INTERNATIONAL ORGANIZATION OF CITRUS VIROLOGISTS

NEWSLETTER October, 2009

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From the Chairwoman

Núria Duran-Vila, Chairwoman

Núria Duran-Vila

Soon we will be able to meet during the next IOCV Conference to be held in Brazil and share our experiences. HLB still remains the most devastating disease and has now been shown to be present also in Iran, Belize, and Mexico. It seems that all of us, sooner or later will have to face this difficult and challenging problem.
Once again I would like to thank all of you who, through this newsletter, share their experience and results with us.

IOCV

IOCV – On line

N. Duran-Vila

At the 16[th] IOCV conference in Monterrey, Mexico, it was decided to produce a "*Description and Illustration of Graft-transmissible Diseases of Citrus: an IOCV Presentation*", and make it available on the IOCV web site. Unfortunately, this project is progressing less rapidly than anticipated. Since the last newsletter, the description of Concave Gum – Blind Pocket is now available. I would like to acknowledge the input of C.N. Roistacher and J.M. Bové for sharing their knowledge and photos on this disease. Unfortunately, many important diseases and issues have not been covered yet. I take this opportunity to encourage all those who have accepted the task of being coordinators to accomplish their share.
I would like to invite all of you to visit our web site (www.ivia.es/iocv/) and help us improve it.

IOCV Digitization Project

R. Krueger

We have completed the digitization of the archival IOCV Proceedings from Vol. 1 (Conference on Citrus Virus Diseases, held in Riverside in 1957) though Vol. 13 (China, 1996). These are available at http://www.ivia.es/iocv/.

We will be registering the domain "iocv.org" in the near future to facilitate navigation.

We thank Ms Marty Nemeth, emeritus librarian from UC Riverside, and our various student assistants for making this project possible.

XVII IOCV Proceedings

M. Hilf

Approximately 80% of the submitted manuscripts in the 17th IOCV Conference have been reviewed and the authors have returned to the editorial board their final proofs. We believe that by the end of 2009 all the material will be ready to be delivered to the publisher. The editorial board would like to apologize to the members of the IOCV for the slow progress of the project but several unforeseen circumstances especially during the past year did not allow us to make the expected progress.

XVIIIth Conference of the International Organization of Citrus Virologists

First Announcement
Campinas and Cordeirópolis, São Paulo, Brazil
September 19-24, 2010

Marcos A. Machado

Theme of the Conference:
Producing (growing) citrus under several disease challenges.

The XVIIIth Conference of the International Organization of Citrus Virologists will be held in Campinas and Cordeirópolis, Sao Paulo, Brazil, in **September 19 – 24, 2010**. Plenary and poster sessions will occur at the Royal Palm Plaza Hotel Resort in Campinas (www.royalpalm.com.br), and the field tours will include visits to orchards severely affected by *huanglongbing*, citrus variegated chlorosis, blight, leprosis near to the Centro de Citricultura Sylvio Moreira (www.centrodecitricultura.br), in Cordeirópolis. The national organizing committee will prepare a exciting and interesting scientific program covering the "state of the art" in research on citrus graft-transmissible diseases, and field tours with visits to farms that are producing fruits under several challenges of diseases.
At the beginning of each plenary session a conference will be presented and will provide integrated, up-to-date scientific information on graft-transmissible diseases of citrus. The plenary sessions will be arranged in modules of 15 minutes followed by a break of 30 minutes. They will consist of invited presentations of 30 minutes, followed by oral presentations (10 min). Poster sessions are scheduled daily.

Local Organizing Committee
Alexandre Morais do Amaral
Jorgino Pompeu Júnior
Juliana Freitas Astúa
Lenice Magali do Nascimento
Marcos A. Machado, Chairman
Mariângela Critofani-Yaly
Raquel Luciana Boscariol-Camargo

Important dates

Activity	Date
Pre Conference	TBD
Abstract submission	June 30, 2010
Registration	June 30 to September 20
Conference	September 19 to 24
Post Conference	TBD

Tentative Conference Program

Sunday, September 19
1 to 6 pm – Registration in The Royal Palm Hotel, in Campinas.
8 to 10 pm – Opening ceremony and welcome cocktail.

Monday, September 20
8 am to 6 pm – Registration
8 to 12 am – Conference session
2 to 6 pm – Conference session
6 to 8 pm – Poster session
Tuesday, September 21

Tuesday, September 21
8 am to 6 pm – Registration
8 to 12 am – Conference session
2 to 6 pm – Conference session
6 to 8 pm – Poster session
Tuesday, September 21

Wednesday, September 22
Visit to the orchards

Thursday, September 23
8 to 12 am – Conference session
2 to 6 pm – Conference session
8 pm – Farewell dinner

Friday, September 24
8 to 12 am – Conference session
2 to 4 pm – Conference session
4 to 6 pm – Closing meeting

M. Wallace-Memoirs

We in IOCV are very fortunate and thankful to have access to the personal writings and memoirs of Dr. J. M. Wallace through the kindness of his daughter Jane Wallace. In his writings, Dr. Wallace leads us through his early experiences at the Citrus Experiment Station at Riverside, California and his close association with Dr. Howard S. Fawcett who turned his research and experiments on psorosis over to him. Working together in field transmission experiments they proved the virus nature of psorosis, the first proven virus of citrus. Dr. Wallace then went on to create the first short term index for psorosis.

In this newsletter we present in Dr. Wallace's words how he came to be part of the Citrus Experiment Station in the early 1940's. In future newsletters we shall present Wallace's writings on the finding of a short index for psorosis and later, the early history of quick decline in California and its association with the tristeza epidemics in Argentina and Brazil. Finally we will present, in Wallace's words, how the International Organization of Citrus Virologists (IOCV) materialized. We wish again to thank Jane Wallace for sharing this history with us.

M. Wallace-Memoirs
Part 1. I smell orange blossoms

J. Wallce & C. Roistacher

In the summer of 1941, Dr. H. S. Fawcett, chairman of the department of plant pathology at the Citrus Experiment Station, came to my office to inquire if I could help him locate someone trained in plant virology to fill an assistant pathologist vacancy in his department. After a few years in Florida, Dr. Fawcett had come to California around 1909 and had established himself as the world authority on citrus diseases. During his long years of study on fungal and bacterial diseases, he had made many contributions of great value to the citrus industry. While in Florida, he had made some study of a damaging disorder which had been given the name "psorosis." In California, he found this same disease widely distributed in citrus orchards where it was described as "scaly-bark." With his training and experience having been restricted to fungal and bacterial diseases and because the effects of psorosis on trees resembled some known fungal diseases, his study techniques were those used for finding a causal agent that could be cultured, viewed under a microscope, and identified. From his investigations in California, he had learned much about the disease and had even found a means of avoiding it in new citrus plantings before he was finally successful in determining its nature or cause.

After the curly top laboratory was expanded at Riverside in 1929 and its staff members began to meet for seminars with Fawcett's staff and others at the Citrus Experiment Station, papers presented by those working on curly top regularly dealt with virus diseases, a discipline that, at the time, was still somewhat in its infancy. I am confident Fawcett's exposure to the subject of virus diseases in the seminars caused him to begin to think in terms of a virus as the cause of psorosis, especially since years of study had not revealed a visible organism associated with that disease. At any rate, in 1932, while examining some of his psorosis-affected experimental trees at a time when there was a new flush of leaf growth, by chance he happened to view some young, soft leaves above him with the light coming through from the sky. His keen eyes noted something different, and when he took individual leaves and examined them closely, he saw that portions of the leaf veins were cleared. Rushing to other known infected trees, he found the same symptom on most of the young leaves. He then went to his experimental nursery where many young seedlings of sweet orange had been budded or grafted with tissue from diseased trees. There he

found what had escaped him for many years—a leaf symptom associated with psorosis. The leaf effect was present on all trees that had been grafted with tissue from psorosis trees but not on untreated trees. After further investigations, he published in 1933 that psorosis was caused by a virus, the first disease of virus nature reported for citrus plants.

Fawcett had described and named some other disorders of citrus for which no causal agent had been detected, and after finding the leaf symptom on psorosis (scaly bark) trees, he discovered the same effects on trees having crinkly leaf, infectious variegation, blind pocket, and concave gum diseases. It was concluded that these were caused by viruses and probably were related to psorosis. These developments led to more studies on psorosis and other disorders for which no causal agent had been identified.

Picture of J. M. Wallace in the Plant Pathology greenhouse in the 1940s. He writes: "Except for some additional laboratory assistants, the plant pathology staff remained at the same level until after 1950. When I began to work there I had no laboratory assistant, and except for part-time help from Robert Drake who was in charge of the greenhouses, I had to grow and transplant citrus seedlings needed in my work."

In 1941 Dr. L. C. Cochran, who had been studying virus diseases of peach and other drupaceous fruit trees and assisting Fawcett in some work on psorosis, resigned his position to work full time on peach tree viruses for the USDA. Thus, Fawcett wanted a replacement for Cochran and had decided that the new appointee would devote full time to the study of citrus virus diseases. When I was asked to suggest a qualified person for that job, I could think of only one who might be interested in it. Two weeks later Dr. Fawcett came back to my office to inform me that the person I suggested had turned down the offer. After some further discussion, he arose to leave but turned back to ask, "What about you? Would you be interested?"

