THE INTERNATIONAL ORGANIZATION OF CITRUS VIROLOGISTS - IOCV

Message from the Chair

Dear IOCV members,

I thoroughly enjoyed reconnecting with the IOCV community during our online conference in September 2022, with more than 200 people participating in the conference sessions. The virtual landscape is powerful and provides options for working with greater efficiency, and even socialising with greater flexibility. But as travel continues to open, and we all reconnect in person, we are reminded of the value of getting together face to face. The spontaneous collaborations that are sparked during morning tea and cemented over a dinner meeting. The confidence that you gain from meeting someone in person, to later email them with a question. So, we look forward to seeing you all in Australia in March 2025 for the XXIII conference of the IOCV – the perfect opportunity to network, learn and have fun!

But in the meantime, it is important that we stay connected and continue to build our society. Our connections and sharing of knowledge are immensely valuable. We understand it is easier to renew your membership during the conference, but the link is easy too! Please renew your IOCV membership for the 2022-25 period at http://journalofcitruspathology.com/iocv_membership.html. And please continue to support your Journal of Citrus Pathology.

I would like to take this opportunity to thank Robert Krueger and Mengji Cao for their years of dedicated service in the roles of IOCV Treasurer and Secretary respectively. Thank you to Changyong Zhou for his valuable service as Chair-Elect, Chair and Past-Chair. I would like to welcome Glynnis Cook to the IOCV Board as Chair-Elect and Irene Lavagi-Craddock who has agreed to take on the tasks of both Treasurer and Secretary. We are grateful to you all.

In this issue, we also pay tribute to those members who are no longer with us. Chet Roistacher, a powerhouse of the IOCV for so many years, sadly passed away in September 2022. Before that (in July 2022) we lost Fanie van Vuuren, a valuable researcher and mentor to so many, particularly to those in South Africa. And in January 2023 we lost Chong Ke who made outstanding contributions to the study of huanglongbing disease. We are 'standing on the shoulders of giants'.

Best wishes and take care, Nerida

IOCV Business

XXII conference of the IOCV

The XXII conference of the IOCV was held online over four sessions in September 2022. We had more than 200 participants in the conference who listened to presentations by 23 speakers from 10 countries on the topics of huanglongbing, citrus viral diseases, citrus viroids and other citrus diseases including emerging pathogens. Here's the link to the recordings: https://www.youtube.com/playlist?list=PLbY_N6-dbI4U9TWqqb8mLsazr6jcesUXJ

The virtual format was convenient but not as fun or productive as meeting in person. We look forward to the next face-to-face conference of the IOCV in Australia in March 2025.

Thank you for your support of the online conference in 2022.

IOCV Business meeting

A business meeting of the IOCV was held in February 2023.

During the meeting, changes to the By Laws were accepted by the members to include electronic ballots, recognise additional awards, acknowledge the Journal of Citrus Pathology, and provide greater options for conferences. The updated By Laws can be found at https://iocv.ucr.edu/laws-iocv.

Secretary's Report

There was discussion surrounding the drop in membership numbers (around half of our members have not renewed their membership) and strategies to attract membership renewals or new members.

Treasurer's Report

The IOCV Awards were discussed. Donation links have been added to the IOCV website.

A membership fee of $60.00 US, payable to IOCV is required for the three-year period between IOCV conferences. Student fee is $30.00 for the three-year period between IOCV conferences. If you wish to renew your IOCV membership, please go the following link: http://journalofcitruspathology.com/iocv_membership.html

Artists in Citrus Pathology

Submit your photos, sketches, or paintings for the chance that your work will be featured on the cover of an issue of the Journal of Citrus Pathology. The work can represent a disease or citrus pathology related activities such as research or extension.

Prizes will be awarded at the next IOCV conference. Send your submissions to: iocvsecretary@gmail.com

If you know of an IOCV member who has retired, please email their name and, if possible, a tribute to iocvsecretary@gmail.com so that we can honor their contribution to IOCV.

Journal of Citrus Pathology

What's new in your journal?

First report of citrus virus A in Australia
NJ Donovan, GA Chambers, A Englezou, W Forbes, A Dando, P Holford
http://dx.doi.org/10.5070/C49157292

Investigating the Impact of Huanglongbing in Southern Lao PDR
NJ Donovan, A Englezou, S Phanthavong, GA Chambers, HT Dao, P Phitsanoukane, A Daly, S Cowan, P Holford, GAC Beattie, S Vilavong, LW Burgess
http://dx.doi.org/10.5070/C49155026

First report of Citrus Bent Leaf Viroid and Citrus Dwarfing Viroid in Argentina
M Florencia Palacios and J Figueroa
http://dx.doi.org/10.5070/C49151296

Vegetative shoot flush dynamics of 'Pera' sweet orange on three rootstock cultivars
E Vieira de Carvalho, JC Cifuentes-Arenas, E Sanches Stuchi, EA Girardi, S Aparecido Lopes
http://dx.doi.org/10.5070/C49149230

Huanglongbing in Bangladesh: A Pilot Study for Disease Incidence, Pathogen Detection, and its Genetic Diversity
MR Islam, MM Haque, H Khatun, J Sarker, Y Wang, W Ke, Y Cen, I Lavagi-Craddock, X Deng
http://dx.doi.org/10.5070/C49152700

Access your journal and submit your manuscripts at https://escholarship.org/uc/iocv_journalcitruspathology

Special topic

Economic Impact of California's Citrus Industry in 2020
BA Babcock
http://dx.doi.org/10.5070/C49156433

The value of California citrus production in the 2020-21 marketing year was $3.63 billion. The total economic impact of the industry on California's economy in 2020-21 was $7.6 billion. The California citrus industry added $1.9 billion to California's state GDP in 2020. Estimated full time equivalent jobs in California citrus industry in 2020-21 totalled 24,247. Estimated wages paid by the California citrus industry income in 2020-21 totalled $759 million. A 20% reduction in California citrus acreage would cause a loss of 8,213 jobs, $214 million in employee income, and reduce state GDP by $569 million.

Coming soon

Abstracts from the

XXII conference of the IOCV.

If you have not yet returned your abstract, please email it to iocvsecretary@gmail.com as soon as possible.

Regional updates

United States

A new citrus virus to North America, citrus yellow vein clearing virus, was recently detected in residential properties in the San Joaquin Valley of California

Greg Douhan and Georgios Vidalakis

Department of Microbiology and Plant Pathology, University of California Riverside

In October of 2021, the California Department of Food and Agriculture (CDFA) inspectors began performing a multi pest citrus survey in addition to routine inspections for the Asian citrus psyllid and Huanglongbing in residential properties. Early in 2022, during the multi pest survey, a surveyor came across some unique leaf symptoms on a residential lemon tree in the city of Tulare, in the San Joaquin Valley (SJV), in central California. Samples from the initial find in Tulare County were sent to CDFA's Plant Pest Diagnostic Center in Sacramento, California (https://www.cdfa.ca.gov/plant/PPD/) and tested positive for the citrus yellow vein clearing virus (CYVCV), a putative new member of the genus *Mandarivirus* associated with the yellow vein clearing disease of citrus. This result was subsequently confirmed by the United States Department of Agriculture, Plant Pathogen Confirmatory Diagnostics Laboratory (https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview/science-technology/plant-pathogen-confirmatory-diagnostics-laboratory). A total of 578 trees have tested positive so far for CYVCV in the city of Tulare and recently two trees tested positive in the city of Visalia, but no findings in commercial citrus groves in the SJV have been reported thus far.

Symptoms of CYVCV disease include vein clearing when viewed from the top of the leaves and water soaking when viewed from the bottom of the leaves (Fig. 1).

Figure 1. Symptoms of CYVCV viewed from the top of leaves and the bottom of leaves showing vein clearing and water soaking symptoms, respectively, as well as leaf curling/crinkling symptoms. Photo courtesy of CDFA.

