Government.
For more information on the fund and strategic levy investment visit horticulture.com.au

Plant Health AUSTRALIA

Citrus Australia

Presentation outline

HLB and Citrus Canker

Florida in 2019 -HLB and Citrus Canker

California in 2019 – HLB at the dooryard

Exotic citrus diseases worldwide

Exotic Plant Pest awareness

Huanglongbing

Huanglongbing (HLB, Citrus greening)

Bacterial disease spread by psyllids, infected plant material, and equipment

Photos: NSW DPI

Huanglongbing

HLB psyllid vectors

Asiatic Citrus Psyllid

- Small 2-4 mm and difficult to identify
- Well adapted to climate in all Australian citrus regions

Photo: David Hall, USDA Agricultural Research Service, Bugwood.org

Photo: Lyle Buss, Department of Entomology and Nematology, University of Florida; USDA APHIS PPQ Center for Plant Health Science and Technology

Citrus Australia

Huanglongbing

HLB is a bacterium in the tree's phloem effectively blocking water transport

It can be present in the plant for up to 3 years before symptoms develop

Psyllids, infected budwood, and equipment can spread the disease

Symptoms can be similar to nutrient deficiencies

Early identification and control of psyllid vectors is essential

Infected trees die within a few years

Citrus Australia

Huanglongbing

HLB is present in many of the world's citrus producing regions

- Africa (1928)
- Asia (China since at least the 1930s)
- Brazil (2004)
- USA (Florida 2005, California 2008)

The psyllid is widespread in California, but the bacterium has not been found in commercial citrus (yet)

HLB has not reached the Mediterranean countries but is present in Iran

Australia and New Zealand are the only citrus producers that have a good chance of remaining HLB free