My reply was that I would not consider the Citrus Station position carrying a rating of assistant pathologist because I was at the associate level in my present position. He then stated that he thought the position could be advanced a grade if I were interested in it and explained that the beginning salary of the associate grade on the university salary scale was $400 above that of the federal government. He also mentioned that the university had continued to provide salary increases and step promotions of $300 every three years for his staff members. Having received only the one small increase during the twelve years I had worked for the government, such a salary increase appealed to me, but I was interested in continuing the work I was doing and had given no thought to changing jobs. However, I told Fawcett I might be interested if the position with the university could be brought up to the associate level. With that he left but was back in two days with the information that the director, Dr. Batchelor, and the dean of the College of Agriculture, Dr. Chandler at UCLA, had instructed him to make me an offer of the job as associate pathologist. Immediately that threw me into a quandary, and I asked Fawcett to give me some time to consider the matter. He understood my situation and informed me he would plan for the appointment to become effective January 1, giving me until early December to make a decision.

After discussing the offer with Dr. Carsner in Riverside, the following weeks brought an exchange of letters between Riverside and Washington. My superiors there encouraged me with a report that

Congress was then considering a provision for an annual salary increase of $100 for civil service employees and that if this became effective it would be possible to promote me to plant pathologist at a salary of $3,800 after I received one increase. However, as time passed and no further word on this was forthcoming, I began to consider the university offer more seriously. I had more visits with Dr. Fawcett, and once when I told him I knew absolutely nothing about citrus, he pointed out that he was in the same situation when as a young man he went to Florida to work on citrus diseases. He explained also that the majority of the technical workers at the Citrus Experiment Station had had no experience with citrus when they first came to work there.

After I had been shown around the plant pathology laboratories, Fawcett took me to experimental orchards to show me trees affected by psorosis and the other suspected virus disorders. There in the orchard, where some of the Valencia trees still held crops of golden fruit, my thoughts drifted back to my boyhood and the treat of Christmas oranges. It occurred to me that not only had my dream to live where citrus grows come true, but now I had an opportunity to become involved in the study of citrus trees. That, and the enthusiasm and gentleness of Dr. Fawcett began to sway me toward accepting his offer. His statement that I would be the only person in the world working full time on virus diseases of citrus, an almost totally unexplored field of study, gave me something else to consider. He showed me a greenhouse under construction with an adjoining office and small laboratory that would be for my exclusive use. I left Dr. Fawcett that day almost convinced that I should accept his offer even if Congress acted favorably on the annual increases for federal workers.

After more correspondence with Washington headquarters that brought only promises of future advances when and if funds became available and further deliberations on my part, it came to me very suddenly on Thanksgiving Day in late November that I should accept the position at the university, and with no further thought or hesitation I notified Dr. Fawcett and sent word to Washington of my resignation, effective December 31, 1941. I had work in progress that could not be completed by that time, but Fawcett had agreed I could continue some work on curly top at the Citrus Experiment Station if I had certain studies I wanted to finish.

I was busy preparing to attend the annual meeting of the American Phytopathological Society during the Christmas holidays in Dallas, Texas, where I was to report on the curly top recovery studies and set up an exhibit showing the plant reactions. In the meantime, Grandmother Hoien in Minneapolis had decided she wanted her three and one-half year old granddaughter to experience a white Christmas and had written that she was sending money to cover rail fares for the three of us. Early in December, Adeline and Jane went to Minneapolis where I was to join them later.

I had some jobs lined up to do around the house while I was alone, and on Sunday, December 7, while busy painting the living room woodwork, the radio brought news of the Japanese attack on Pearl Harbor and the subsequent declaration of war on Japan. Although there was much military activity under way by December 15 when I was to travel by train to Minnesota, I was able to get there for a visit through Christmas Day and then went to Dallas. After the meetings, I returned to Riverside, and on Monday, January 5, instead of going to my laboratory near downtown I drove to the Citrus Experiment Station three miles east of town to report for duty on a new job and field of study in which I was to be actively engaged for more than twenty-eight years. By that time the new greenhouse and my office had been completed, and after a couple of trips to my old office, I had moved all my books, records, and personal office supplies to my new location.

I have thought back on that move many times and have felt that few individuals in my profession left a position for another in an entirely different organization with so little inconvenience. As I settled in at my new quarters and began to learn and plan a program of research I had some lingering thoughts as to whether or not I had been wise to make the change. There was no way then for me to know that within a few years I would congratulate myself for making such a “smart” move and bless the time when the perfume of orange blossoms was more than I could resist!

RESEARCH

From the viroid laboratory

Centro de Protección Vegetal y Biotecnología, Instituto Valenciano de investigaciones Agrarias (IVIA).
N. Duran-Vila

Nubia Murcia Riaño from Colombia will defend her PhD thesis on September 25, 2009. The topic of her work is: **"Detección y caracterización agronómica de viroides de cítricos. Identificación y caracterización molecular y biológica de variantes del viroide del enanismo de los cítricos CDVd". (Detection and agronomic chracterization of citrus viroids. Identification and molecular and biological characterization of variants of Citrus Dwarfing Viroid (CDVd))**.

Seyed Mehdi Bani Hashemian from Iran will defend his PhD thesis on September 29, 2009. The topic of his work is: **"Respuesta de distintos genotipos de cítricos y géneros afines a la infección con viroides". (Response of several genotypes of citrus and citrus related genera to viroid infection).**

Both of them have acquired expertise on citrus viroids and I am looking forward to meet them in further IOCV Conferences.

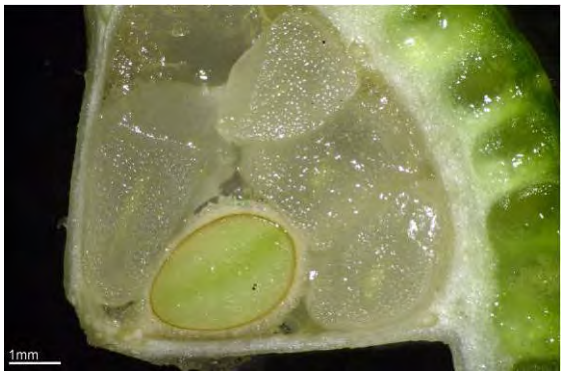
You can see part of their work in the following publications:

- N. Murcia, L. Bernad, A. Caicedo, N. Duran-Vila. (in press) Citrus viroids in Colombia. Proceedings on the XVIIth IOCV Conference.
- S. M. Bani Hashemian, C. J. Barbosa, J.A. Pina, N. Duran-Vila. (in press). Is Desert lime (*Eremocitrus glauca*) resistant to viroid infection or only a poor viroid host? Proceedings on the XVIIth IOCV Conference.
- N. Murcia, S. M. Bani Hashemian, K. Bederski, N.A.Wulff, C.J. Barbosa, J.M. Bové, N. Duran-Vila. (in press) Viroids in Tahiti limes showing bark cracking symptoms. Proceedings on the XVIIth IOCV Conference.
- P.Serra, M.Eiras, S.M.Bani Hashemian, N.Murcia, E.W.Kitajima, J.A.Daròs, R.Flores, N.Duran-Vila. 2008. Citrus viroid V: occurrence, host range, diagnosis and identification of new variants. *Phytopathology* 98:1199-1204.
- N.Murcia, P.Serra, A.Olmos, N.Duran-Vila. 2008. A novel hybridization approach for detection of citrus viroids. *Molecular and Cellular Probes* 23:95-102
- S.M.Bani Hashemian, P.Serra, C.J.Barbosa, J.Juárez, P.Aleza, J.M.Corvera, A.Lluch, J.A.Pina, N.Duran-Vila. 2009. The effect of a field-source mixture of citrus viroids on the performance of 'Nules' clementine and 'Navelina' sweet orange trees grafted on Carrizo citrange. *Plant Disease* 93:699-707
- P.Serra, S.M.Bani Hashemian, G.Pensabene-Bellavia, S.Gago, N.Duran-Vila. 2009. An artificial chimeric derivative of *Citrus viroid V* involves the terminal left domain in pathogenicity. 2009. *Molecular Plant Pathology* 10:515-522
- M.E. Mohamed, S.M. Bani Hashemian, G.Dafalla, J.M.Bové, N.Duran-Vila. 2009. Occurrence and identification of citrus viroids from Sudan. 91:185-190
- N.Murcia, L.Bernad, P.Serra, S.M.Bani Hashemian, N.Duran-Vila. 2009. Molecular and Biological characterization of natural variants of *Citrus dwarfing viroid. Arch Virol* 152:1283-1294
- S.M.Bani Hashemian, C.J.Barbosa, P.Serra, N.Duran-Vila. (in press). On the resistance of *Eremocitrus glauca* and *Microcitrus australis* to viroid infection: Impaired replication/ accumulation does not affect long distance movement. *Plant Pathology,* accepted for publication.

Investigations on seed biology and cryopreservation in Australian rainforest citrus

Kim Hamilton
Botanic Gardens Trust, Sydney Australia

The International Treaty on Plant Genetic Resources has identified citrus as one of 35 food crops important to humanity for conservation and development of crop diversity (FAO 2005). Citrus germplasm has traditionally been conserved in *ex situ* field collections of botanic gardens and research stations because of its non-orthodox seed storage behavior.