Symptomatic leaves may also be curly or have some crinkling. The virus is vectored by the citrus white fly (*Dialeurodes citris*) and several aphid species (*Aphis spiraecola*, *A. craccivora*, and *A. gossypii*), all of which occur in California. There have also been single reports of virus detection on some weed species and CYVCV can also spread by grafting as well as by pruning tools.

The yellow vein clearing disease was first identified in Pakistan in 1988 on lemon and sour orange trees. The disease was then found in India on 'Etrog' citron, 'Rangpur' lime, sour orange, and lemon trees in 2003. The disease was subsequently found in Turkey, Iran, and China. Lemons and sour oranges seem to be the most susceptible citrus types to this disease, but most citrus species, varieties, and hybrids tested thus far, developed the disease with varying symptomatology. Finally, there has also been one report of CYVCV infecting wild grapes in Turkey in 2020. In the study from Turkey, the infected wild grapevine was climbing on an

United States CYVCV cont.

infected citrus tree. There was no evidence of serious impacts on the wild grapevine.

The report of CYVCV from the city of Tulare, California was the first account of this virus in North America, and the impacts of this disease on the citrus economy are not clearly known at this time. Researchers in China have reported up to 80% loss in production in some lemon groves but the losses are usually less in most instances. CDFA continues with delimitation surveys around the positive finds to define the extent of the infestation and if any commercial citrus operations, groves or nurseries, are infected or are at risk. For updates on this and other citrus pests in California visit 'Citrus Insider' at https://citrusinsider.org/.

Please send us your country updates for our next newsletter.
iocvsecretary@gmail.com

South Africa

Glynnis Cook

On the African continent Huanglongbing (HLB) is known to occur in Ethiopia and Kenya, and the primary vector, the Asian Citrus Psyllid (ACP), *Diaphorina citri*, is present in Kenya, Tanzania, Ethiopia, Nigeria and Benin. Citrus Research International (CRI) established a Biosecurity division to prepare the southern African citrus industry for incursion of ACP and HLB in addition to other biosecurity threats. Surveillance activities are integrated with diagnostic development and research. To determine the most likely incursion pathway of HLB and ACP into South Africa, CRI developed a risk heat map for southern Africa to indicate strategic areas to focus surveillance and monitoring efforts. A modelling project is underway to validate and refine the current risk heat map. A national HLB Action Plan and an HLB Safe System for nurseries were developed that detail preparedness and incursion response actions. These documents were officially adopted by the Department of Agriculture, Land Reform and Rural Development (DALRRD). Surveillance and monitoring efforts are ongoing in South Africa, Zimbabwe and Eswatini and CRI is working with collaborators in various African countries to track the movement of HLB and ACP into southern Africa. Surveys have been conducted in Mozambique in 2019, 2020 and 2022 around Maputo, in Inhambane province, and the Beira-Chimoio-Machipanda corridor, respectively. Surveys and visits have also been conducted in Angola, Botswana and Namibia. As yet no ACP or HLB were detected in southern Africa.

Australasia

Huanglongbing (HLB) is not known to occur in Australia, but we remain vigilant because the disease is on our doorstep in countries close to our north. Australian, Indonesian, and Chinese researchers have joined forces to learn more about the technical and practical management aspects of the disease in a collaborative research project funded by the Australian Centre for International Agricultural Research (ACIAR). Field visits to citrus orchards, and an inaugural technical workshop on HLB took place in Java, Indonesia in February 2023. The technical workshop brought together leading international experts from Brazil, China, Indonesia and Australia to update project participants and industry representatives on the latest HLB research and management programs from around the world. The workshop is the first of a series planned for the project aimed at capacity building in HLB management in Indonesia and Australia. Besides the workshops, the project aims to improve HLB management in Indonesia using HLB-tolerant rootstocks, high-density plantings, psyllid repellents and inter-cropping. An additional objective is to improve our ability to detect ACP incursions in Australia by evaluating improved trap designs and lures.

Regional updates

Brazil

Eduardo Stuchi

Brazil has the first sweet orange variety resistant to *Xylella fastidiosa* available for growers: the navel orange "Navelina XR".

The Navelina XR navel orange is the only variety of sweet orange resistant to the bacterium *Xylella fastidiosa*, eliminating the need to control citrus variegated chlorosis (CVC), an important pest that has affected Brazilian citrus production since the 1980's, as well as the sharpshooter vectors. It is suitable for cultivation in the state of São Paulo, preferably in regions with milder temperatures, and is recommended for the fresh fruit market.

The tree has a medium size and a canopy with the typical shape of navel oranges (Fig. 1), with thicker leaves compared to other oranges in the group. The fruits have an early to mid-season maturity and can remain on the trees after reaching commercial maturity but with a certain degree of granulation. It exhibits good fruit production and quality, characteristic of navel orange varieties. The cultivar does not show corky veins associated with citrus tristeza.

The Navelina XR was selected within the framework of the Embrapa Mandioca e Fruticultura UMIPTT at the Fundação Coopercitrus Credicitrus - formerly the Estação Experimental de Citricultura de Bebedouro, with the collaboration of Centro de Citricultura Sylvio Moreira, based on genetic material introduced from the Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement (Inrae Centre San Giuliano, Corsica, France) in the late 1990's, as Navelina ISA 315, its original name in Italy.

HIGHLIGHTS

- The only sweet orange variety resistant to *Xylella fastidiosa*, eliminating the need to control citrus variegated chlorosis (CVC) disease and sharpshooter vectors

- Fruits with typical Baianinha orange characteristics: seedless, early to mid-season maturity, and capable of remaining on the trees after reaching commercial maturity, but with a certain degree of granulation

- Does not exhibit corky veins associated with citrus tristeza

- Average productivity: 15 kg per plant at 4 years of age and 100 kg per plant at 10 years

- Limitations: may exhibit alternate bearing, occasional seeds, and sensitivity to elevated temperatures during flowering. Susceptible to other diseases affecting sweet oranges.

Reference: Fadel, A. L., Stuchi, E. S., de Carvalho, S. A., Federici, M. T., & Della Coletta-Filho, H. (2014). Navelina ISA 315: A cultivar resistant to citrus variegated chlorosis. Crop Protection, 64, 115-121. http://dx.doi.org/10.1016/j.cropro.2014.06.014

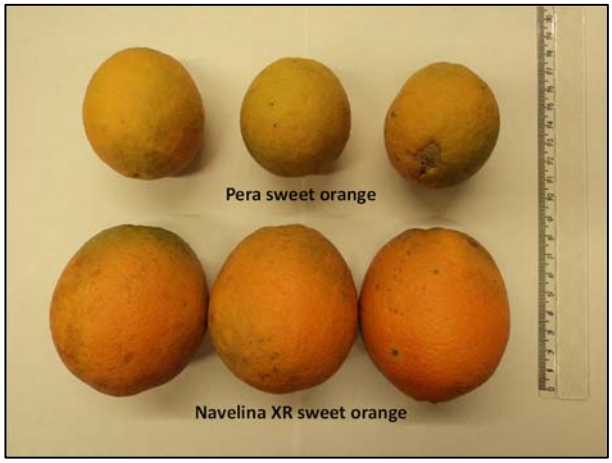


Figure 1. Sweet orange fruits from trees inoculated with *Xylella fastidiosa*.

Regional updates

Europe

Recent outcomes from 'Pre-HLB'

Leandro Peña

The aim of the European Union (EU) project 'Pre-HLB: PREVENTING HLB EPIDEMICS FOR ENSURING CITRUS SURVIVAL IN EUROPE', granted by the Horizon2020 Framework Programme, is to prevent the entry into Europe of the citrus Huanglongbing (HLB) disease and to investigate strategies for its effective control in the short, medium and long term.

