

Plant Virology for the Citrus and Grapevine industries at the University of Pretoria

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Pro-active strategies to prevent the introduction of viruses to new plantings and new areas are amongst the most efficient control methods for plant virus-induced diseases as it is very difficult and expensive to control them once they are already present. Foremost amongst these strategies are phytosanitary regulations and certification schemes, both of which ensure that healthy status of propagation material.

To ensure that these strategies continued in the local citrus industry after the retirement of Dr. Fanie van Vuuren, formerly plant virologist at the ARC-Institute for Tropical and Subtropical Crops (ARC-ITSC), the South African Citrus Growers Association (CGA) via Citrus Research International (CRI) established a Plant Virology program in 2004 in collaboration with the Microbiology and Plant Pathology Department of the University of Pretoria (UP). This is housed at UP.

Research at this unit (CRI@UP) is directed at support of the South African Citrus Improvement Program (CIP) as well as the Wine Grape Certification scheme. Winetech, the wine industry research co-ordinating body, supports the grapevine research component financially. In both schemes virus control plays a central role, with citrus tristeza virus (CTV) being the most important virus in the citrus scheme, and Grapevine leafroll associated virus type 3 (GLRaV-3), the most important one for the wine grape scheme. Both of these viruses belong to the Closteroviridae family but CTV is in the Closterovirus genus and is aphid transmissible, while GLRaV-3 is in the genus Ampelovirus and is mealybug-transmissible. The differences in mode of transmission require that the respective certification schemes employ different strategies for control of these viruses. As CTV is easily and rapidly transmissible by highly mobile aphid vectors, citrus material from which viruses have been eliminated are protected against CTV infection in the field through the pre-inoculation of planting material with mild CTV strains. In contrast with this, wine grape material is subjected to virus elimination techniques and then propagated under conditions to minimize re-infection. This approach is possible as the re-infection takes place relatively slowly as mealybugs are generally sessile and it is possible to provide essentially "virus-free" propagation grapevine material. Neither strategy is foolproof. In citrus the cross protection by mild CTV strains is not always durable and severe CTV symptoms may occur with time. While, in grapevines the certified planting material is often re-infection by GLRAV-3 when healthy planting material is established in the field.

Research projects at CRI@UP are directed at doing basic and applied studies to understand and control 1) the occasional lack of CTV cross protection durability, 2) GLRaV-3 re-infection of certified material, and 3) improving methods to detect graft-transmissible pathogens of citrus and grapevines for improved quarantine and pathogen elimination with the certification schemes.

With these objectives in mind four MSc. students are currently studying aspects of the above; 1) Katherine Stewart is establishing techniques to differentiate CTV strains in order to study the dynamics of CTV strains within the mild strain cross protecting populations under different environmental conditions, 2) Orienka Koch is identifying pathogens spreading within certified material of the wine grape certification scheme, 3) Aletta Kotze is studying GLRaV-3 variability in order to develop molecular markers with which to monitor the spread of the virus in vineyards, and 4) Baby Phahladira is developing a protocol for the detection of "Candidatus" *Liberibacter africanus*, the causal organism of African greening of citrus. Gerhard Pietersen is study leader to all of the above and is also busy establishing a comprehensive diagnostic capability to the graft-transmissible pathogens of citrus, and is studying the epidemiology of GLRaV-3 in the wine grape certification scheme.