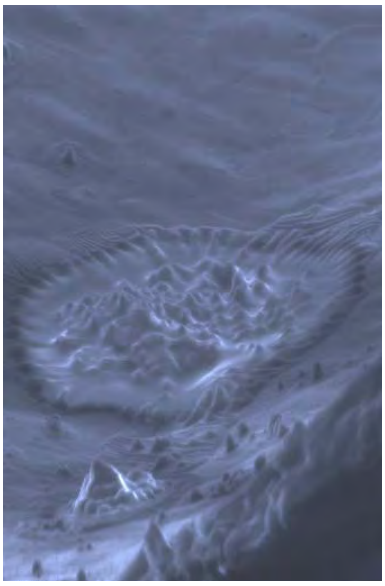


Fruit segment of rare listed Citrus garrawayi (Mount White lime) Photo: K. Hamilton

These collections are vulnerable to pests, disease and natural disasters so complementary long-term storage options are urgently needed. Target 8 of the Global Strategy on Plant Conservation (GSPC) recognizes the importance of the development of new approaches to long-term *ex situ* conservation for recalcitrant (i.e. non-orthodox) seeded species, stating the need for '*additional resources, technology development and transfer, especially for species with recalcitrant seeds*' (GSPC 2002). Cryopreservation (e.g. storage in liquid nitrogen) has been reported for seeds of cultivated species of citrus, but has not been fully researched or developed for routine use in seedbanks.

Germinant from cryopreserved seeds of Citrus australasica (finger lime). Photo: K. Hamilton

Australia has six species of citrus which represent an important source of wild diversity for this economically important genus. Five of these species are found in Queensland and two are listed as rare and threatened *in situ*. The only Australian wild lime not found in Queensland is the Humpty Doo lime (*Citrus gracilis*), a newly discovered species found only in the Northern Territory Top End. Australian wild limes have breeding compatibility with commercial cultivars and some species, such as *C. australasica* (finger limes), form part of an increasingly popular 'bushfood' industry.



Seed micrometropolis – the microscope reveals a city within the seeds of vulnerable listed Citrus inodora (Russell River lime)

The climatically distinct and geographically separate distribution of *C. australasica* (N New South Wale / SE Queenland), *C. inodora* (NE Queensland) and *C. garrawayi* (Far N Queensland) provided an opportunity to assess the effects of natural distribution on seed germinability at a range of temperatures, thermal transitions in seed oils and cryopreservation. Findings from this work are to be published later this year in *Cryoletters*, a leading international journal on cryopreservation. The paper authors are Dr Kim Hamilton, (Botanic Gardens Trust, Mount Annan NSW), Dr Sarah Ashmore (Environment Futures Centre, Griffith University QLD) and Prof. Hugh Pritchard (Royal Botanic Gardens Kew UK).

About the author

Kim Hamilton collecting rainforest fruits for seed biology testing. Photo S. Cottrell

Kim Hamilton is the co-ordinatior and post doctoral researcher of the Rainforest Seed Project which is investigating the seed biology of Eastern Australian rainforest species. Kim has worked for over ten years in the conservation and use of tropical and rainforest plant diversity and completed her PhD in 2007 on the ex situ conservation of Australian wild citrus. Her work on the conservation of Australian citrus received a high commendation awarded by the Queensland State Premier. One of Kim's passions is

creating art works from microscopic images (pictured right). In 2008, her creations from scanning electron micrographs of seeds of threatened rainforest citrus were exhibited at Southern Cross University's (NSW) annual art exhibition 'Vegetative Visions IV' and she won first prize.

AROUND THE WORLD

Montevideo (Uruguay)

N. Duran-Vila

The Department de Plant Biology (Departamento de Biología Vegetal) of the Universidad de La República, offered a postgraduate course on **Biotechnology and Molecular Diagnosis of Citrus Viroids** that was held on March 23-27, 2009. The course was attended by eighteen MSi students on Agricultural Sciences and Biotechnology. Dr. Gabriela Pagliano organized the course that was taught by Dr. Nuria Duran-Vila with the support of Gabriela Pagliano and Rodolfo Umaña. Rodolfo Umaña is now progressing with his work on the identification of citrus viroids in Uruguay.

HLB and other diseases in the Americas

J. Bove

HLB continues to keep us quite busy. Under the framework of OIRSA (Organísmo Internacional Regional de Sanidad Agropecúaria), an international, as well as a regional, organisation for animal and plant health in Central America, with Gisela Tapia Castillo from Panama as the coordinating and driving force, we taught a course on HLB from April 27th to May 1st, 2009, in Santo Domingo, Dominican Republic. HLB was first recognized there in 2008. During the field excursions, typical HLB symptoms were seen on Mexican lime in the Luperon region and on Tahiti lime at Hato Mayor. In Belize, liberibacter-positive psyllids were reported in May 2009 and symptoms were found rapidly thereafter by Veronica Manzanero and her team in "HLB hot spots" along the coast, south of Dangriga on many backyard trees of Rangpur lime, Mexican lime, and sour orange as well as in some nearby orchards of Tahiti lime and sweet orange. During my visit to Belize with Gisela Tapia, from August 6 to 11, these symptoms were confirmed. However, the disease has apparently not yet reached San Ignacio in the western part of the country near Guatemala. Soon after Belize, liberibacter-positive psyllids were also reported in Mexico in the Yucatan peninsula and symptomatic Mexican lime trees were quickly identified. Several citrus meetings have taken place in the summer of 2009 in Mexico. I was invited to give two talks on HLB at the "Primer.Encuentro Internacional de Investigacion en Citricos", organized in particular by José Manuel Alvarez Godinez (CEDEFRUT) and Sergio A. Curti Diaz (INIFAP) from August 3rd to 5th, 2009, at Martínez de la Torre, Veracruz province. No HLB has yet been seen there. However, we were shown foliar symptoms of blotchy mottle **very similar to those of HLB** on Tahiti lime trees affected by Wood Pocket (WP). WP is characterized by three types of symptoms: cracks in the bark, fruits showing conspicuous sectors of various colors and/or textures, and blotchy mottle leaves. Many, if not all, of the Tahiti lime trees which I saw near Martinez, but also previously in the Dominican Republic and later in Belize, show these three symptoms. In Belize, it was particularly interesting to see WP-affected Tahiti lime orchards with and without HLB: with HLB close to the east coast and without HLB close to western San Ignacio. Practically all the trees in both locations had WP symptoms as witnessed by bark cracks and fruit sectors. In addition, the trees in the HLB-free area had foliar blotchy-mottle symptoms on a few shoots or branches only, while the trees in the HLB-affected zone were much more severely affected, having blotchy-mottle symptoms all over the canopy. However, it was impossible to tell, by visual inspection, the difference between WP-associated blotchy-mottle and HLB-associated blotchy mottle. Of course, PCR can differentiate between the two. On Tahiti lime, WP, as seen in Dominican Republic, Mexico, and Belize, as well as "Quebra Galho" (QG), as seen in Brazil and Peru, have a common symptom: bark cracking. However, only WP-affected trees are associated with fruit sectoring and leaf blotchy-mottle. In addition, Dra. Nuria Duran and co-workers have shown that QG from Brazil and Peru is associated with CEVd, the exocortis viroid (Murcia *et al*., 17th IOCV conference, Adana, Turkey, 2007), but WP, from Belize at least, is CEVd-free (Nuria Duran and Veronica Manzanero, unpublished). These observations confirm that WP and QG are different, WP being a genetic disorder and QG an infectious, viroid disease.

In Florida, HLB has become so serious that it might destroy the citrus industry. HLB management as carried out in Brazil and sometimes also in Florida (Psyllid control by insecticide treatments AND removal of symptomatic trees after frequent inspections) is often successful, but it is only a short-term solution, which "buys time" for a long-term solution to be found. Therefore, the Florida citrus growers have asked the National Research Council (NRC) of the National Academies of the USA to set up a committee on "Greening and the future of the Florida citrus industry". Over the last four months, the eleven members of the committee plus staff members of the NRC have met once in Orlando and twice in Washington D.C., and are preparing short-, mid-, and long-term recommendations to cope with Huanglongbing. Pete Timmer, Ray Yokomi and I have enjoyed working together on the committee. We hope that the work will not only help Florida but also other HLB-plagued regions.
I would like to sincerely thank my colleagues from Panama (Gisela Tapia), Dominican Republic (Miguel Marrero), Mexico (José Manuel Alvarez, Sergio Curti, Xochitl Loredo Salazar, Alexandra Soto), and Belize (Veronica Manzanero) for sharing their information with me and making my visits so interesting.

From the Editors
The wood pocket disease is a very severe problem in the lime growing around the world.

Dying trees found in Belize in 1995 due to wood pocket disease. By C. Roistacher

More information on the wood pocket disease can be found on:
http://ecoport.org/ep?SearchType=slideshowView&slideshowId=77

Rational management of emerging Citrus greening/ HLB infections An open item for discussion with IOCV

M. Bar-Joseph

Introduction

The recent outbreak of the citrus greening/HLB epidemic in the New World is posing a considerable threat to the global industries of fresh and processed citrus products which constitute the largest fruit crop with a worldwide annual production of more than hundred million metric tons.

The timely realization of the citrus greening/HLB threat by the Brazilian and the US (Floridian) Plant Protection agencies, resulted in the outburst of major information flow including numerous scientific publications as well as many popular reports and electronic documents (32.900 Google citations of "citrus greening disease"). These have comprehensively covered most of the available information on the different phases of citrus greening/HLB disease, the pathogen(s) involved, the vectors and the epidemiological and economical scenarios and consequences of its emergence and spread.

As a result of the timely ringing of these alarm bells, the Citrus greening/HLB epidemic became the focus of considerable attention of the scientific community, of citrus grower associations and the general media as indicated by the popularity and wide attendance of several recent national and international meetings discussing the topic.