Citrus Australia

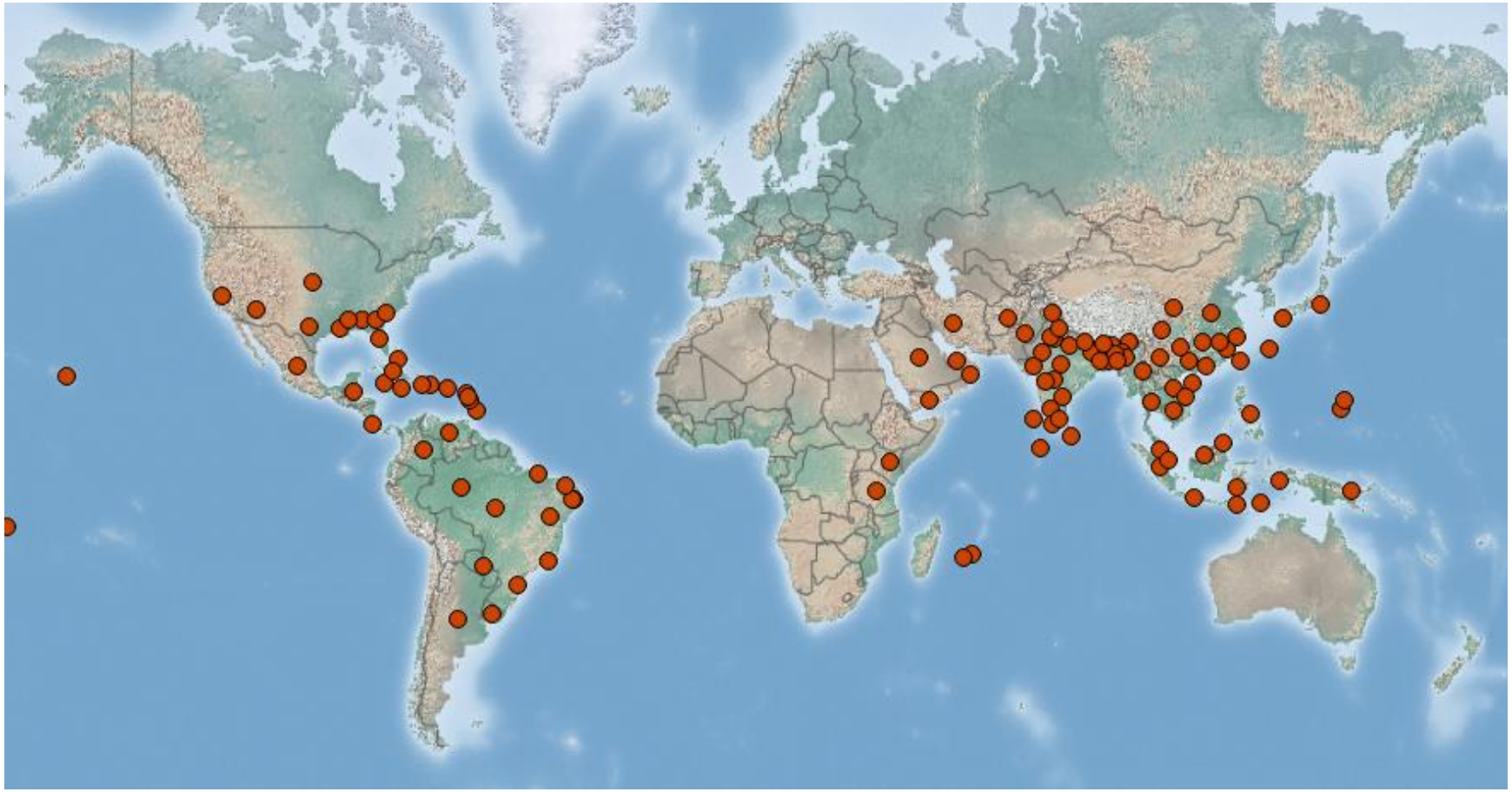
Huanglongbing

HLB Brazil 2004-2010

China 1999-2005

Citrus Australia

Huanglongbing worldwide



Asian citrus psyllid
HLB vector distribution

CABI

Invasive species compendium

Citrus Australia

Huanglongbing

All countries with HLB say in retrospect they did too little, too late

HLB management is complex and includes

- Regular inspection
- Removal of infected trees
- Replacement with disease free material from insect screened nurseries
- Psyllid monitoring and coordinated area wide control spraying
- Citrus movement restrictions (plants & fruit)
- Improved irrigation and nutrition management
- Host removal and parasite release in urban areas
- Public awareness

Anecdotally best results are yields around 70% of pre HLB

Citrus Australia

Citrus Canker

Citrus Canker: *Xanthomonas citri*

Highly contagious bacterial disease spread by

- wind driven rain and water splash
- infected propagation material

Citrus Canker

Citrus Canker

Repeated copper sprays required to control

- Insufficient control for fresh market so lower packouts
- Quarantine issues for fresh market access – domestic & export
- Not viable in current juice market

Native to SE Asia, Australian native citrus species are hosts

Previously eradicated in Australia (Darwin x2, Thursday Island, & Emerald)