Regarding the short-term preventive actions, a range of networks have been established to inform, discuss and alert stakeholders as to the critical importance of understanding the threats that HLB disease poses to citrus production, including a web page of the project (https://www.prehlb.eu/), EU EIP-AGRI resources (https://ec.europa.eu/eip/agriculture/en/find-connect/projects/pre-hlb-prevenci%C3%B3n-de-la-epidemia-por-hlb-para) and an HLB blog (https://prehlb-blog.eu/). These lines of communication provide key information targeted to different citrus sectors (from growers to scientists) and, at least, in two different EU languages. A mobile app, holding a tool that enables the recognition of HLB vectors and symptoms and a mechanism to warn about HLB appearance/presence (both essential in the execution of an effective contingency plan), is being released soon. Both HLB bacterial vectors are already present in the EU: *Diaphorina citri* has been detected in Israel and *Trioza erytreae* is widely spread over the whole Atlantic coast of Spain and Portugal. Understanding their biology and performance in European conditions is also critical to fight HLB. Because *D. citri* infests relevant citricultures (e.g Brazil and USA) from more than 20 years, scientific understanding of its biology is relatively well established. However, information regarding *T. erytreae* was scarce and thus it became a major objective within the project. Pre-HLB entomologists have studied the life cycle and reproductive biology of *T. erytreae* and have concluded that both are strongly influenced by climatological conditions. For example, population peak of adult psyllids appears in early August in the Porto region. Beyond this, it has been determined that adult psyllids present maximum flying activity in the morning and at night. The flight potential of females is higher than that of males. Long-distance flyers (up to 102 m in a single flight), probably involved in field-to-field dispersal, were also identified. The spatial pattern of *T. erytreae* is aggregated towards the edge of citrus fields, as already described for *D. citri*. The psyllid biology and epidemiological dada obtained indicate that *T. erytreae* may invade most Mediterranean citrus areas.

Regarding the medium-term actions proposed in Pre-HLB, important advances have also been achieved. For psyllid detection, it has been established that standard yellow sticky traps are the most efficient, low-effort and cheapest sampling method for monitoring *T. erytreae*. Analysis from *T. erytreae*-associated bacterial communities indicated that some of the published (and most commonly used) PCR primers to detect *Candidatus* Liberibacters (CLs) in psyllid vectors may be misidentifying the bacteria resulting in false positives. Within the project, based on a newly designed set of gene primers, a cheap and efficient user-friendly field applicable detection protocol, able to detect 100% of naturally-infected samples (either trees or vectors) has been developed. Insect endosymbiont populations from Spain, Portugal and different African countries, are being analysed through next generation sequencing technologies (NGS) to decipher the origin of *T. erytreae* populations present in the Iberian Peninsula. Data indicate that the current populations arise from two different introductions. On the other hand, it seems that *D. citri* arrived in Israel through the illegal import of Kaffir lime, an ornamental citrus commonly used for culinary purposes. So, the fact that in the Mediterranean area at least three independent introductions have occurred raises serious concerns over the entrance of the HLB-associated vectors and/or bacteria through the movement of host plants or budwood from countries where they are already present. In all trapped psyllids the presence of HLB-associated bacteria has been analysed with negative results so far. The location and density of commercial/residential citrus areas in Spain has been compiled and combined with presence/absence records of *T. erytreae*/*D. citri* and environmental data in order to generate an

Europe: Pre-HLB update continued

epidemiological model for HLB-quantitative pest risk assessment. The model, which aligns with the International Standards for Phytosanitary Measures and the EFSA guidance framework, will be updated progressively with data from other regions and psyllid performance in EU conditions. This is being essential for the development of Citrus Health Management Areas (CHMAs) to coordinate area-wide treatments directed to limit the spread of the disease when it arrives.

T. erytreae transmits the African bacterial species (CLaf) in most African countries, while the Asian bacterium (CLas, causing much more severe damage than CLaf) is usually transmitted by *D. citri*. A highly significant Pre-HLB finding is that *T. erytreae* acquires, multiplies, and transmits CLas as well as *D. citri*. This finding is extremely troubling not only for Mediterranean citrus, but also for several African countries where *T. erytreae* is endemic but they do not have yet CLas.

In relation to the development of new pest management strategies, it was determined that *T. erytreae* do not fly in the afternoons, making this timeframe the most suitable to apply insecticide control. Moreover, it was demonstrated that kaolin treatments reduced the number of individuals that settled on plants. Furthermore, kaolin was able to delay sustained phloem sap ingestion by *T. erytreae*, thus reducing the chance of acquiring and transmitting CLs. UV-absorbing nets were also effective for reducing *T. erytreae* landing on covered rows. Biological control of *T. erytreae* was also shown to be efficient at reducing psyllid populations. *T. erytreae* host range and its behaviour in relation to attractive/repellent plants, as well as that of *D. citri*, is currently being investigated. Ongoing Pre-HLB research on other pest management strategies, such as enthomopathogenic fungi, antimicrobial peptides or fusion protein-based bio-pesticides, which have already generated promising results, are expected to open the way to new IPM (Integrated Pest Management) strategies in the coming years. For example, specific peptides contained in artificial diets induced high levels of mortality in *D. citri*.

With the aim of developing long-term strategies to control HLB, different approaches are ongoing. Studies directed to dissect psyllid-citrus-bacterial interactions have already revealed sources of full-resistance to CLas or to *D. citri*. *Murraya* spp. (*Bergera koenigii*) resistant to CLas infection and *Eremocitrus* and *Microcitrus* spp. resistant to CLas infection and partially resistant to *D. citri* infestation are still under investigation to decipher the molecular/physiological basis of their phenotypes. As all these resistant genotypes were uncharacterized genomically, their genomic features are being determined within Pre-HLB. In addition, segregating populations have already been generated between some of the resistant and early-flowering susceptible genotypes. Their challenge-inoculation with CLas (currently ongoing) and parallel GBS (Genotyping By Sequencing) and QTL (Quantitative Trait Locus) analysis of the segregating populations will allow the identification of genes of interest in relation to resistance/susceptibility to CLas. Transcriptomic and metabolomics experiments aimed at analyzing the interaction of CLas with resistant (*Eremocitrus* spp., *M. paniculata* and *B. koenigii*) vs. susceptible genotypes (*Citrus x sinensis*) have been performed and are being analyzed to shed light on HLB-resistance/susceptibility mechanisms. Unraveling the genes involved in HLB-resistance/susceptibility of the different plant genotypes or the psyllid/bacterial effectors responsible for the pathogenic reactions would allow the use of specific genomic regions/genes for the development of biotechnological strategies leading to the generation of somatic hybrids/cybrids and genome-edited new citrus cultivars and rootstocks resistant to the disease, that in the long term is envisioned to be the most cost-effective and durable strategy to control HLB. Furthermore, the discovery of *T. erytreae* viruses and endosymbionts will be potentially useful to develop new strategies to attempt controlling the spread of the disease vector.

Young Scientists in the Spotlight

Dr Arunabha Mitra

Dr Arunabha Mitra is an early-career Postdoctoral Scholar in the Department of Microbiology and Plant Pathology at University of California, Riverside. He received his PhD in Plant Pathology from Washington State University in 2021. At UC Riverside, working with Georgios Vidalakis, he is investigating the effects of citrus yellow vein associated virus (CYVaV) on 12 commercially popular citrus varieties in a replicated field trial funded by the California Citrus Research Board (CRB) and conducting experiments to determine CYVaV transmissibility by natural means such as aphid vectors, pollen, and seed. Preliminary studies with CYVaV at UC Riverside and collaborators at University of Maryland demonstrated that CYVaV has multiple intrinsic properties (small genome size, phloem-limited, mild to no symptoms, high titers) that make it a suitable candidate for applications as an expression vector in virus-induced gene silencing (VIGS) systems against economically important citrus pathogens, such as citrus tristeza virus (CTV) and Huanglongbing (HLB). Data from the field trial at UC Riverside indicates that CYVaV is compatible with Limoneira 8A Lisbon Lemon and Tango Mandarin under field conditions, with successful CYVaV infection persisting up to two years after graft-inoculation, mild to no yellow vein foliar symptoms, and no detrimental effects on either vigor or fruit yield and quality parameters of infected trees. Furthermore, CYVaV presence was detected by RT-qPCR in pollen collected from CYVaV-infected Limoneira 8A Lisbon Lemon and Shiranui Mandarin trees and this pollen was used to hand-pollinate virus-free trees under field conditions. Fruits resulting from these hand-pollinations are currently being tested for CYVaV. The results from this study will be critical towards leveraging federal regulatory approval for subsequent comprehensive field studies with CYVaV-based VIGS vector systems.