As a result of these meetings and discussions all those concerned with citrus production realized that at the present there is a considerable inadequacy of cost effective means of controlling the disease once trees are infected with the citrus greening/HLB diseases and hence the epidemic is due to continue at an alarming scale.

The common conclusion of this threatening scenario remains: **The urgent need to mobilize the most advanced scientific personnel and research facilities and tools to develop new and more effective means of disease management and control.**

Although these limitations of disease control are not specific for the greening/HLB epidemics, the urgency of developing new management strategies of this particular citrus disease are considerably aggravated by:

1 The accepted paradigm that allowing a grove untreated after finding a greening/HLB focus leads to the rapid and complete loss of the entire grove, as well as all surrounding citrus groves.
2. The absence of effective bactericides for controlling the causal agent of the greening/HLB disease once a tree became infected.
3. The absence of citrus species and /or varieties immune or tolerant to the disease, thus preventing the possibility of employing horticultural measures that were successfully employed in the past for controlling several of the dreadful citrus epidemics that growers experienced in the past.
4. There is a need for the development of new strategies and tools for disease management and control.
5. The new means of control must become available to citrus growers in the infected areas at the fastest possible timeframe.
6. Such important targets could only be achieved through coordinated and ambitious research efforts aimed to timely develop new treatments of infected trees based on the most advanced research tools that are now available in the basic molecular biology and citrus research departments

It is worth praising the fact that the citrus greening/HLB research in the USA has been recently upgraded to an extent never experienced previously by any of the many other countries where the disease was previously noticed. The ability of the US citrus community to persuade its members and the public for the urgent need of such a major research effort is a clear indication that despite the major changes in the US citrus industry, the citrus grower community and the states of Florida and California remain the most seriously dedicated citrus producers anywhere in the world.

The main objectives and most sought research-based remedies to control the greening/HLB crisis are the following:
1. Developing selective means of controlling the causal agent of the disease,
2. Blocking disease spread with new means of vector control and/ or,
3. Improving on diseased tree health by handling the physiology of infected trees.

Although all these objectives are of high priority, it is also clear that achieving these tasks presents considerable challenges and difficulties. It is also apparent that while it's reasonable to assume that although by focusing all the available research resources toward just one of these goals, the result could have been met at a far faster pace. However, there is a lack of information on numerous possible pitfalls that will affect the outcome of the different avenues and it is therefore difficult to point to a specific target that is achievable and sufficiently effective as a means of disease control.

Understanding this major problem, the Florida citrus industry has rightfully delegated the difficult mission of managing the greening R&D to the prestigious US National Academy of Science, which already made its call for research projects and the selection of research topics and priorities.

Judging from the list of the numerous projects the agency decided to fund recently, it is apparent that it had decided to spread its limited resources, rather than concentrate on a single major effort.

The present document is not aimed to challenge any of the selected programs that the agency had decided to fund and/or its general policy. It will include however a short draft of a suggested mission-oriented R&D project that I expect will allow the rapid development of a genetically engineered greening /HLB resistant rootstock. I expect that the results of such a program will provide the citrus industry with disease tolerant rootstocks that could rapidly be used as replants in greening /HLB infected groves.

However, even allowing for an optimistic approach to the time scale (5 to 10 years), of expected developments of new control measures, there is a need for some new ways of handling the greening/HLB problem through an interim phase during which the citrus industry will still lack the new means of disease management that will derived from through the major R& D efforts currently underway.

Adopting new realistic policies to deal with emerging greening/HLB infections

Background:

Some lessons from the recent outbreaks of the disease in Brazil, Florida and Cuba. The outbreaks of citrus greening/HLB disease infections in Brazil (2004), Florida (2005) and Cuba (?) were met throughout these countries with considerable anxiety and fear. Although the three countries realized immediately the significance of the problem, the reactions toward the emerging crisis varied considerably not only among the three countries, but even within each these different citrus production areas, the management of disease varied considerably.

What is the apparently common situation for the large and economically important Brazilian and the Floridian citriculture communities was that there was a dramatic dichotomy in the pattern of grower's reactions. Thus, for both countries only a fraction of the citrus grove owners have opted for full blown eradication/suppression action to block disease spread. Other growers and in some cases even close neighbors of the most fiercely reacting group opted for a desperate approach, giving up on any intensive control action and allowing the disease to take its own course

Although the immediate costs of these contrasting ways of handling the disease are naturally unbalanced, growers decisions to follow either one of these two opposite actions was most probably based on some far reaching economic calculations regarding the expected impact of the disease on the future economy of their groves.

Calculating the epidemiological consequences of an emerging disease such a greening/HLB is mainly based on reports of considerable damages and crop and economic losses experienced in areas where the disease turned endemic. The availability of a variety of mathematical and statistical formulas of disease progression allows presenting many such epidemiological calculations as predictors of future disease spread and for forecasting the future losses. However, past experience with several plant disease epidemiological studies suggests that many such models and the resulting calculations deduced, often failed to predict properly the outcome of citrus diseases.

Thus, while it is rather easy to adjust existing epidemiological formulas to the actual figures and curves past epidemics, their application as predictive tools still suffer considerable inadequacies probably because not all the variables that will affect an actual epidemic spread of a diseases of citrus and probably other crops can be precisely forecasted.

It is therefore worthwhile to suggest that neither the comforting, nor the deterring forecasts regarding the expected rates of greening/HLB disease spread and the resulting losses from the disease for a given grower or area could be precisely forecasted at this stage and it seems therefore that there is a serious lack in information for an optimized economic decision making on the actual outcome of such an epidemic.

Nevertheless, these two contrasting decisions to act or stay idle are still expected to meet each other at some point of time and cross road dictated by the economical costs of losing productivity due to no action compared with the accumulated expenses incurred by the timely control costs.

The presently recommended measures of disease control which involve psylla control, repeated scouting and inspection followed with tree removal impose heavy expenditure on grove maintenance at a time that the prices of orange juice (OJ) are rather low and for most growers not allowing recovering the costly expenditures. The costs of the inaction will start at a far lower spending, however at a later stage, the dim prospect of crop loss, both in yield and fruit quality and later toward losing trees and further down in time losing the whole groves as a result of the uncontrolled disease spread.

Among the possible factors that could had have led growers to react to the disease in such a contrasting way, one could include the fact that infections by greening/HLB disease agent are restricted to citrus and the possibilities of cultivating alternative crops in case the grove will have to be neglected. The reduced global demand and lower commodity prices of orange juice, thus questioning the economic return on the heavy investment involved in active suppression.

This document is an attempt to suggest on some less radical alternative possibilities of handling the disease in newly infected areas, through an **interim**

stage of unknown length when the promising cures from the heavy investments in greening/HLB research are still not available.

In this respect, it's worth mentioning that despite the major investments in development of new cures to this malady, there are still limitations to forecast the time frame of when and how will these intensive efforts turn into cost effective means of disease management.

The **interim** disease management strategies are expected to be useful in citrus- growing areas where the disease could emerge at some later stage. However, even in Florida where the disease is already present in some parts of the state, there are still other areas where the disease is spread only to a limited extent and such areas are also expected to benefit from the suggested the **interim phase** program.

The logic of adapting such a new disease management system stems from the fact that neither one of the two opposing approaches for dealing with the greening /HLB is compatible with the present economic situation of citrus producers. Furthermore, with the absence of mandatory control regulations, the total suppression effort seems unrealistic for Florida, mainly because the disease is never static and will spread from non-treated toward the treated groves.

It is therefore clear that the present two opposed management strategies are absolutely incompatible.

It should be however strongly emphasized that the suggested interim phase management strategies should be considered as theoretical and none binding legally and should only be adopted after their specific adaptation to the particular conditions of any given citrus growing area.

Part 1. Rational management during the Interim Phase of citrus in areas recently invaded by Greening /HLB

What should be considered as rational means of HLB control at the interim phase before the new advanced cures will become available?

The following comments are based on the author's long association with citrus and experience gathered by being involved in different phases of research, diagnosis and policy management of the costly eradication efforts of citrus tristeza in Israel. Starting in 1969, when the epidemic stage of citrus tristeza virus (CTV) was first noticed in Israel until 1986, when it became clear that despite the costs and efforts, the available resources and the disease spread did not justify the continued eradication effort.

But, first a clear statement although both CTV and greening/HLB pathogens are invading and damaging the phloem tissues of infected trees, these two diseases differ considerably in many aspects, both as for the causal agents, the vectors, the intensity of disease and most important the ways and measures that could be used for their control. Thus, unlike the CTV disease problem that can be controlled in many cases by changing the stionic combination to new tolerant or to immune rootstocks, all known citrus varieties and rootstocks regardless of their stionic combination are sensitive to the greening/HLB malady. Therefore the outcome of greening/HLB infection cannot be controlled by changing to any new citrus rootstock combination.

It is, however, the author's aspiration that rootstock-based control measures could become available following the adaptation of complex biotechnological strategies (see Part 2).

Yet there are still some basic principles that growers, especially in newly infected areas, could hopefully benefit if these will be properly followed.

One of the major obstacles for rational handling of new epidemics and especially in the case of the citrus greening/HLB disease had to do with fact that the lessons from some of the past costly failures of handling the Canker epidemic in Florida were not seriously discussed. Furthermore, the fact that the citrus greening epidemic in Florida began at the same time that the state reached the conclusion of giving up on canker control through aggressive eradication was most probably among the main reasons why so many growers opted for such desperate policies of letting the disease take its course.