Eradication program in place for current outbreak WA & NT

Citrus Australia

Citrus Canker

Citrus Canker overseas

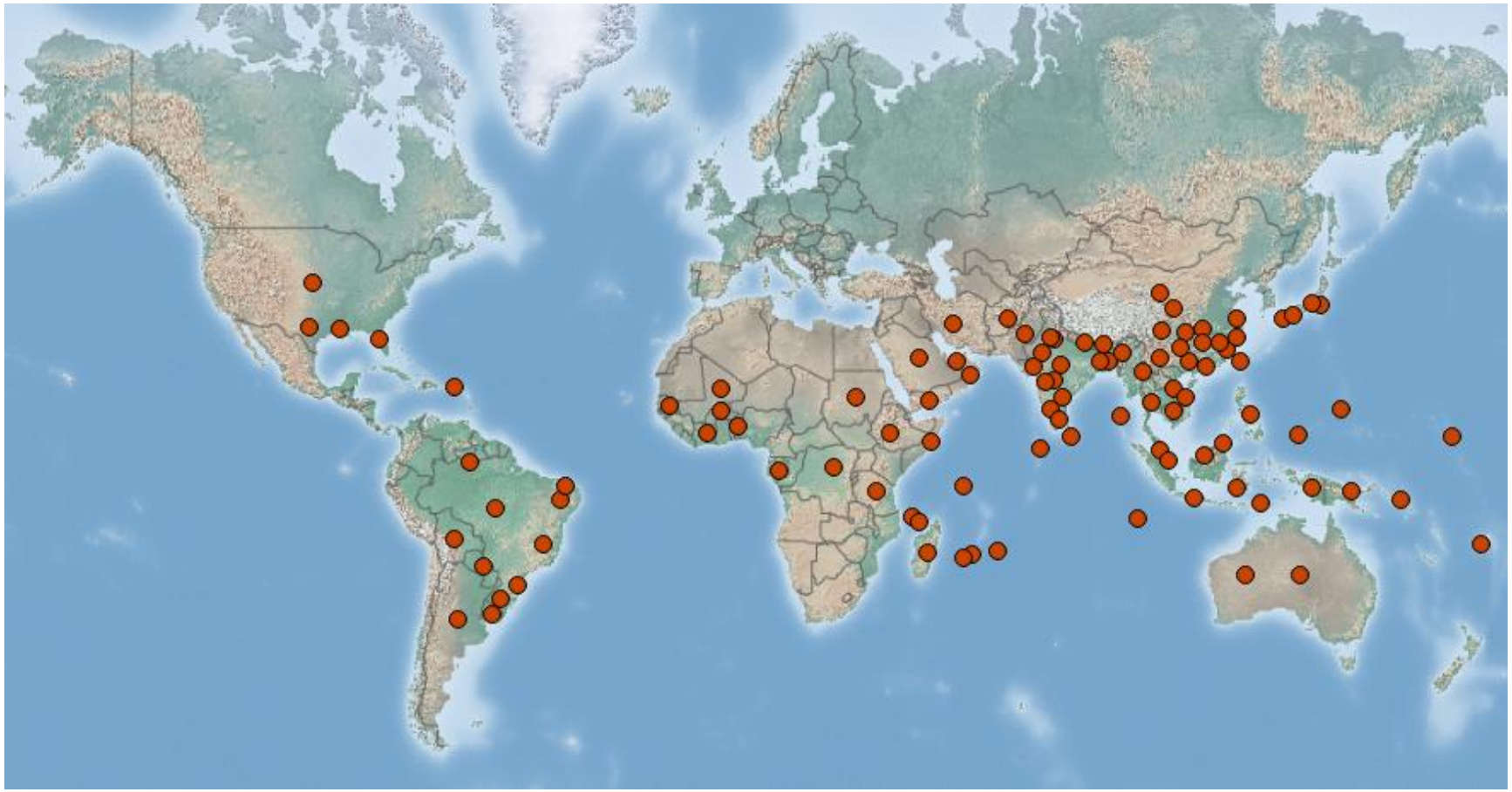
More recently overshadowed by HLB in Florida and Brazil

- Eradication attempts abandoned
- Increased production costs

- Lower production and less 1st grade fruit
- Move to less susceptible varieties and rootstocks

