# Fourth Conference of the International Working Group on Legume & Vegetable Viruses, Antequera, Malaga, Spain

Denis Persley
Australian Plant Virology Group

Project Number: MT10704

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# FINAL REPORT - HORTICULTURE AUSTRALIA LIMITED

## PROJECT NUMBER: MT10704 – 15 August 2011

### 4th CONFERENCE of the INTERNATIONAL WORKING GROUP ON LEGUME AND VEGETABLE VIRUSES (IWGLVV)

May 17-20, Antequera, Malaga, Spain

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## Media summary

Denis Persley, a principal plant virologist and leader of HAL project VGO 7128 Integrated management of viral diseases in vegetable crops, attended the Fourth Conference of the International Working Group on Legume and Vegetable Viruses (IWGLVV) from May 17 to May 20, 2011 in Antequera, Spain

The Conference provided new information on a range of endemic virus and potential disease threats to the Australian vegetable industry. The objectives of the travel were met by maintaining and establishing new contacts in the areas of plant virology and plant pathology. New information was obtained on the biology and management of viruses affecting capsicums, cucurbits, beans and lettuce, including management of resistance –breaking strains, insect vector management and disease resistance.

New information and relevant contacts will better equip Australian virologists to identify and manage disease threats presented by Pepino mosaic virus, whitefly transmitted criniviruses and begomoviruses and viroid diseases which continue to spread throughout most vegetable production areas worldwide.

A conference field visit provided a valuable insight into the successful management of insect transmitted viruses in the Almeria region of Spain which large volumes of vegetables under protected cropping for export throughout Europe.

Attending this meeting of 100 scientists with similar interests allowed access to information and contacts which would take at least some years to obtain and develop through other methods. The information obtained is valuable in meeting current and future project objectives designed to provide practical management of viral diseases in the vegetable industry.

## Introduction

The 4th Conference of the International Working Group on Legume and Vegetable Viruses (IWGLVV) was held in Anteguera, Malaga, Spain from May 17 to 20 2011. The meeting was organised by the International Working Group on Legume and Vegetable Viruses which is linked to the International Society for Horticultural Science and operates through a steering committee. The current members of the working group are:

President – Dr HJ Vetten, Institute of Epidemiology and Pathogen Diversity, Braunschweig, Germany.
Secretary – Dr Scott Adkins, USDA, Fort Pierce, Florida USA.
President – elect: Dr JA Walsh, University of Warwick, Wellesborne UK
Secretary – elect: Dr Hanu Pappu, Washington State University, Pullman WA USA

The objectives of the IWGLVV are the distribution of information among group members through the exchange of an annual report; exchange of antisera, germplasm and diagnostic protocols to support virus disease management worldwide and the organization of international meetings open to both members and non-members.

The Conference website is www.eelm.csic.es/iwglvv

The chairperson of the organizing committee was Jesus Navas-Castillo (inavas@eelm.csic.es)

The IWGLVV meetings are held every three years, with the last meeting being in August 2008 at Ljubljana, Slovenia.

The focus of the meeting in Spain was to share and discuss recent work on the identification, epidemiology and management of viruses infecting vegetables and legumes worldwide. The meetings had an applied focus and many participants work in the areas of virus disease identification and developing management systems for important diseases in vegetable crops, including legume crops such as peas and beans.

## Expected outcomes/ achievements and relevance to industry

The IWGLVV meeting provided an excellent opportunity to access the latest information on the epidemiology, ecology and management of virus diseases affecting vegetables. It provided a valuable opportunity to meet and establish contacts and collaborations with scientists with similar interests worldwide and allow access to methods, results, diagnostic assays and germplasm long before these become available through publication and formal release.

The conference program was very relevant to current and proposed work undertaken for the vegetable industry. I led project VGO 7128 Integrated management of viral diseases in vegetable crops and have a VC funded project approved to continue

work on the adoption of integrated viral disease management in the vegetable industry under the industry development plan. I am also the plant virologist responsible for the virology component of VGO 10081 which supports work with Syngenta Seeds on the development of capsicum hybrids with resistance to the tospoviruses, Tomato spotted wilt virus and Capsicum chlorosis virus.

## Specific outcomes from the conference

*Biology and management of tospoviruses*: A presentation by Rubio examined the development, dispersal and management of strains of Tomato spotted wilt virus which are able to overcome the *Sw-5* and *Tsw* resistance genes in tomato and capsicum, respectively. This is an increasing problem worldwide, particularly in capsicum where the *Tsw* gene appears more vulnerable to new virulent strains. Effective management includes reducing virus pressure through crop and farm hygiene, thrips management and limiting the use of resistant hybrids in areas where resistance breaking strains occur as these hybrids may increase the frequency of virulent genotypes within the virus population.