It is clear that controlling a disease by an aggressive eradication or suppression policy is the most

effective mean of control. However such treatments should only be continued as long as:

There is clear indication that the eradication/suppression agency wins the support of the industry and the population involved.

The operation is continuously backed by valid calculations of the economical benefits of such costly operations.

Once the situation changes and it becomes clear that the original suppression effort is no longer sufficiently effective, it should not been either remain static or alternatively suddenly given up.

There is always the intermediate treatment, probably less effective than the maximal means of control, but still far more workable and realistic than a complete halt of any effort of disease management.

Adopting new control policy which involves less drastic means of control at far less direct costs will gain far better chances of grower's cooperation (probably the most important aspect of any large scale suppression effort).

Before any decision on disease management policy, there is an urgent need to find out the exact status of the disease prevalence.

When a new disease is reported in an area, it will normally draw plenty of attention and a wide range of reactions, what is normally neglected is a serious attempt to find out at the fastest possible time frame, actually within a week or less, the extent of its distribution.

The main reason for the necessity to collect such data at the fastest speed is the considerable differences that will be needed for effectively controlling the problem. Thus, if the disease is essentially limited to just a few trees, these should be immediately discarded and the surrounding area severely sprayed with the most effective insecticide to prevent its dispersal by the vectors. However if the initial survey indicates that the disease is already spread at the different locations with multiple foci of infections, such actions will be of limited use and the policy to be adapted should be different. The nature of such survey should be based on the poling systems used prior to general elections, it's not the knowledge of the locations were infected trees are present, but first of all, the assessment of the extent of disease trees in a given area.

Rule number one in such case is a rigorous objection to any horticultural practice that will enhance the vector population and result in faster disease spread and distribution within the infected trees. **Some possible means of action**

1. A total halt on the practice of hedging and topping of trees within the suspected or infested area.

The main target of action will be to enforce a total embargo on pruning trees, either by topping or hedging. These practices which are so important for orchard management are the main factors of CTV or of greening/HLB spread within mature citrus trees. The Greening/HLB agent will normally be restricted to the individual branch were infection took place, it is a common observation that some branches that were naturally infected by a vector continued to harbor the disease agent for many years, while at the same time other branches on the same trees remained disease free. This situation is common to greening/HLB and stubborn a disease with rather similar pathology, but with a different causal agent. This we also proved experimentally in the past for other citrus diseases that were experimentally graft inoculated on single grapefruits branch that turned the disease agents restricted to the inoculated branches for almost a decade.

The situation however changed drastically when these graft inoculated grapefruit trees carrying sectorial infection were topped. One year after topping all the tree parts turned infected with fruit symptoms spread through most of the new fruits.

Thus, in addition to the well-known information that by pruning, the trees will develop many new shoots and young leaves that will turn as breeding grounds for large vector populations. Pruning mature citrus trees is leading to the systemization of the disease agent and especially ones inhabiting the phloem tissues throughout the infested tree.

As a result the greening /HLB pathogens will reach many new flushes with an excellent opportunity to multiply and turn far more abundant than in undisturbed trees.

Therefore the main and most important message to be sent to growers in a newly infested area is stop the pruning machines, don't allow the disease agent the luxury of fast distribution within trees were it could stayed undisturbed for a long while.

It's not easy, with good growers that consider this practice as an absolute necessity for the proper treatment of their trees, but in case of greening/HLB dealing properly with disease means that this practice must be immediately stopped, or delayed for some time, despite the problems involved in discontinuing this important practice.

2. Tree removal?
Removing infected trees will be the most effective means of reducing the inoculum source and reducing the danger of continuous disease spread. There are three main questions involved before applying this drastic measure:

The first is how many trees need to be removed. The second is will tree removal sufficiently help reducing the amount of inoculum, and third will the cost of this drastic action returned through the benefits of tree removal at a stage that they are still productive.

1. Answering the question in a serious way necessities first of all a fast and serious attempt to map the exact situation of the disease within an infected grove and its adjacent neighbors.

That to remember epidemics of diseases like Greening/HLB are not effectively blocked by fences and therefore measures of control, taken by a grove owner, regardless of its seriousness and investment could become of no value if neighbor will not follow with some similar phytosanitary measures. Once the situation is assessed the results will dictate the way to continue, groves that will be found to be at this stage heavily infested, need to be dealt differently than those with only minimal amounts of infection. Furthermore only if the readiness of the neighbors to cooperate in case that eradication is still feasible is assured the action program should be followed.

3. Where to start and what to do.

Remove first the young infected trees, and do not touch the mature groves, especially not when just a few infected twigs show symptoms. Old trees > 10-15 years will stay productive when a grove is infected for the next 10-15 years when the chances are reasonable that a cure will be found. So only take care of the very young and healthy trees, young and infected need to be discarded.

Reduce flushes during the main psylla infection periods, there are two main aspects of this approach that will be worth considering, first is trying some of the hormonal treatments that might be affect the physiology of the tree toward a less flushing at the major psylla spreading phase and it will be also worth of considering the possibility of using **girdling** to affect not only yield but also to prevent the fast movement of the agent toward the roots system.

Furthermore the possibility to of combining a pruning regime where in case of marginal infection in mature trees, a combination of girdling and major branch removal will be applied will be also a reasonable option not to use the more drastic policy of total tree removal.

The duration of the interim stage. The question how long it will take to develop a successful remedy to control the disease is probably the greatest mystery, naturally the answer to this question is most important for the interim management and yet the most difficult to predict. *See footnote for acknowledgments**

URL on my Nepal consultancy of 1996

C. Roistacher
As many of you are aware, over the past two years, I have been putting my consultancy reports of technical trips on the internet through EcoPort.org. With our modern search engines these reports can now come to life rather than lie dead or dormant in some retired person's files or gathering dust in FAO, AID or GTZ libraries. Transcribing these reports by using modern technology puts text and pictures directly into the internet and makes them available worldwide. It also can give some measure of progress of the current status of diseases and current control measures in the various countries visited. On a personal note it gives me satisfaction and keeps my mind working and active and keeps me in touch with my field of citrus virology which has nourished me these 50 plus years.

*The author wishes to acknowledge, Drs P. Barkley, S. Garnsey, and P. Timmer for their valuable comments.

Showing the unique and difficult means of transportation of supplies and equipment for farms in Nepal. In 1996 There were few roads in the country which could navigate the steep mountain terrain and all fertilizers, tools etc. were transported in this manner and harvested fruit is carried to market this way; sometimes a two to three day journey.

I now have some 23 eArticles on the EcoPort.org/eNarrative website, most all of which are my various consultancy reports on visits to a number of countries beginning with Venezuela in 1979.

More information available at: http://ecoport.org/ep?SearchType=domainContents&id=9&type=group

My latest consultancy report transferred as an eArticle in the EcoPort.org website is on my visit to Nepal in 1996. This is of interest today because of the imminent threat of the greening disease entering California. The insect vector for the greening bacteria *Diaphorina citri* is now in California and last month it appeared in Orange County. I liken this greening threat to California or Texas (which has the vector) to a dry forest with the hot wind blowing and waiting for a match to set it off. We can see illustrated in Figures 2 though 5 the effect of greening disease on the citrus of Nepal and these pictures give some indication of what may happen to California citrus. This devastation by the greening disease can also be seen in my consultancy reports on my visits to Thailand in 1994 and 1995. The URLs to the Thailand reports are in the Nepal report below.

Other diseases and practices are covered in this Nepal report and their means for control are presented. All or any updates or corrections would be sincerely appreciated.

The URL for e Article ID #3201 on Nepal visit in 1996 is AID

http://ecoport.org/ep?SearchType=earticleView&earticleId=3201

Click on "Display full eArticle" and scroll down to see pictures. Look especially on Figure 5 to get the full impact of the devastation of the greening disease.

Update from Texas

J. da Graça and M. Skaria

The citrus industry in Texas remains on high alert for Huanglongbing. Surveys for the disease continue in the areas where commercial citrus is grown, with a major effort aimed at residential sites, as well as other parts of the state. So far, no plant or psyllid samples tested in the HLB-certified diagnostic lab at the Citrus Center have been confirmed as being positive for Liberibacter (4,000 plants tested and 1,800 psyllids tested during the past year). An Action Plan has recently been developed by a Task Force appointed by the Commissioner of Agriculture. It contains details of the steps to be taken in the event of HLB being detected. The budwood source trees in the certification scheme will shortly be covered by insect-resistant screenhouses, using funds from a grant obtained from the US Department of Commerce.

Programs to develop psyllid control strategies are being undertaken jointly by the Citrus Center, USDA-APHIS-PPQ and USDA-ARS. A demonstration program for area-wide psyllid management is under way, as are investigations on low-volume sprays. We also have a joint project with Ron Brlansky (Univ.Florida) investigating alternate hosts of the psyllid and HLB – one of our graduate students is studying native Rutaceae to see if any could serve as hosts.

On November 16-18, a conference bringing together scientists working on HLB and zebra chip disease in potato (also associated with a *Ca.* Liberibacter sp.) will be held in McAllen, Texas. The HLB

component is designed to inform the Texas citrus community about the disease and its impacts. Speakers from Brazil, Mexico, Belize and several US states will give invited talks.

Another graduate student is working on citrus tatter leaf virus, investigating the possibility of seed transmission. This work was started because of a report from Japan of seed transmission of a tatter leaf virus strain in lily and *Chenopodium*.