Citrus Australia

Citrus Canker worldwide



Xanthomonas citri
(citrus canker) distribution

CABI

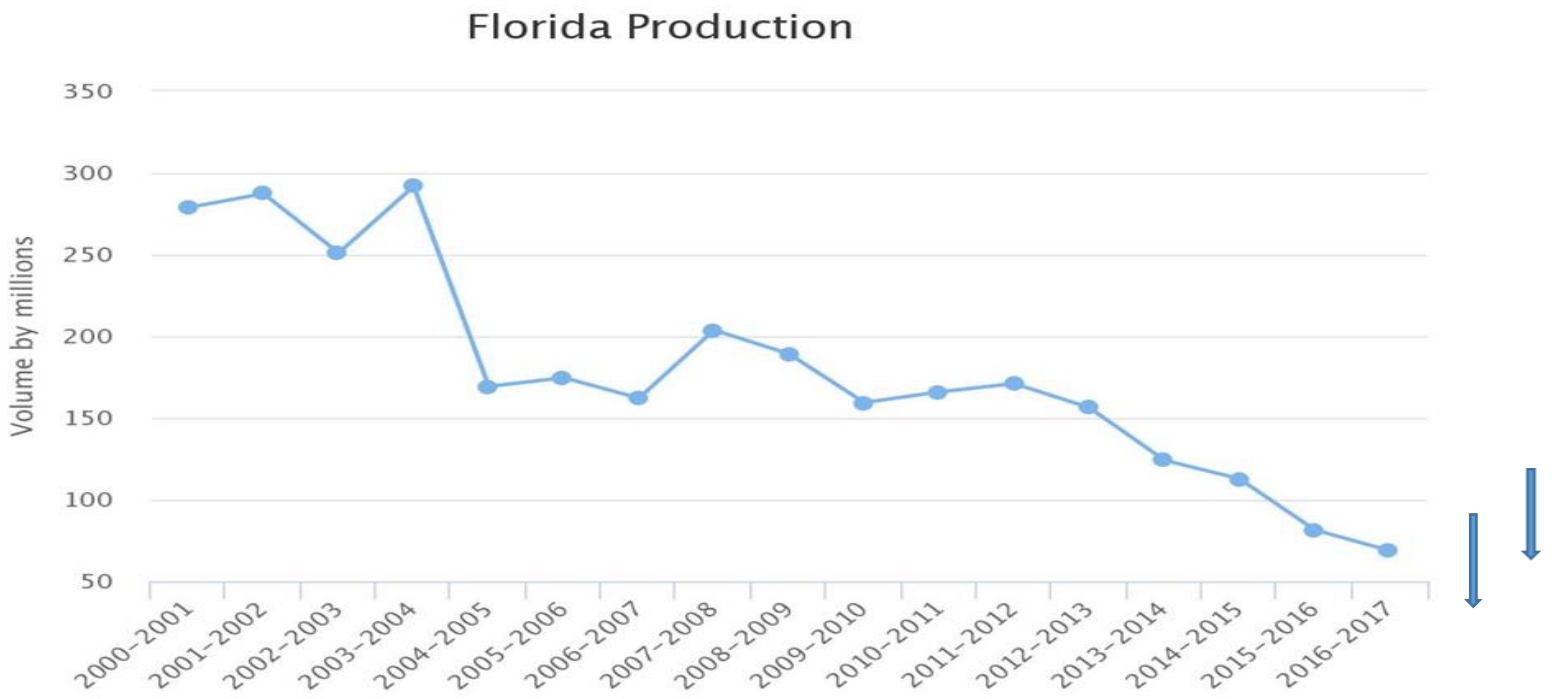
Invasive species compendium

Citrus Australia

Florida 2019

A combination of HLB, hurricanes, freezes, and ceasing canker eradication saw Florida production fall from 297 million 42kg boxes in 2004/5 to 47 million boxes in 2017/18 and is estimated around 70 million boxes this season

The area of citrus in Florida fell from 393,350 Ha in 1997 to 162,300 Ha in 2018



Florida 2019

Asian Citrus Psyllid and citrus canker eradication attempts ceased

All trees considered HLB infected – yield reductions around 30%

Managing orchards with HLB & Canker additional costs around $US 500/acre

Good,

bad,

and ugly

Citrus Australia

Florida 2019

University of Florida CREC

Fred Gmitter's "Grand experiment in natural selection"

Variety collection 11 years after HLB/ACP arrived

Most sensitive:

- Sweet orange
- Some mandarin hybrids (Murcott tangor, W. Murcott, etc.)
- Grapefruit
- Some pummelo cultivars

Less sensitive:

- Other mandarin hybrids (Nova tangelo, Shatangju, etc.)