Background: CYVaV was first reported in 1957 by Dr. L. G. Weathers (UC Riverside) from four limequat trees in California. Further studies by Weathers in the 1960s demonstrated it to be graft-transmissible to many citrus species and having an ability to interact with other graft-transmissible viruses of citrus that led to variations in intensity of yellow vein foliar symptoms. CYVaV is most closely related to Umbraviruses and in 2021, was classified as a Class 2 umbravirus-like associated RNA (ulaRNA). UlaRNAs are a new category of plant-infecting sub-viral RNAs that encode their own replication-required protein but are coat protein dependent and require a helper virus to complete their infection cycle. Currently, there are three classes of ulaRNAs.

Young Scientists in the Spotlight

Stacey Comstock

PhD candidate in Plant Pathology

Stacey Comstock is a young scientist investigating viral symptom expression in citrus indicators grown in vertical farming towers that have been subjected to light spectra manipulation. She is currently working with her PhD advisor and extension specialist, Dr Georgios Vidalakis, at the Citrus Clonal Protection Program (CCPP) and University of California, Riverside. Using the modular plant growth unit (MPGU), Stacey will explore optimizing biological indexing, a lengthy but required step in the CCPP's new citrus variety introduction in California. In the MPGU, sensitive citrus indicators are grown and indexed in an indoor farming setup, fitted with closed-system recirculating hydroponics, artificial LED lights, and computer controlled environmental conditions set for optimal citrus growth. She is currently investigating viral symptom onset, severity, persistence and host responses of graft-inoculated pathogens on citrus indicators grown with different ratios of red and blue light wavelengths compared to the current CCPP procedure. Additionally, Stacey plans to address a common challenge in biological indexing: mixed viral infections and subsequent virus-virus and/or virus-host interactions that increase, or eliminate, symptom expression in sensitive citrus hosts. In particular, if her MPGU light spectra conditions can alter the historically observed phenotypes of mixed viral antagonistic infections, generating faster more severe symptom expression and reducing the likelihood of false-negatives in biological indexing readings. Her research contributions will help optimize the CCPP's required biological indexing procedure for new variety introduction, meeting the demands for new and exciting pathogen-free citrus varieties in California.

Background:

The majority of disease-free source trees used in citrus propagation in California are introduced, grown, and/or diagnosed by the Citrus Clonal Protection Program (CCPP); one of the key cooperative programs that provide services to the citrus industry, academic researchers and personal collectors. The CCPP uses the Variety Introduction index to detect graft-transmissible pathogens for new citrus varieties which must undergo a quarantine period of disease testing and therapy procedures that include the use of biological indexing (Cal. Admin. Code tit. 3, § 3250 Citrus pests exterior quarantine).

Young Scientists in the Spotlight

Dr. Qiang Li is an associate professor at the Citrus Research Institute, Chinese Academy of Agricultural Sciences (CRIC) / Southwest University. In 2015, he received his PhD from the Laboratoire de Recherche en Sciences Végétales (LRSV) of the Université de Toulouse / the French National Centre for Scientific Research (CNRS), France. In LRSV, Dr. Qiang Li has been engaged in the research on the origin and evolution model of plant reactive oxygen species (ROS) regulatory enzyme systems, as well as the ROS regulation involved in plant stress resistance. He is a major contributor to the establishment and maintenance of RedOxiBase, a database of ROS regulatory networks. In CRIC, he focused on gene mining for citrus bacterial canker disease, identified the functions of these genes through transgenic technology and gene editing, and established the molecular regulatory network of these genes through molecular biology technology.

Dr. Qiang Li and his collaborators have identified multiple disease resistance genes in citrus canker disease and studied their molecular regulatory mechanisms, such as: the ethylene response factor CsAP2-09 confers resistance against citrus bacterial canker by regulating CsWRKY25-CsRBOH2 cascade mediated ROS homeostasis and CsGH3.1L mediated phytohormone biosynthesis; basic leucine zipper transcription factor, CsBZIP40 confers resistance against citrus bacterial canker by repressing CsWRKY43-CsPrx53/CsSOD13 cascade mediated ROS scavenging and activating the CsNPR1 mediated SA signaling pathway; the citrus lysin-motif receptor-like kinases, CsLYK6, enhances citrus bacterial canker resistance via the regulation of CsRBOH5 and CsCAT1-mediated ROS burst; transcription factor CsWRKY22 regulates canker susceptibility in sweet orange (*Citrus sinensis* Osbeck) by enhancing cell enlargement and CsLOB1 expression, etc. Furthermore, several susceptibility genes for citrus canker disease, such as CsLOB1, CsGSTF1, CsGSTU18, CsAPX01, CsAPX02, CsXTH04 and CsPAE2, have also been identified and studied. These studies revealed that candidate genes regulate the resistance and sensitivity to citrus canker disease through ROS signaling and plant hormone signaling pathways, which provides important theoretical basis and genes for the molecular breeding of citrus disease resistance.

Background: Citrus bacterial canker, caused by *Xanthomonas citri subsp. citri* (*Xcc*), is a serious bacterial disease that affects citrus plantations throughout the world. It is a destructive disease of sweet orange, grapefruit, and tangelo. However, kumquat, satsuma mandarin, and ponkan are resistant to the disease. Intensive studies of the differences in resistance-related mechanisms among different cultivars will provide a theoretical basis for citrus disease-resistance breeding and contribute to its targeted improvement. Phytohormones, including salicylic acid (SA) and jasmonic acid (JA), play pivotal roles in the accurate regulation of plant immunity. ROS serve as important signaling molecules, regulating immune activity through multiple mechanisms, including crosstalk with hormone signaling pathways. Altering the hormonal signaling pathways and ROS signaling pathways of citrus may provide beneficial strategies to enhance citrus canker disease resistance.

In Memoriam

Chet Roistacher: Life and Legacy

Robert R. Krueger, Georgios Vidalakis, and John Bash

Although high quality citrus research continues to be performed in California, the decades of the 1950s through to the 1980s can be thought of as the "Golden Age" of citrus research there. Those decades saw the development of much of the production technology currently used, particularly the development of a seminal citrus sanitation and certification program that became the model for such programs throughout the world. Many scientists contributed to the development of this program, most of who have passed on.

Chester N. "Chet" Roistacher, who died in September 2022, was one of the last of that generation of California citrus scientists and the last remaining contributor to the development of the certification program and its technological underpinnings. He was instrumental in the development of thermotherapy and shoot-tip grafting for the elimination of citrus pathogens and the biological indexing techniques to detect them. Chet has also contributed greatly to the health status of citrus industries around the world through his many travels, lectures, writings, and consultancies.

Chet was an early member and eventual fellow of IOCV, serving as Chair from 1989 to 1992 and as Secretary from 1992 to 2007.

Chet Roistacher was born in 1924 in Brooklyn, New York. After serving in World War II, he returned to civilian life and graduated from Cornell University in 1949 with a degree in Plant Pathology. Chet moved to Southern California shortly thereafter and began work as a Technician for Prof Kenneth F Baker at UCLA.