The Citrus Center in Weslaco recently hosted a visitor for the Trinidad & Tobago Ministry of Agriculture. Dexter Samm spent 10 days in Texas familiarizing himself with the industry, and the research being done here.

Finally, construction has just begun for a new Citrus Center facility. It will be a two-story building with labs, offices and meeting rooms, and should be complete by the middle of 2010, and will replace the barrack structures which have served the center for over 60 years.

…new Citrus Center facility. It will be a two-story building with labs, offices and meeting rooms, and should be complete by the middle of 2010.

California Asian citrus psyllid findings

G. Vidalakis

The last couple of months several findings of the Asian citrus psyllids (ACP) have been recorded in California. Some were interceptions of plant material moving through airports and some were natural findings. Here is the time line of the findings since the first one on August of 2008:

▲ August, 2008: First detection of ACP in San Diego County

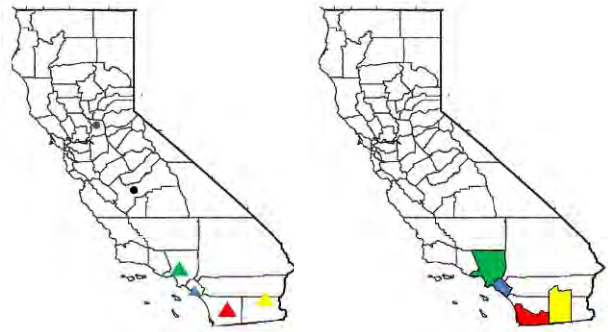
△ October, 2008: ACP findings in Imperial County east of the San Diego County. Some findings were at the border line with Riverside County

● July, 2009: A parcel inspection dog in a Fresno packaging facility detected ACP in a duffle bag containing curry leaves shipped from India

▲ August, 2009: ACP detected in Santa Ana, in Orange County

▲ August, 2009: ACP detected in Los Angeles

● August, 2009: A parcel inspection dog detected ACP in a package containing Guavas and curry leaves in a Sacramento package facility. The parcel originated in Texas and was not inspected locally prior to shipment.



California ACP findings (triangles), interceptions (dots) and quarantine zones

The ACP findings trigger two actions: insecticide treatment in a 400m radius from the finding site and a more intense trapping program. Unfortunately it appears that in most cases (natural findings, triangles) the ACP populations are growing so additional treatment and monitoring efforts are planed from the State and Federal agencies as well as the industry.

All ACP findings in California are tested for HLB. The only positive finding so far was from one insect from the July 2009 Fresno airport intercepted package from India. The new ACP findings added to the partial interior quarantine of the San Diego, Imperial, and Riverside Counties, quarantine zones that include the entire Orange and Los Angeles Counties (Figure 2).

For more details visit:
http://www.cdfa.ca.gov/phpps/acp/pressreleases.html

http://www.californiacitrusthreat.org/

Update on California Citrus Research Board (CRB) operations program

M. Polek

Currently, the CRB program is responsible for commercial citrus whereas the California Department of Food and Agriculture is dealing with residential properties and nurseries. The CRB Field Department has traps deployed in southern California around the Salton Sea and along the fruit transit corridors (major highways) in Ventura County. We are using the standard yellow sticky trap and placing them every quarter of a mile along the grove perimeter within the quarantine area and every one half of a mile in non-quarantined areas. Trap density in young or newly planted groves is higher, about every one- eighth mile. Additional traps are placed within a grove. Traps are serviced every two weeks. Trees are visually inspected especially if flushing. To date, no psyllids have been detected in CRB traps. The main lab officially opened on August 19 and is located in Riverside, close to the UCR campus. Leaf tissue from trees where the traps are placed is collected and brought to the lab for analysis for HLB-related pathogens. Field and lab staff will travel to Florida the first part of October where Phil Stansly, Susan Halbert, Mike Irey, Tim Gast, and Peggy Sieburth will show them psyllids, disease symptoms, and laboratory operations. We are in the process of USDA certification.

The Asian citrus psyllid population in Los Angeles County near the Dodger Stadium continues to be troublesome. Nearly eight-hundred residential properties are in the process of chemical treatment by the California Department of Food and Agriculture. Host plants within a 400 m radius around a detection site are treated with both a cyfluthrin (Tempo) as a foliar application and imidacloprid (Merit), a systemic soil drench. Many methods of public education have been deployed. This campaign has been quite effective as only a few property owners in L.A. County within the 400 m treatment zone have refused treatment.

CCPP, Preparations to face the ACP/HLB challenge

G. Vidalakis

The California Citrus Clonal Protection Program (CCPP) has its roots back into the 1930s when the original discovery of the viral nature of the graft transmissible disease Citrus Psorosis by Dr. H. Fawcett at the University of California Citrus Experiment Station in Riverside triggered the establishment of the "Psorosis Free Program." The CCPP was officially established in 1956 as the "Citrus Variety Improvement Program (CVIP") after the request of the citrus industry to the University of California. In 1977, the CVIP was restructured and renamed to CCPP and today stands as a cooperative program between the University of California, Riverside (UCR, Department of Plant Pathology & Microbiology), the California Department of Food and Agriculture (CDFA), the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) and the citrus industry of the state of California represented by the California Citrus Nursery Board (CCNB) and the Citrus Research Board (CRB). The CCPP is the only quarantine and budwood distribution program for the $1.2 billion citrus industry of the state of California while it supplies Arizona and Texas with citrus budwood.

The CCPP maintains citrus germplasm at two locations. Under quarantine at the Rubidoux Quarantine Facility in down town Riverside (South California), and in a foundation block for budwood distribution at the Lindcove Research and Extension Center (LREC), Exeter (Central, California). Thus the movement of citrus germplasm from the southern California to the central California, after its release from State and Federal quarantines, it is a critical component of the CCPP operations.

In anticipation of the quarantine regulations/restrictions that will be enforced into the Riverside and/or Lindcove areas due to the arrival of the Asian citrus psyllid (ACP) and inevitably of the huanglongbing (HLB) during the past year we have initiated efforts for the adjustment and improvement of the CCPP facilities and protocols that will allow the safe operation of the program under the ACP/HLB pressure.

A. Quarantine facilities

The Rubidoux Facility consists of approximately 5,000 sq ft (~450 sq m) greenhouse with temperature and light controls that are required for biological indexing, 9,000 sq ft (~850 sq m) of screenhouse and a modular office and laboratory area. The College of Natural and Agricultural Sciences has

committed $100,000 while the citrus industry (CRB and CCNB) is expected to match those funds for the upgrade of the Rubidoux facilities. The plans include the reconstruction of the screenhouse (suggested plan, figure 1) and the upgrade of the greenhouse (protective screen in air intakes and exhaust, headhouse improvements etc).

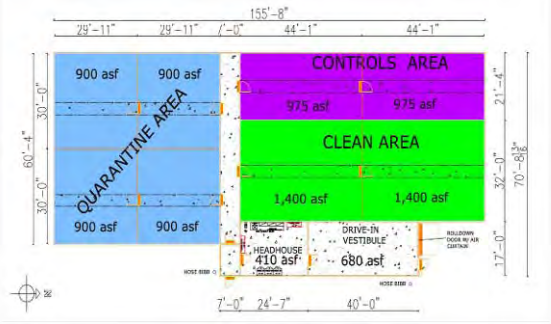


Fig. 1. Proposed floor plan for a new quarantine CCPP screenhouse

In terms of the operating protocols the CCPP made a multileveled approach:

- **i.** ACP monitoring: Traps were placed around Rubidoux Quarantine Facilities as well as inside the Screen- and Green- house for biweekly monitoring. The native and landscape flora was examined for plants of the Rutaceae family for additional monitoring.
- **ii.** ACP chemical control: Systemic insecticides are routinely used and special treatment protocols were developed for the movement of plants released from quarantine to LREC depending on the ACP status of Riverside and Lindcove.
- **iii.** HLB diagnosis: The CCPP recently set up a real time quantitative PCR diagnostic lab for HLB. Test of every tree in the protected foundation block has been scheduled for 2009 while every tree registered for budwood distribution will be tested for HLB at the time of the distribution (up to three times per year).
- **iv.** Experimentation: A series of experiments that included monitoring temperature differences within and outside the screenhouse and ELISA testing for tristeza were initiated to verify the efficacy of other standard protocols under the new operating procedures. Preliminary data indicated that the screenhouse (size: 150x336x22 ft, 46x102x7 m) with Econet M (pore size 400 x 450 µm, aphid exclusion) maintained temperatures at similar levels as the outside environment (figure 2 a-d) and tristeza virus titers under screen fluctuated as in the open field (figure 2 A-C).