Workers in Florida have identified a novel reassortment of two tospoviruses, Groundnut ringspot virus and Tomato chlorotic spot virus following full genome analysis of the Groundnut ringspot virus introduced into Florida. The work indicatres that viral recombination may be more common among tospoviruses than originally thought which presents potential problems with detection and management, particularly through resistance.

*Virus diseases of vegetable cucurbits*: These viruses are a major constraint to the production of vegetable cucurbits and melons in many countries, including Europe, the Middle East, North Africa, USA south east Asia and Australia.
Management is difficult because of the active vectors involved, the lack of resistant germplasm to most of the viruses, the production systems in tropical regions favouring year round production and the presence of virus complexes in several instances.

The major viruses affecting cucurbits worldwide are**:**

**Whitefly transmitted viruses**
Squash vein yellowing virus
Cucurbit leaf crumple virus
Cucurbit yellow stunting disorder virus
Cucurbit chlorotic yellows virus
Beet pseudoyellows virus
Watermelon chlorotic stunt virus

**Thrips transmitted**
Watermelon silver mottle virus
Watermelon bud necrosis virus
Melon yellow spot virus

**Aphid transmitted**
Cucurbit aphid borne yellowing virus
Papaya ringspot virus-W
Watemelon mosaic virus
Zucchini yellow mosaic virus
Cucumber mosaic virus

**Seed transmitted**
Cucumber green mottle virus
Squash mosaic virus

Work on developing management systems for these viruses include reflective mulches, improved methods of crop destruction to reduce inoculum levels, insecticide applications, host resistance barrier crops and the identification of alternative weed hosts. In Florida, a decision support system has been developed to help growers select appropriate management systems based on local virus and insect vector pressure and weather forecasts.

Recent work with most of the above viruses was discussed and proved valuable for future work with those present in Australia and for an increased awareness of potential incursions.

*Whitefly transmitted viruses*: Viruses in the crinivirus and begomovirus families are all transmitted by whiteflies (*Bemisia tabaci* or *Trialeurodes vaporariorum*. Viruses within these groups are causing major losses in vegetable crops worldwide, including cucurbits, solanaceous crops, beans and lettuce. Although seed transmission is not known within the groups they have been widely dispersed by the whitefly vectors which are highly invasive and easily dispersed in plant products and by weather disturbances.

The begomovirus Tomato yellow leaf curl and the crinivirus Beet pseudoyellows virus are present in Australia and the risk of further introductions is high. Conference presentations discussed current work on the detection, epidemiology and management of these viruses, providing valuable information to aid early detection of incursions and how best to manage these economically damaging viruses.

*Virus detection techniques*: A technique called deep sequencing allows the detection of unknown viruses, viruses with low concentration in plants and separation of viral disease complexes. Deep sequencing is based on RNA silencing in plants which is a fundamental antiviral defence mechanism in which host enzymes cut viral RNA into pieces of 20 -24 nucleotides. When isolated and sequenced and properly aligned and analysed by bioinformatics systems these virus derived small RNA sequences can provide genomic sequence information of the viruses been targeted in the plant. This approach to pathogen identification is independent of the ability to culture or purify the virus and does not require specific amplification of viral nucleic acids. Deep sequencing can be used to resolve the cause of new virus diseases, experdite the testing of nuclear stock of vegetatively propagated crops and detect viruses in insect vectors. As the cost of the method is decreasing and economies of scale are developing with multiple samples the method promises to become a powerful tool in the identification of viral and other plant pathogens.

*Field visit to Almeria region*: Spain is a major producer of vegetables for the European market and a visit to the Almeria production area in southern Spain was made during the conference. This area has probably the largest area of greenhouse production anywhere in the world, covering approximately 25 000 ha. The region is desert like and situated along the Mediterranean coast between the foothills of the Sierra Navada and the Meditterranean Sea. The first greenhouse were built over 40 years ago. The area is largely operated as small farms, with the average area being 2 ha, although there are several operators with up to a 1000ha of greenhouse.

Although the farms are generally small, growers operate as several successful cooperatives who handle marketing, supply of products and crop management advice.