In that era, agricultural research in California was carried out at the Berkeley, Davis, Los Angeles, and Riverside campuses of the University of California. The UCLA program was later moved to Riverside (and much of the Berkeley program to Davis) in response to urbanization pressure. It was while working for Prof. Baker at UCLA with ornamental plants that Chet made his first important contribution to citrus research by working on the development of the "UC System for Producing Healthy Container-Grown Plants", which was published as UC AES Manual 23 in 1957. Though the UC system was originally developed for ornamental plants, it was later adapted for use with container-grown citrus and other crops. The UC system basically consists of phytosanitary practices designed to eliminate production losses due to pathogens and soil conditions. The UC mix, which allowed the production of superior, fast-growing plants, made possible the development of biological indexing methods for the detection of citrus pathogens and thermotherapy and shoot-tip micrografting for their elimination.

Chet transferred from UCLA to the UC Citrus Experiment Station (C.E.S., now UC Riverside) in 1951. He initially worked as a technician for Prof. Leo J. Klotz and subsequently for Profs. Joseph W. Eckert and Max Middleton. In 1954, he began working for Prof E. Clair Calavan on the detection of citrus virus diseases and the establishment of "clean" (uninfected) bud sources. Chet continued this work with Prof, Calavan until Calavan's retirement in 1977 and thereafter with Prof, David J. Gumpf until Chet's retirement in 1986.

The basis for what evolved into the California citrus certification program began with the establishment of the Psorosis-Free Program in 1937. Prior to that, many graft-transmissible diseases were present in California and other citrus producing areas. Psorosis had been identified and named in the late 1890s and caused many production losses in California and elsewhere.

In the early 1930s, Prof. Howard S. Fawcett of the C.E.S. demonstrated that Psorosis could be transmitted by grafting. This led to the development of Psorosis-free bud sources and their use in the industry. The development of a biological index for Psorosis by Prof J. Merrill Wallace of the CES in 1945 made rapid (at that time) detection of the virus possible and contributed towards the development of the certification program. It was during this time period in the 1950s that Tristeza and other diseases of citrus were being demonstrated to be caused by viruses and "virus-like" particles.

This led to a call by the California citrus industry that the University of California assume responsibility for Foundation plantings to serve as high health ("clean") sources of true-to-type scion and rootstock varieties. The result was the Citrus Variety Improvement Program (C.V.I.P.), established in 1957 as a

cooperative effort of the Departments of Horticulture and Plant Pathology. The CVIP was led by Prof. Clair Calavan in Plant Pathology and Prof. Walter Reuther in Horticulture. In 1977, the CVIP was renamed as the Citrus Clonal Protection Program (C.C.P.P.), the name under which it continues to function today.

The C.V.I.P. was a pioneering effort at a scale unprecedented in the citrus industry up to that time. It necessitated the acquisition of land near Exeter in Tulare County for the establishment and maintenance of the Foundation materials. This is now the Lindcove Research and Extension Center (L.R.E.C.). Clean trees were grown and tested at Riverside before being planted for the first time at Lindcove in 1951. Chet Roistacher participated in these activities and had the honor of planting the first tree in the Lindcove Foundation Block.

In order to verify the clean status of the materials produced by C.V.I.P., biological indexing was carried out. Prior to the development of biological indexing assays, verification of the clean status of trees was done by quarantine restrictions or visual inspection. Although these techniques were important in reducing the amount of disease present in California, some diseases were difficult or impossible to detect until they were well established. Biological indexing greatly reduced the incidence of virus diseases of citrus in California.

For biological indexing to be successful, exacting standards of cleanliness and plant growth are necessary. Indexing is best performed in plants grown using the UC system that Chet had a vital role in developing. Indexing must be carried out in greenhouses that are precisely regulated as to temperature and light conditions, as well as being phytosanitarily clean. One of the basic premises that Chet insisted upon was that the quarantine greenhouse be operated under the same detailed and exacting standards and protocols as any other lab on campus. These conditions are what Chet has called the “Plant Laboratory”, a term that recognizes the importance of a well-managed greenhouse program in the production of clean plant materials.

The need for these conditions and for maintaining quarantine items remote from the main citrus growing areas of the C.E.S. is what led the University to establish the Rubidoux quarantine and indexing facility at the base of Mount Rubidoux in Riverside. It was at the Rubidoux facility that much of the technology for both biological indexing and the sanitation of citrus was developed. Chet was instrumental in the development of these technologies, as were his colleagues in Prof. Calavan’s laboratory-- Richard Blue, Reg Wagner, and Joe Goodale-- along with Ed Nauer from the Department of Horticulture.

Many of the standard biological indexing techniques and indicators were established by research performed at the C.C.P.P. Many of the biological indexes were developed by the C.V.I.P. and Chet was instrumental in screening many different potential indicators, selecting the most sensitive and documenting the symptoms. Among the diseases that Chet and his associates developed assays for were exocortis, cacahexia, dweet mottle, tatterleaf, and vein enation. These assays are still used around the world in conjunction with laboratory-based tests.

Prior to the C.V.I.P., pathogens were eliminated from nursery stock by visual inspection or the selection of nucellar seedlings. Two important new pathogen elimination techniques were developed by Chet and C.V.I.P. personnel: thermotherapy and shoot-tip grafting. Chet and his associates extended the early attempts at thermotherapy by Lin in China and Grant in Florida, developing the thermotherapy methodology that is still used today throughout the world. They documented that different viruses and viroids had varying levels of susceptibility to heat, that certain rootstocks are more heat-resistant and thus suitable for use in thermotherapy, and that preconditioning plants at high temperatures improved survival of the host plant.

Although thermotherapy was a major advance in the sanitation of citrus propagative materials, it is not effective against all pathogens. In particular, viroids are difficult to eliminate using thermotherapy. Shoot-tip grafting is effective against viroids as well as other pathogens. Many crops rely upon meristem culture for the elimination of pathogens. However, meristems of citrus could not be cultured, even by the renowned tissue culturist at UC Riverside, Prof. Toshio Murishige. Murashige conceived the original concept of micro-grafting meristems onto small seedlings grown aseptically. This technique was refined

Chet Roistacher: Life and Legacy continued

and perfected by a team consisting of graduate student Luís Navarro from Spain, Chet, Chet's associate Teresa Carson, and Prof. Murashige. The paper documenting the shoot- tip grafting technique won the prestigious Wilson Popenoe award for outstanding research paper in horticultural science in 1975. Chet and his associates later showed that shoot-tip grafting was effective in eliminating other citrus pathogens in addition to the exocortis viroid. Shoot-tip grafting was adopted for use around the world in citrus certification, sanitation, and importation programs. The two techniques pioneered by Chet and his associates in the Calavan group remain the standards for citrus pathogen elimination.

Chet retired from the University in 1986 but remained active. He was particularly active in spreading knowledge regarding graft-transmissible pathogens of citrus, their detection, and the establishment of "clean" sources of propagative materials through formal and informal consultations in many different countries under the auspices of the World Bank, the Food and Agriculture Organization of the United Nations, US-AID, GTZ, and at the invitation of local growers and industry groups. Chet conducted a short course in citrus pathology for 26 consecutive years at the Institut Agronomique Mèditerranèen at Valenzano, Bari, Italy. This short course is aimed at students in the Mediterranean and Arabic countries and has been important in improving the phytosanitary health of those countries.