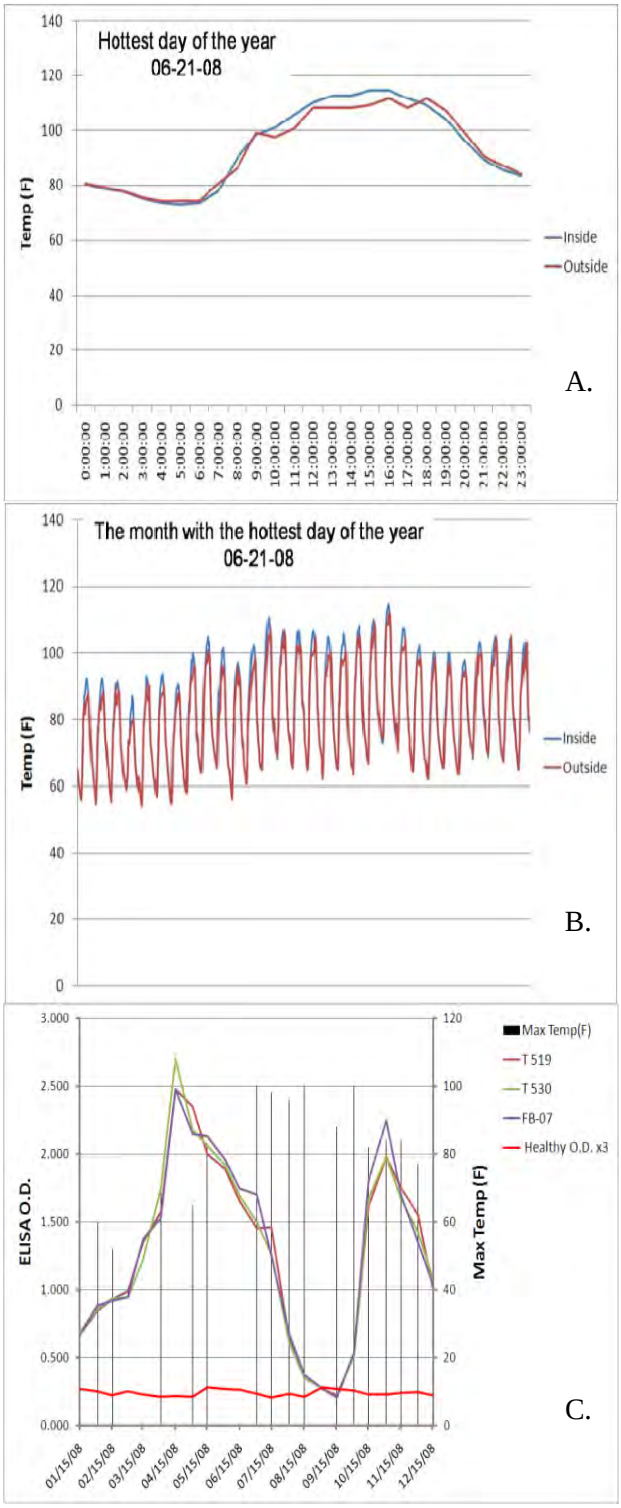


Fig. 2. A. Hourly temperatures inside an Econet M screenhouse (blue line) and outside (red line). B. Daily in- and out- door temperatures for a month period. C. ELISA OD values for three tristeza isolates in Sweet orange and Satsuma mandarin respectively. Base line three times the OD of the healthy citrus.

B. Budwood distribution facilities

In September of 1998 in anticipation of the spread of the tristeza disease in the areas surrounding LREC, due to the termination of the tristeza eradication efforts, the CRB funded the construction of the first CCPP protected foundation block. A few years later the screenhouse of the protected block was expanded to its final size of aprx. 50,000 sq ft (~3700 sq m). The value of those efforts became apparent almost a decade later when in 2007-08 the CCPP started distributing budwood exclusively from the protected foundation block due to increased incidence of tristeza in the LREC. The protected foundation block today holds 600 trees (500 potted and 100 in-ground) representing 379 varieties. From those 233 varieties are currently registered with CDFA for budwood distribution (California, Arizona, Texas, and around the world if requested) that ranges to 30-35.000 buds per year.

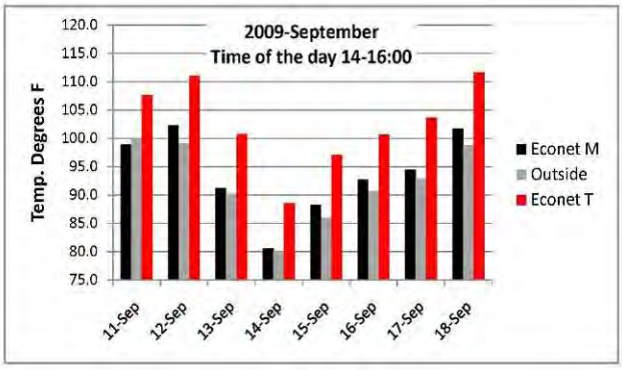
In a similar fashion the California citrus industry proving once more its proactive way of thinking approved and funded the construction of a second protected foundation block (picture 1). The new screenhouse (size: 90x336x24 ft, 27x102x7 m) is screened with Econet T (pore size 150 x 350 µm, thrip exclusion), will house aprx. 160 in ground trees is 30,000 sq ft (~2800 sq m), and includes the novel feature of a drive in vestibule that will allow the loading and unloading of plant material and the movement of heavy equipment in a safe environment.

Early construction note the original screenhouse in the back

Completed exterior

Completed interior

It is important to mention that during the first week of temperature monitoring in the new screenhouse (screen Econet T) the inside temperature was 8-13 degrees F (~5-7 C) higher than the outside or the Econet M screenhouse temperature, indicating that special care of plants and pathogen test protocols will be needed to be used in this foundation facility.



News from Changyong Zhou

Changyong Zhou

From August 10-19, 2009, Changyong Zhou led a citrus delegation from Chongqing, PRC to visit Egypt and South Africa.

In Egypt, the delegation visited a few institutes of the Agricultural Research Center (ARC), including the Agricultural Engineering Research Institute, the Horticultural Research Institute and the Plant Pathology Research Institute, and signed an agreement with ARC President Ayman Abou-Hadid.

Egypt, Cairo at Giza an agreement was signed

In Cairo, it was great to see Dr. Hassan Marei, the president of ISCN, who accompanied us for a visit to his nursery, orchard, and farm house. Dr. Marie also strongly recommended visiting the nursery and orchard of Maghraby Farms (MAFA).

The delegation visited Hassan Marei Nursey in Cairo

Changyong Zhou and Hassan Marei at Hassan's farm house

In South Africa we visited nurseries and orchards of Western Cape Citrusdal and the Biogold (Citrigold) International Co. Ltd. These visits were kindly arranged by the Biogold Director Peter Turner, with whom we also signed an agreement. Dr. Peter Turner visited us on September 5, 2009. That was his 5th visit to CRI, CAAS.

The delegation visited an orchard of Western Cape Citrusdal in South Africa

CONFERENCES / MEETINGS / PUBLICATIONS / ANNOUNCEMENTS

XIII Simposium Internacional de Citricultura

N. Duran-Vila

The symposium was held on July 16-18, 2009 at Ciudad Victoria, Tamaulipas, Mexico and like in previous years it was an effort to exchange the views of University professors, scientists, administrators and private companies. The symposium covered several topics related to citriculture in Tamaulipas such as insecticide treatments, organic citriculture, quarantine pathogens, prevention and epidemiology of citrus pathogens and postharvest diseases. It is worth mentioning that citrus trees, mostly grafted on sour orange, are not declining in spite of the occurrence of CTV in the region. Given the recent detection of HLB in Yucatan, this topic was covered in the presentations of Marcelo Pedreira who described the strategies to control HLB in Brazil, Philip Stansly and H. Alejandro Arevalo who elaborated on monitoring and management of the Asian psyllid, and Gustavo Mora and Nivardo del Valle who offered their views regarding the future of the Mexican citrus industry if/when HLB spreads.

Asian citrus psyllid workshop, Riverside California

G. Vidalakis

A two-day workshop ***with the title "***Meeting the Challenge of the Asian Citrus Psyllid (ACP) in California Nurseries" was completed with great success on June 11-12, 2009 in Riverside, California***. Fifteen speakers from around the world, among them several IOCV members, covered a broad range of topics including, nursery and field practices, screen- and green- house construction, specifications and financing,*** and insect biology and control. There were 80 registered participants but the audience was well above 120 people since there was high interest from regulatory agencies as well as UCR faculty and students. The workshop was sponsored by six organizations and companies while five screen-green- house construction and supplies companies exhibited their products to the audience. The message of the workshop was very clear and understood by all the participants as it was reflected at the closing discussion organized by the California Department of Food and Agriculture in regard to the California nursery regulations.

One of the most important, if not the most important, action for the fight against ACP and Huanglongbing, is the production of healthy nursery trees, using disease tested propagative material in indoor/protected operations.

More than eight hours of workshop sessions were videotaped and along with the power point presentations of all the speakers are available to the public at the:

http://www.acpnurseryworkshop.ucr.edu/

Asian citrus psyllid workshop, Riverside California

The organizing committee from left to right: R. Lee (USDA-ARS, IOCV), A. Eskalen (UCR), T. Delfino(California Citrus Nursery Society), and G. Vidalakis (UCR-CCPP, IOCV)

HLB and Zebra chip disease

J. DaGraca and G. Vidalakis

SAVE THE DATE FOR A JOINT RESEARCH CONFERENCE ON HLB/ACP AND ZEBRA CHIP IN TEXAS

On November 16-18, a conference bringing together scientists working on HLB and zebra chip disease in potato (also associated with a *Ca.* Liberibacter sp.) will be held in McAllen, Texas.

Location: Conference will be held at the brand new McAllen Convention Center, McAllen, Texas

For more info on HLB program contact John Da Graca: jdagraca@ag.tamu.edu
Office: 956-447-3362

For more info on ZC program contact Karen Hodges: kbhodges@ag.tamu.edu
Office: 979-845-7313

Contact Texas Citrus Mutual, ray@valleyag.org, for registration and hotel information.

International Workshop on Citrus Quarantine Pests-Report

J. Cranney

On Monday, July 27 I traveled to Villahermosa, Mexico to attend the International Workshop on Quarantine Citrus Pests. Approximately 300 people attended the meeting, which was hosted by the North American Plant Protection Organization (NAPPO). The purpose of the meeting was to educate North American citrus interests about citrus canker, citrus leprosis and huanglongbing (HLB).