Some tolerance:

- Lemon; Persian lime
- Citrus latipes
- Other pummelo varieties
- Mandarins hybrids such as LB8-9 (Sugar Belle)

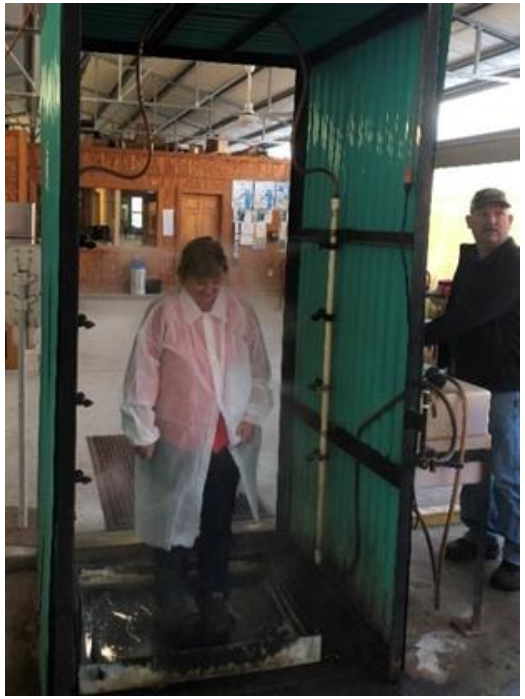
Tolerant or resistant:

- Poncirus trifoliata and some hybrids with Citrus

Citrus Australia

Florida 2019

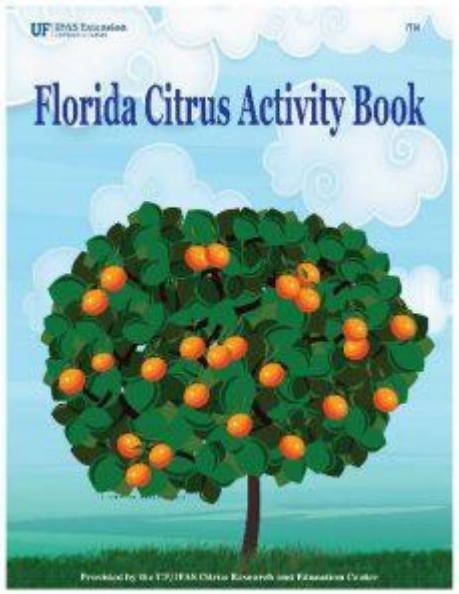
Insect screened propagation & psyllid exclusion



Citrus Under Protective Structures

Florida 2019

Public awareness campaigns



Some are still optimistic

Citrus Australia

California 2019

Psyllid detected LA 2008

HLB confirmed LA 2012

Psyllid in central valley 2013

HLB confirmed Riverside 2017

HLB yet to be confirmed in commercial citrus

= HLB Quarantine

= ACP Quarantine

= Commercial citrus

Citrus Australia

California 2019

$3.4 billion in sales

$7 billion in economic revenue

22,000 jobs

3,900 farmers

292,000 acres of citrus production

Intensive dooryard surveillance 2017-8

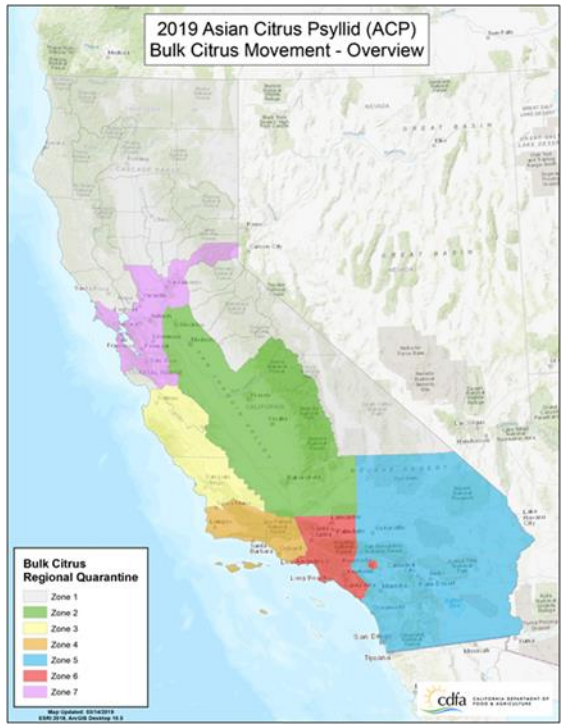
- 129,118 surveys
- 49,229 ACP controls
- 676 HLB +ve and tree removed