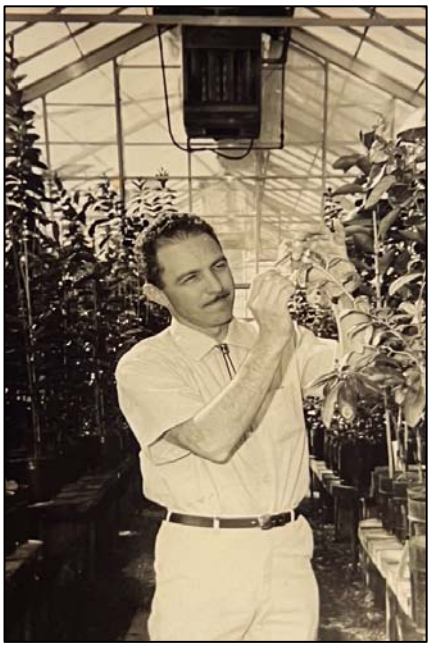
Chet is an author on more than 200 publications since 1951 on citrus virus and virus-like diseases and their control. Perhaps most influentially, he authored the "Handbook for Detection and Diagnosis of Graft-Transmissible Pathogens of Citrus" published by the United Nations FAO in collaboration with the IOCV in 1991. This remains the standard reference devoted to biological indexing for citrus pathogens. The section regarding greenhouse indexing facilities was also incorporated into other FAO handbooks that deal with indexing.

Chet also authored "A Historical Review of the Major Graft-Transmissible Diseases of Citrus" published by FAO in 1995. This is a very useful overview of the discovery of the various citrus pathogens and the development of techniques for their diagnosis. He also contributed many informative slideshows to Ecoport < http://www.ecoport.org/ep?SearchType=displayMenu&menuName=Resources&submenuName=Slideshows > (accessed 2023-06-20).

Remarkably, Chet's considerable career accomplishments were achieved as a Staff Research Associate (SRA) at UCR. Obviously, the support of his faculty supervisors was critical, but Chet's intuition, initiative, and perseverance led directly to his substantial contributions to citrus pathology. These contributions were recognized by the bestowal of an Honorary Doctorate (DSc) by the Council of the Senate of the University of Pretoria, South Africa in 1999.

Away from work, Chet was an avid musician who especially enjoyed playing classic American folk music on his mandolin. Other enjoyments included fishing and spending time with his family in the Sierra Nevada and local San Jacinto Mountains, where Chet's ashes were scattered near his beloved cabin. He was preceded in death by his wife Jeanne Roistacher and his son Mark Roistacher, and is survived by his four daughters – Robin Kinzer, Sandy Roistacher, Leslee Menke, and Dawn Frier – seven grandchildren and two great grandchildren.

Chet's passion and dedication remained undiminished his entire life. Chet's body of work over the course of his career remains impressive and serves as a source of inspiration to those of us in subsequent generations. It can truly be said that without the career of Chet Roistacher, the California and world citrus industries would be much the poorer.



Chet in the greenhouse

Chet planting the first CCPP Foundation tree at Lindcove in 1961

Chet picking oranges

Chet with Joseph Bové and Núria Duran-Vila

Chet at Centro de Saneamiento, Argentina

Chet playing tourist

Remembering my beloved friend Chet Roistacher

Luis Navarro

In February 1973 I began working in the laboratory of Professor Murashige of the Department of Plant Sciences at the University of California, Riverside. The objective of my work was to develop a routine and efficient technique of shoot-tip grafting *in vitro* (STG) to recover citrus plants free of all graft transmissible pathogens and without juvenile characters. I was using a small greenhouse cabin for my experiments, which were more successful than expected, and soon this cabin became full of shoot-tip grafted plants. Additionally, I needed to know if the pathogens that infected the mother plants had been eliminated after STG. For a long time, I was asking Prof. Murashige for more greenhouse space and specially to establish a collaboration with someone from the Department of Plant Pathology to index my plants. He was reluctant to these demands because, as I found out later, his relationship with this Department was not very good.

Finally, one morning he said to me, "Luis, tomorrow we are going to visit Chester Roistacher at the Rubidoux greenhouse". I only knew Chet by his name from his papers on the elimination of citrus pathogens by thermotherapy, a technique in which he was likely the best expert and that was effective to eliminate all citrus pathogens except Exocortis and Cachexia.

The first time I met Chet Roistacher was on Tuesday, September 4, 1973, at the Rubidoux greenhouses of the Department of Plant Pathology. In this meeting we proposed to him a collaboration to develop a new technique to eliminate all citrus pathogens that, if successful, would make his thermotherapy technique obsolete. The challenging proposal was made without any additional budget available or prior approval from his Department supervisors. Surprisingly, it took him only a few seconds to say, "I will buy it". This was the beginning of a long and fruitful collaboration and friendship between us.

The only problem that he initially considered was the transfer of plants from the Plant Science greenhouse. He was afraid that they might be contaminated with Phytophthora, which could spread throughout his greenhouses. Finally, he accepted that we could bring the plants, which were placed in trays on an isolated bench the following Monday, with additional disinfection to minimize the risk of contamination. Fortunately, contamination never occurred.

From that day on, I transplanted all new shoot-tip grafted plants directly at the Rubidoux greenhouses, which I visited weekly. During almost a year I had the opportunity to know Chet in depth and discovered his wonderful personality on both personal and professional levels. At that time, I had no idea about biological indexing on indicator citrus plants, but slowly, in each visit he taught me all the details involved. A basic requirement of this procedure was to grow high quality plants, which in his case was based on the use of the famous UC potting soil mix, a continuous fertilization with watering, and an extreme sanitation and care of the plants. I always kept these concepts in mind and applied them throughout my scientific career, not only for pathogen indexing, but also for all biotechnological research. This experience revealed Chet's passion for teaching everything he knew to help others.

My visits often ended with a taco lunch at a nice place nearby, before Chet disappeared to have his daily 20-minutes nap in the car. He could not believe that a Spaniard like me never took a nap.

Chet´s greenhouses were gradually invaded with my plants. I transplanted about 700 micrografted plants, but including the corresponding indexing plants, several thousand STG-related plants were grown. We were very excited when the first indexing results indicated that the technique was eliminating all the pathogens tested. The highlight was when the results showed that Exocortis, a disease that could not be eliminated by thermotherapy, was easily eliminated by STG.

By the end of May 1974, I had a fairly advanced draft of the manuscript on STG, but I was not very happy with the description of the complicated technique. I wanted any reader to be able to reproduce it without any hidden information. I mentioned this to Chet and he was enthusiastic about the idea. For

Remembering my beloved friend Chet Roistacher continued

this purpose, he invited me to spend a weekend at his beautiful cabin in the Idyllwild mountains, where we worked out every detail of the manuscript (Picture 1). I returned to this cabin several times during my trips to California (Picture 2).

The next step was that Chet wanted to learn how to do STG by himself. For three weeks in June, I showed him how to do it. I was amazed at how quickly he learned, especially considering that he had never done any tissue culture work before. Indeed, after I left for Spain at the end of June, Chet introduced the technique into the Californian Citrus Protection Program (CCPP), as he proudly told me. The paper was published in 1975 in the Journal of the American Society of Horticultural Science. We received from this Society the Wilson Popenoe Award for excellence in research with tropical and subtropical evergreen tree fruit and nuts, an important recognition that made us feel very proud (Picture 3).

Before I left, Chet talked to me about the International Organization of Citrus Virologists (IOCV) and strongly recommended me to become a member of this society, attend its seventh conference, to be held in Greece the following year, and present our STG results there. I followed his advice and this was the beginning of my fruitful and rewarding relationship with the IOCV. At that time, we did not imagine that, years later, both of us would become Presidents of the Society.

In July, 1974, I returned to my research institute in Spain, where I worked for only two months before leaving for California. I was assigned to start a sanitation Program to recover pathogen-free plants of the citrus varieties grown in Spain by STG. This program had the highest priority for our citriculture due to the huge damage caused by many different pathogens. I was at the Department of Citriculture to develop the tissue culture work, but indexing was the responsibility of the Department of Plant Protection, which at that time had not yet developed reliable procedures. I had intense discussions on this matter with the Director of the institute and explained him that the lack of proper indexing procedures was a major bottleneck for the development of the Program, and that the staff responsible for it would be unable to solve the problem. Then one day he asked me if I was ready to take care of the indexing with my new young inexperienced group. This proposal was like a thunderstorm in the institute, but I took Chet's help for granted and immediately accepted the challenge.