With the discovery of huanglongbing (HLB) in the Yucatan Peninsula just one month prior to the workshop, there was significant interest in HLB and exceptional attendance by the Mexican citrus industry. The meeting was organized to focus a day each on citrus canker, citrus leprosis and HLB. However, during question and answer sessions the majority of questions were related to HLB.

On Friday, I joined other attendees in a tour of citrus orchards in Tabasco to observe citrus leprosis. The disease is being managed by some producers by controlling mite populations which are a vector for the disease, and by pruning infected branches. While some producers are conscientious in monitoring and managing the disease others are not.

Leprosis-Educational efforts for the public. Photo by G. Vidalakis

Citrus Diseases in Brazil

A significant portion of the agenda was dedicated to presentations from Brazilian scientists who provided a glimpse of Brazil's attempts to simultaneously cope with citrus canker, leprosis and HLB. Dr. Renato Bassenezi reported that Brazil estimates citrus canker tree losses at $116 million and an additional cost of $360 million for its citrus canker eradication program over the last ten years.

The following data were provided by Dr. Silvo Lopes regarding Brazil's annual costs to control major citrus diseases:

Disease	Cost ($ million)	Treatment
CVC & HLB	173.3	Insecticide applications (~6x) plus inspection (~6x -40%)
Leprosis	123.5	Miticide applications (~2x –100%)
Black Spot	69.9	Fungicide application (~4x –47%)
Citrus Canker	36.0	Inspection and eradication (Fundecitrus and growers)
Post Blossom Fruit Drop	27.5	Fungicide applications (~2x –56%)
TOTAL	430.2	

HLB in Mexico

Sanidad Vegetal's Dr. Pedro Roblez reported that HLB had been detected in six trees following the initial psyllid detection in El Cuyo is located on the northern coast of the Yucatan Peninsula in Mexico. El Cuyo was being monitored as part of Mexico's program to survey high risk HLB areas. The Yucatan Peninsula is considered a high risk area because of its proximity to Florida and Cuba where HLB is present. Mexico's plant health agency has removed the HLB infected trees and continues to apply pesticides to HLB hosts in the area to lower psyllid populations while it monitors for HLB in other high risk areas. Robles reported that Sanidad Vegetal sampled 299 psyllids and 44 plants for HLB in 2008, and as of July 2009 it had sampled 2,130 psyllids and 77 plants for HLB.

Observations

The immense problems facing Brazil were evident and speakers implied that the strategies in place in Brazil are unsustainable because of the cost and environmental concerns. Small producers without

resources are unable to afford the treatments necessary to survive. With each passing season, Brazil loses more small producers while larger producers struggle to sustain production until research delivers a solution. Now that HLB has been detected in Mexico it is possible that the same scenario may be replicate there. Sanidad Vegetal continues to do everything possible to slow the spread of HLB and work with the local citrus industry to prevent the spread of HLB.

In this environment the importance of a well funded and organized research effort has never been greater. If research fails to deliver the solution in a timely fashion, organized citrus industries in the Americas could cease to exist. Additionally, the meeting highlighted the importance of programs and policies to protect against the introduction of these diseases. It became clear that the best way to treat for these diseases is to avoid them in the first place. In that respect the workshop was a great success. It provided significant information on the experiences of countries that continue to battle citrus canker, leprosis and HLB while identifying areas where North American citrus industries could collaborate to better understand these diseases and provide solutions to producers on how to manage them if they are introduced.

Impressive Mayan ruins in the nearby Palenque. Photo by G. Vidalakis

About the Author:
Jim Cranney is president of the California Citrus Quality Council (CCQC). He provides leadership to ensure that California citrus production meets domestic and international regulatory standards. CCQC has established a partnership with the Mexican citrus industry and its phytosanitary regulatory authorities to identify common interests and initiatives to slow the spread of Huanglongbing in Mexico. He can be reached via e-mail at jcranney@calcitrusquality.org.

Obituaries

Patrick Niven
December 7, 1924-July 3, 2009

Patrick Niven died on Friday the 3rd of July at his home in Plettenberg Bay, South Africa. Patrik and his wife Marina created a large family that will "celebrate his life instead of mourning his deth" as Marina wrote to Chet a day after his death "Patrick was a great man and we loved him dearly and we will miss him terribly…. we will not mourn Patrick's death but celebrate his life...". Patrick's friends and colleges from IOCV will do the same.

For Pat Niven

Louis von Broembsen

Most fruit industries of the world can clearly identify a few people whose passion, belief and dedication to the subject of their interest had a profound effect on those around them and on the progress of the industry as a whole. Alfred Newcomb was one of those - kind, mentoring, humble and wise, yet a powerhouse of experience and knowledge. Perhaps what sets people like Alfred and Patrick Niven apart was their continuous striving for improvement and their adventurous spirit of enquiry.

Patrick Niven was the grandson of Sir Percy Fitzpatrick the legendary figure in South Africa's early days of gold digging, transport riding and imperialist politics - and the author of the classic book, Jock of the Bushveld. As early as 1895, Percy had been in discussion with HEV Pickstone, (a remarkable pioneer of scientific fruit farming in South Africa) over the possibilities of developing a fruit industry in South Africa. In 1913 he centered his ideas on the Sundays River Valley in the Eastern Cape Province where he visualized a successful citrus development. He then undertook numerous visits to Florida and California where he conducted exhaustive studies of American citricultural methods and acquired an extraordinary knowledge of citrus growing, from seedbed to pack house. Percy and his wife Lillian had four children, three sons and a daughter. They lost their three sons with the only surviving child being Cecily, who married Jack

Niven and farmed at Amamzi Estate, near Uitenhage. Patrick was the eldest of Jack and Cecily's three sons. Patrick and his wife Marina eventually settled on Amanzi Estate, where Patrick developed Amanzi Nursery and farmed commercial citrus until the late 1990's.

Pat holding the stump of one of the three Parent Navel trees imported into California from Bahia Brazil in 1800s.
This historic stump of the parent Washington navel orange tree, which died in 1922 of Phytophthora gummosis at the Mission Inn, now resides at the home of Patrick and Marina Niven at the Amanzi Estate in Uitenhage, South Africa.
The plaque on the stump reads: "Parent Washington navel orange tree planted at Riverside, California 1873; died and removed 1922. This section of trunk 2 ft above ground is presented to Sir Percy Fitzpatrick as a memento from California. A.D. Shamel, December, 1922."
Pat Niven was the grandson of Sir Percy Fitzpatrick.

It was during these years on Amanzi that Patrick learned, tried and tested various nursery and production technologies. In the late 1960's he was the first commercial nurseryman in South Africa to index his own selected budwood mother trees for exocortis - and as a result the first to produce commercial quantities of healthy nursery trees on rootstocks susceptible to exocortis. This was a critical step as rough lemon's sensitivity to root and collar rot was proving problematic to growers throughout South Africa at this time.

Patrick formed and chaired the Eastern Cape Citrus Nursery Association and was a founder member of the SA Citrus Nurserymen's Association. He went on to Chair the International Citrus Nurserymen's Association and convened its international conference in South Africa in 1991. He was instrumental in importing new varieties into South Africa and painstakingly selecting parent trees throughout the country for improved horticultural characteristics.

But his contribution was not only in the positions of leadership he occupied in the citrus industry. Above all, Patrick inspired colleagues, field advisers and academics to tackle problems with optimism and self-belief. Patrick's resoluteness, creativity, and drive were always couched in modesty, courtesy and charm. He was a delightful personality whose contribution to the successful development of the South African citrus industry will always be appreciated.

My indebtedness to Pat Niven
Personal recollections

Chet Roistacher
In 1973, a citrus nurseryman named Pat Niven visited our greenhouse facilities at the University of California at Riverside and was impressed with our plants and how we tested (indexed) for citrus viruses using these plants. In 1976, Louis von Broembsen, who was touring the citrus industries of the world for the South African citrus marketing organization `Outspan', visited our facilities and witnessed the very new magic procedure of shoot tip grafting which was recently developed and as with Pat Niven he witnessed how we indexed for citrus viruses and was also deeply impressed for he had not been aware of the new developments for elimination and our methods for the detection of citrus viruses. Subsequently, Louis invited me to come to South Africa to teach them shoot tip grafting plus help develop their indexing facility. Therefore, in 1977 Jean and I visited South Africa for the first time and

traveled the country, lecturing and I introduced the technique of shoot tip grafting. I had the privilege of spending my last few days at the beautiful Amanzi Estate, the home of Pat and Marina Niven and it was in their lovely guest house that I wrote my final report and recommendation.

Like Albert Newcomb, Pat Niven was one of those rare nurserymen who looked beyond the immediate problems and profits of his citrus nursery operations and envisioned a richer future for the entire citrus industry of his country. He understood the importance of citrus viruses and their impact upon his industry and as a responsible nurseryman, did not wish to distribute trees infected with viruses which could cause havoc to the farmer as well as to the entire industry and country. I mention this because, as I later learned, it was Pat Niven who was responsible for setting the stage for my Honorary Doctorate degree from the University of Pretoria.

This was written in 1999 after returning home from South Africa. The recent news of the loss of Pat to the citrus industry of the world, to his many friends throughout the world and to his wife Marina shocked me deeply. I hold Pat Niven deep in my memory and heart.

Chet and Pat in 1999