Early detection important

Riverside 5th test before +ve

the dog debate

Movement controls



Citrus Australia

California 2019

The California Citrus Pest and Disease Prevention Program 2017-18

IN THE LAB

89,155
citrus plant samples tested for HLB

67,753
ACP samples tested for Candidatus Liberibacter asiaticus

EXPENDITURES

Strategic Priority 1
Quickly Detect and Eradicate Diseased Trees: **$13,182,757**

Strategic Priority 2
Control Movement of Psyllid Around the State; Enforce Regulations: **$3,450,200**

Strategic Priority 3
Suppress Asian Citrus Psyllid Populations: **$12,215,904**

Strategic Priority 4
Improve Data Technology, Analysis and Sharing: **$235,180**

Strategic Priority 5
Outreach and Collaboration: **$1,702,526**

Administrative
$1,922,775

TOTAL FUNDS: $39,440,000

- Assessment on cartons of citrus: **$15,000,000**
- US Dept. of Agriculture, Citrus Health Response Program: **$14,440,000**
- California's General Fund: **$10,000,000**

Citrus Australia

Exotic citrus diseases worldwide: Xylella (Citrus Variegated Chlorosis)

Citrus Variegated Chlorosis (Xylella)

Bacterial disease spread by glassy-winged sharpshooter (GWSS), infected plant material, and equipment

Other sap feeders such as spittlebugs may also transmit Xylella

Citrus Australia

Exotic citrus diseases worldwide: Xylella (Citrus variegated Chlorosis)

Xylella/GWSS impacts many other crops overseas – Australia's #1 Exotic Plant Pest