The typical greenhouse is a “parral”-a structure that is semi-open, unheated with a plastic covered rectangular wire frame. Most greenhouses have roof ventilation and netting on the walls for insect management and maintaining bees for pollination in the greenhouse. Soils in the area are calcareous and of low nutrient status. Crops are grown in a sand compost mix. Water quality is often poor with salinity a problem in some areas. Water use is 4 to 5 times higher than the annual rainfall and the additional water is supplied from wells and mountain run-off with rainwater and well water mixed to improve water quality for irrigation.
The important vegetable crops are tomatoes, capsicum, cucumbers, eggplant, melons and beans. The crops are established during summer and terminated during winter.

Virus diseases, particularly those caused by whitefly transmitted viruses, have been a major problem in almost all crops in Almeria and growers faced the loss of market access several years ago because of unacceptably high insecticide residues in vegetables produced in the area. These high residues were largely due to excessive insecticide use in efforts to control whitefly and other insect vector populations to provide virus control. Problem viruses included Cucumber vein yellowing virus, Cucumber yellow stunting disorder virus, Tomato yellow leaf curl virus and Tomato chlorosis virus. Virus control was not been achieved with major crop losses in tomato, cucurbits, capsicum and beans. A major change was necessary to protect markets and provide a rational, sustainable production system.

The important changes made on an area wide basis were the introduction of biocontrol agents, crop and area wide hygiene to reduce vector populations and virus inoculum, reduction in pesticide use and the introduction of softer, IPM compatible products and host resistance where available.

One important biocontrol agent used is the predatory mirid bug *Nesidiocoris tenuis* which occurs naturally in the Mediterranean region and is a very active predator of whitefly and other insect pests.

The success of the program is an excellent example of the introduction of an integrated pest and disease management program on a large scale with major economic and social benefits.

## Dissemination of information from meeting

A presentation on virus diseases and their management in Australia was given at the conference :

Gambley C, Persley D, Thomas J, Forsyth L, Tesoriero L, Rodoni B, Coutts B, Jones R, Burfield T Virus diseases in Australian vegetable crops.

A summary of conference outcomes has been presented to colleagues in the plant virology group at DEEDI, Ecosciences Precinct, Brisbane.
A link to the Conference abstracts has been provided to team members of VG0 7128 and highlights discussed with several team members.

Information gained will be used in planning future projects and in experiments as part of a HAL funded project on the management of viral diseases in vegetable crops in field and protected cropping.

Information on plant viruses not present in Australia will be valuable in dealing with incursions, planning biosecurity responses and providing information on threats to the vegetable industry.

Some of the invited papers will be published in *Archives of Virology* or *Virus Research* in 2011 or 2012.

The conference program and abstracts of all conference presentations can be found at www.eelm.csic.es/iwglvv/

## Travel itinerary

May 13/14 Brisbane-Singapore-London Madrid-Antequera
May 15 Antequera
May 16 IWGLVV begins
May 17 IWGLVV
May 18 IWGLVV
May 19 IWGLVV/ field trip to Almeria vegetable production area
May 20 IWGLVV
May 22 Antequera/ Netherlands/ London /Australia

## Key contacts

Dr Scott Adkins, Virologist, US Department of Agriculture, Florida USA
Dr Luis Rubio, IVIA, Valencia, Spain
Dr E Moriones, IHSM-UMA, Malaga, Spain
DR K Verhoeven, Plant Protection Service, The Netherlands
Dr J Navas-Castillo, IHSM-UMA, Malaga , Spain
Dr J Vetten, Federal Research Centre for Cultivated Plants, Braunschweig, Germany.
Dr H Pappu, Washington State University, Pullman, Washington
Dr J Fletcher, NZ Institute for Plant and Food Research, Christchurch New Zealand
Dr A Takacs, University of Pannonia, Keszthely Hungary

## Recommendations

The meeting provided a valuable opportunity to access new information in plant virus epidemiology and management. Every session of the meeting was relevant to my work and to current and planned work on virus disease management in vegetables.

The information gained, and contacts maintained or renewed, are invaluable in obtaining access to new diagnostic protocols, disease resistant germplasm and new disease management techniques.

The short time overseas for the meeting is an efficient means of accessing new information and maintaining contacts which are often difficult to make by other means given our geographical isolation from most major research and development centres.

I recommend that conference visits of this type continue to be supported as an important means of maintaining and developing specialist expertise to support Australian horticultural industries.

## Acknowledgements

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I thank Drs Jesus Navas-Castillo, Enrique Moriones and Javier Romero for organizing a very successful meeting and for their hospitality while in Antequera.