As expected, I easily convinced Chet and obtained the funds to invite him for a three-month consultation, just before the 1975 IOCV Conference, to come to Valencia to train my staff and establish the procedures for reliable citrus pathogen indexing under our local conditions. It was wonderful to see how quickly the previous practices in the institute were changed, enthusiastically following all Chet's advice to create new indexing facilities operating as close as possible to the Rubidoux system. We even imported from Canada the same peat moss used in California. The first groups of indicator plants were inoculated, and after returning from the IOCV Conference we all celebrated the clear and fantastic symptoms caused by several diseases in the new conditions, thus confirming the success of Chet's advice.

These three months were also a wonderful opportunity for social activities. We changed the taco lunch for a daily typical Spanish "bocadillo" and frequent dinners at home which always ended with Chet singing and playing his mandolin.

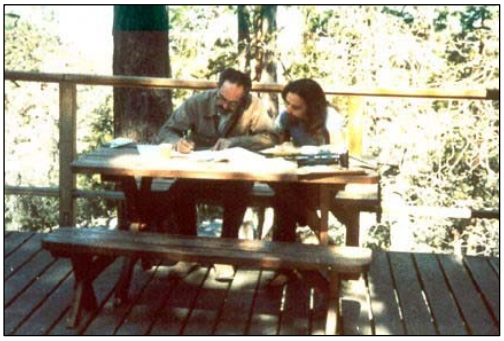
During the IOCV preconference in Israel and the conference in Greece, Chet was my cicerone, introducing me to the most famous citrus virologists. This Conference was a highlight in my career because I suddenly found the incredible atmosphere of friendship and cooperation among IOCV members, which was a unique forum for international knowledge exchange and technology transfer on citrus diseases and their control.

Remembering my beloved friend Chet Roistacher continued

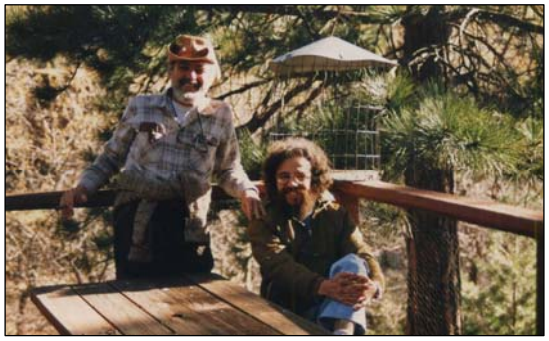
During the conference sessions, we presented extensive results on indexing of the micrografted plants that confirmed the elimination of all citrus pathogens tested. We were still anxious to know if Cachexia, which could not be eliminated by thermotherapy, would be eliminated by STG. Indexing of this disease (at that time its viroidal etiology was not known) on Parson´s Special mandarin grafted on Rough lemon required 1.5-2 years. The first results arrived by cable from Riverside during the preconference and they showed that all 66 micrografted plants were free of this disease that infected the original plants. This Conference was the beginning of the widespread use of STG throughout the world, stimulated by the activities of both of us, teaching and demonstrating the technique and its application to scientists from many different countries.

From that time on, I was in constant contact with Chet, initially through long letters and later through e-mails, exchanging information, ideas and advice. We met regularly at IOCV meetings, during my visits to Riverside, and in Spain where I invited him several times to teach in our international Citriculture Master Course. This was the basis for the very deep friendship that we developed over the years.

The last time I saw Chet was in March 2019 at the IOCV conference held in Riverside. We were both invited by the organizer, Dr. Vidalakis, to give two open Conference talks. Chet talked about the history of IOCV and I talked about the history of STG. At this opportunity, we really enjoyed remembering old times and recognizing how our collaboration helped to control citrus graft transmissible diseases worldwide (Pictures 4 and 5). Chet's death left a major void among his friends and IOCV members. I will never forget him.



Picture 1



Picture 2

Picture 3

Picture 4

Picture 5

In Memoriam

Tribute to Chet Roistacher

Dr Richard Lee

Chet Roistacher embodied the spirit of IOCV; he was involved with developing the principles used worldwide for the citrus certification program: developed the use of pasteurized potting media suitable for citrus, helped develop the shoot tip grafting technique used universally today to rid citrus of graft transmissible pathogens, published a handbook on detection of citrus virus and virus-like diseases for The Food and Agricultural Organization of the United Nations/IOCV which is the "bible" for biological indexing of citrus graft transmissible diseases, freely offered advice and training to those requesting, and served as a mentor for many young scientists, including myself. As an example, I will relate how Chet helped us and the University of Florida Citrus Research and Education Center (CREC) obtain high quality greenhouses for research on the Citrus Blight.

Dr. Ron Brlansky and I were hired at CREC to solve the citrus blight problem, which was taking 15 per cent of trees on rough lemon, the most common rootstock used in the Flat woods of Florida, out of production yearly. Citrus blight (CB) is a true recalcitrant disease of citrus. In 1987, we had successfully graft transmitted CB to healthy trees by use of approach root grafts. I had related this success to Chet, he then sent a letter to Dr. Brlansky and myself suggesting that maybe we could find an indicator plant for CB by grafting various indicator plants under greenhouse conditions. With the support of the Center Director, Dr. Kender, we invited Chet to come to help us initiate the trial. In preparation, we obtained seed for the varieties he had suggested and had seedlings ready. Chet arrived in July and was dismayed at what he observed. Our greenhouses at CREC were old, built in the 1920s. They lacked adequate cooling and had no heat. The wood benches were decaying and falling apart. Requests for repair of cooling and renovation of benches placed in the CREC shop over two years had been ignored. Our screenhouse was made of wood and near collapse. We were not using UC mix as a potting media.

Chet took pictures, explained all the problems (of which we were already aware), then wrote a letter to Dr. Kender explaining the importance of having suitable facilities in which to conduct research. At the time, the Florida citrus industry had no organized program with which to help fund production research. Some of the citrus industry leaders would make contributions to help some research programs but this was an unreliable source of research funds. Dr. Kender wrote a letter to the industry explaining the problem with lack of research funds for CB and the need to have quality greenhouses for CB research. Contributions started coming in, many initially were small donations. Once $50,000 had been received, the Florida Citrus Mutual became involved with the fund raising and a total of $140,000 was soon raised. The CREC Blight Research Greenhouse Complex with four greenhouses, a headhouse, and a concrete sidewalk connecting the facilities was dedicated on May 19, 1989.

During the fund-raising campaign, the Florida citrus industry realized that while they were paying a box tax for post-harvest research which, by law, could not be used for production research, citrus production research was not funded. This eventually led to a box tax for production research which exists now as the Florida Research and Development Foundation (https://citrusrdf.org). The benefit of Chet's visit to Florida was great.

Chet has published eight books which are available on Amazon, just search for Chester Roistacher. He was working on a 9th book about his mountain cabin, which I don't think he finished.

In Memoriam

In memory of a good man and a dedicated citrus virologist: Dr Fanie van Vuuren (1941-2022)

Dr Fanie van Vuuren with his wife Bets

The IOCV has always been a small group of passionate people that become friends while going about the business of citrus virology. Fanie van Vuuren attended each of the IOCV conferences since 1989 and fittingly his last conference was in 2013 in South Africa. His presence could not be overlooked as he stood head-and-shoulder above most delegates. This gentle giant was known and loved by many and his life's work left an indelible mark on the southern African citrus industry.