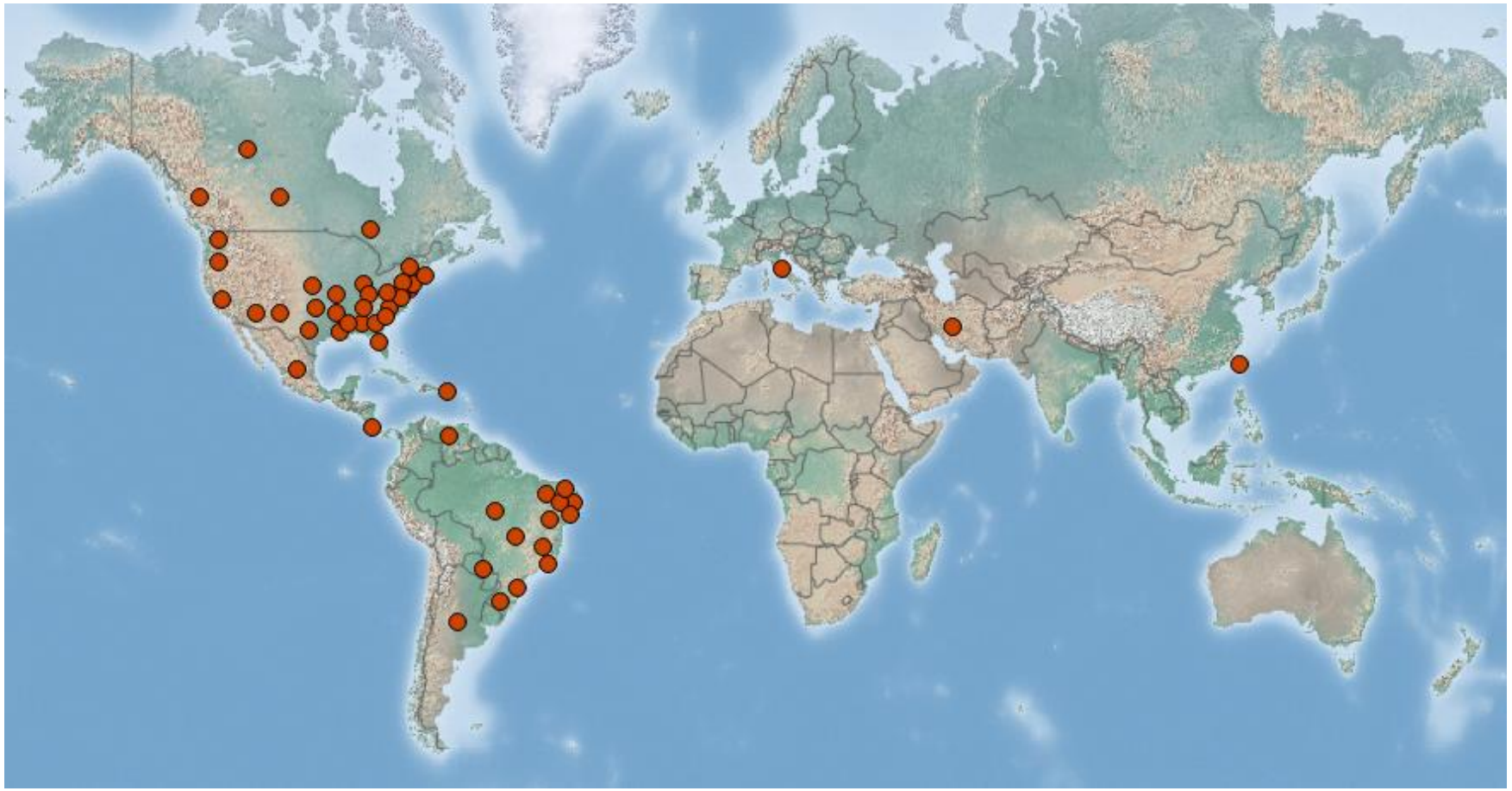
Pierces Disease Grapes
California

Almond Leaf Scorch
California

Olive Quick Decline Syndrome
Italy

Citrus Australia

Exotic citrus diseases worldwide: Xylella (Citrus Variegated Chlorosis)



Xylella fastidiosa
CVC vector distribution

CABI

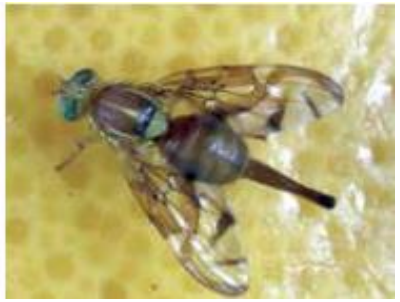
Invasive species compendium

Citrus Australia

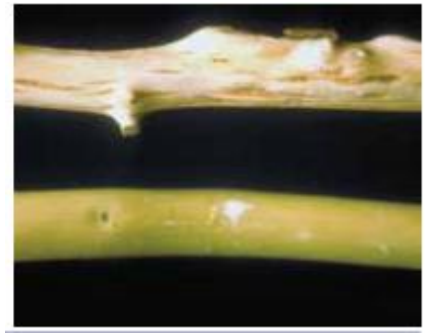
Other Exotic citrus diseases:

Several species of fruit flies, thrips, & a citrus fruit borer not present in Australia have a wide host range and cause;

- Production losses
- Additional costs
- IPM disruption
- Trade restrictions



Citrus Stubborn (bacteria) and Citrus Tristeza Virus (mandarin stem pit strain) affect tree health, production, and fruit size



Photographs from the Biosecurity Manual for Citrus Producers

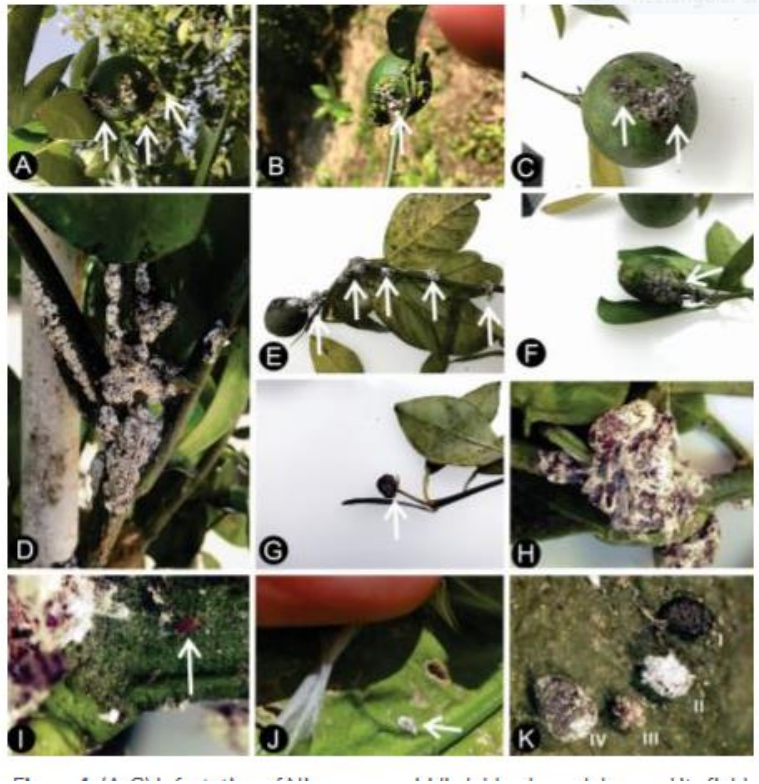
Citrus Australia

Exotic Plant Pest awareness

Citrus pests and diseases are evolving and new threats appearing

Pest Alert: Lebbeck Mealybug Found in Florida Citrus

June 26, 2019 / Industry News Release, Pests



On June 14, 2019, a citrus sample with lebbeck mealybug was collected by Lauren Diepenbrock (University of Florida) (E2019-3408-1) in Highlands County, Florida after noticing heavy infestation of white wax on branches and citrus fruits (Figure 1). This find represents a new county record and is the first occurrence of lebbeck mealybug in commercial citrus

ECONOMIC IMPORTANCE

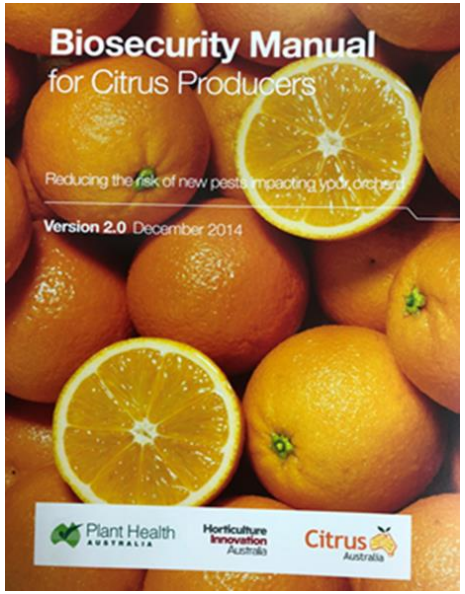
This is an agricultural pest in many parts of the world on a variety of agricultural crops. In Florida, citrus, cotton, ornamentals and tropical plants would all be potential impacted crops. In citrus growing areas of Jordan, where this insect had been a pest prior to introduction of biological controls, it caused such extensive damage that groves were burned in an effort to eradicate it (Stocks 2013). Losses in citrus groves are mainly due to premature fruit drop. In South Africa, infested citrus acreage demonstrated losses of up to 50% of the crop (Cilliers and Bedford, 1978).

Citrus Australia

Exotic Plant Pest awareness

As an industry we need to be vigilant
The ostrich approach or “she’ll be right mate” will not help us prepare for Exotic Plant Pest incursions

Use the Biosecurity Manual for Citrus Producers to develop a Farm Biosecurity Plan



http://www.planthealthaustralia.com.au/wp-content/uploads/2018/08/Biosecurity-Manual-for-Citrus-Producers.pdf

Citrus Australia

Exotic Plant Pest awareness

Your farm biosecurity plan will involve

- Pest monitoring and recording
- Reporting anything unusual
- Using pest free propagation material
- Managing produce carefully
- Managing people movements
- Reducing the risks from vehicles and equipment

IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE

1800 084 881

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Exotic Plant Pest awareness

Citrus Australia are running Farm Biosecurity Plan workshops or can visit your farm

Please contact me if you require anything further

Thankyou

Any questions?

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