Fanie started his career in citrus virology directly after school in 1960 as a learner technician at the Department of Agriculture, stationed in Nelspruit. He worked himself up through the ranks and obtained his PhD (Agric) at the University of Natal in 1998 when he was also promoted to Specialist Researcher at the Agricultural Research Council (ARC). Fanie left the employ of ARC after 43 years' service to join Citrus Research International (CRI) in 2003 and he finally retired in March 2017. He worked 57 years in the South African citrus industry, testifying of his passion.

These 57 years were mostly dedicated to the protection of the industry from graft transmissible diseases. Fanie's work was integral in the establishment of the South African Citrus Improvement Scheme (CIS). Having learnt from Dr Hannes de Lange and Chet Roistacher, Fanie continued with virus elimination using shoot-tip-grafting. Fanie also did all the initial biological indexing following STG to ensure pathogen free material was entered into the CIS. Additionally, Fanie was integral in the establishment of the citrus tristeza virus cross-protection programme as the early years of grapefruit production were severely affected by stem pitting. The CTV sources initially used in the programme were empirically selected by Fanie through numerous field trials. The first bud-wood supplied by the CIS Citrus Foundation Block in 1984 already contained the selected mild CTV sources. Fanie's inputs contributed directly to South Africa's world-class Citrus Improvement Scheme and one of the healthiest citrus industries in the world.

Fanie's further citrus work entailed investigating the application of viroids as dwarfing agents and various aspects of the control of African greening (Huanglongbing) of citrus.

Fanie received notable awards during his career including the International Society of Citrus Nurserymen's Certificate of Appreciation in 1993; the South African Citrus Nurserymen's Association's Amanzi Estate Award for outstanding services in 1995; the President's Award of the ARC in 1998. During his 14 years of dedicated service to CRI, Fanie received CRI's Citrus Grower's Award for Outstanding Services in 2006, as well as the International Organization of Citrus Virologists' special recognition for his longstanding service to Citrus Virus Research in 2013. CRI recognised Dr Fanie van Vuuren's lifelong dedicated service to the citrus industry of South Africa, and the CIS in particular, by naming the CIS facilities at CRI in Nelspruit the "Dr Fanie van Vuuren - Citrus Improvement Scheme Laboratory and Nucleus Block" on 1 June 2017.

Apart from Fanie's research and service contributions, many colleagues in industry are proud and honoured to have had Fanie van Vuuren as a mentor. To his peers and protégés, his example of Christian values, gentle humility, impeccable work ethic, scientific discipline and unwavering integrity is perhaps Fanie's greatest legacy. Those who worked with Fanie would all attest to this contagion of goodness.

We celebrate his life and his contribution to citrus.

Tribute by Glynnis Cook

In Memoriam

Professor Chong Ke

The IOCV committee is sad to announce the passing of our colleague Prof. Chong Ke on Jan. 7th, 2023, 35 days after his 99th birthday on Dec. 3rd 2022.

Prof. Ke graduated from the Agriculture Department of Fujian Xiehe University in 1949 and got his master's graduate certificate, major in plant pathology, from the Research Academy of Lingnan University in 1953, then he successively served as Assistant Professor, Lecturer, Dean of Plant Protection in the Department of South China Agricultural University until 1976 in Guangzhou, Guangdong province. He then moved to his hometown Fuzhou of Fujian province to serve as a Deputy Director at the Institute of Fruit Trees, Fujian Academy of Agricultural Sciences (FAAS) from 1976, then was President of FAAS from 1983-1985, Coordinator of an UNDP-FAO project (Study on the Control of HLB in Asian Pacific Area) from 1989-1990, and Chief of the Fujian Science Foundation Committee from 1993-1995.

Before 1976, he focused on the study of mosaic diseases of cruciferous vegetables in South China with many achievements. In the 1950s', as a member of Prof. Kongxiang Lin's group, he joined a series of experiments to exclude the possibility of HLB as a physiological disease, thus Prof. Lin proposed it as a virus disease after his group proved the graft-transmissible property of the HLB pathogen. In 1979, Prof. Ke was the first in China to observe the pathogen of Citrus Huanglongbing (HLB) via transmission electronic microscope, proved that it was a kind of prokaryote called a Rickettsia-like organism which was getting close to the current *Candidatus* Liberibacter spp., found periwinkle as a herb host of the HLB pathogen, and mentored a few master degree students. As a Chinese state expert, he visited Cuba, Japan, and the USA in 1965, 1977 and 1979, respectively. In the 1980s' and 1990s', Prof. Ke led eight state/provincial research projects focused on the control of HLB and virus diseases of fruit trees, published more than 40 scientific papers related to the HLB issue, directed the editorial board for the "Journal of FAAS" and the "Newsletter of Fujian Society for Plant Pathology", and led two provincial societies and one sub-society for East China related to plant protection and plant pathology and was also a long term member or executive member of those national societies. He was awarded many honors including a First-class Prize of MOA Sci. & Tech. Progress Award in 1990, and a Second-class Prize of Fujian Sci.& Tech. Progress Award in 1997, and a Second-class Prize of National Sci.& Tech. Progress Award in 1992 for his outstanding contribution on comprehensive control of HLB. He received the Plaque of Honor of the Advanced staff of FAAS for Agriculture Sci. & Tech. for the 60th anniversary of FAAS in 2020.

Prof. Ke was a long-term member of our IOCV family. In 1995, as Chairman of the Local Organizing Committee, he closely cooperated with Prof. Xueyuan Zhao from the Citrus Research Institute (CRI) of CAAS and led the hosting of the 13th IOCV Conference in Fuzhou with a post-conference tour in Sichuan. During that conference, Profs. Bove, Ke and Zhao et al. raised a motion of HLB as scientific name for remembering Prof. Kongxiang Lin's outstanding contribution.

Since the 13th IOCV Conference I am glad to know him who was both socialist-minded and professionally competent, an outstanding orator who will be deeply missed. He is survived by his two daughters and their families.

Tribute by: Changyong Zhou (Former IOCV Chairman, CRI, Southwest University, PRC)
Guocheng Fan (Director of Plant Protection Institute, FAAS, PRC)

Upcoming Events

Advertise your event in the IOCV newsletter
email iocvsecretary@gmail.com

March 2024

International Research Conference on Huanglongbing
Riverside, California, United States
26-29 March 2024
Abstracts due 25 September 2023 – submit at
https://www.cvent.com/c/abstracts/92328f2a-d724-4114-b7a1-79778fa17ecd

March 2025

IOCV conference
Mildura, Australia
Watch this space….

2025

International Society of Citrus Nurserymen's conference
South Africa

Conference update

The next face-face IOCV conference will be held in AUSTRALIA.

We look forward to welcoming you to Mildura, on the banks of the Murray River in the Sunraysia citrus growing region. Mildura is a vibrant regional city surrounded by wineries and fruit growing farms. This will provide an ideal location for our IOCV family to reconnect, share knowledge and discuss how best to protect our global industry from citrus diseases.

Key Dates

Abstracts open: June 2024

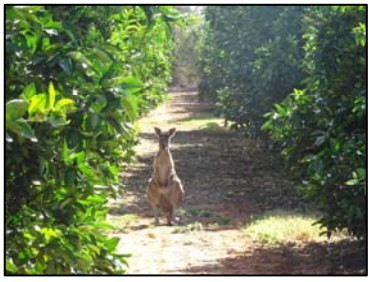
Registrations open: June 2024

Abstract deadline: Nov 2024

Conference: March 2025

Mid-conference tour: Auscitrus and NSW DPI facilities, local nurseries, and orchards

Auscitrus propagation scheme



NSW Department of Primary Industries Institute

Travel to Mildura: there are direct flights to Mildura from major capital cities within Australia.
Travel to venue: there are accommodation options within walking distance of the conference venue.
Weather: in March the average daily temperature is 28°C, minimum 14°C
Post-conference tour – Riverland growing region followed by McLaren Vale, South Australia.

Consider taking a holiday after the conference – COME AND SAY G'DAY https://www.australia.com/en