REPORT ON THE IXth INTERNATIONAL PLANT VIRUS EPIDEMIOLOGY SYMPOSIUM – APPLYING EPIDEMIOLOGICAL RESEARCH TO IMPROVE VIRUS DISEASE MANAGEMENT, LIMA, PERU, 3-7 APRIL 2005

This successful and stimulating international symposium was held on April 3-7 in the attractive Hacienda style "El Pueblo" Hotel, just inland from Lima, the capital of Peru, located on the countries' central Pacific Coast. The symposium was attended by 104 participants from 26 different countries from five continents. It was the ninth in the series of international symposia held every three years under the auspices of the Plant Virus Epidemiology (IPVE) Committee of the International Society for Plant Pathology. It was also the first symposium in this series to be held in a developing country. The programme started on *Sunday 3rd April* with registration and a welcoming reception in the outdoor restaurant area of the hotel hosted by Dr Pamela Anderson, the new Director General of the International Potato Centre (CIP), which is headquartered in Lima.

On *Monday 4th April* the opening session started with introductory presentations by Pamela Anderson, the principal symposium organiser, and Roger Jones (Australia), Chairman of the IPVE Committee. Dr Anderson emphasised the importance of locating one of the epidemiology symposia in a developing country for the first time. She also briefly explained the history and changing role of CIP as an International Agricultural Research Centre focussed on tuber and root crops, initially concentrating on potato and, more recently, also on sweetpotato. Dr Jones outlined the activities of the IPVE group in the 3 years since the eighth Symposium held in Aschersleben, Germany. The main activity was a successful 1 day meeting organised by John Fletcher (New Zealand) held in Christchurch, New Zealand before the International Congress of Plant Pathology in February 2003.

The opening introductory presentations were followed by the Chairmans' address in which Roger Jones spoke on the topic "Developing effective integrated virus management (IDM) strategies – the way forward". He emphasised the need to use generic control measures in devising interim IDM approaches where insufficient information on epidemiology and control measures is available for a pathosytem, and the need to validate such interim approaches thoroughly afterwards. He also emphasised that optimum control is achieved by including control measures of low and high selectivity, and ones acting against internal and external virus sources, and against early and late virus spread. He gave examples from diverse pathosystems illustrating IDM validation and individual control measures of these different types. Success in devising effective IDM's in the future will depend on intelligent, innovative and flexible use of available experience, information and new technology. Within the current environment of skills erosion, lack of focus and diminishing research funding, the challenge for the virus epidemiologist is to apply new technologies to greatest effect, while still ensuring adequate epidemiological studies and field validation of control measures and IDM tactics.

The morning session that followed started with a contribution on "Defining conditions favouring spread of *Tomato spotted wilt virus*" by Alan Clift (Australia). Ten years of records of TSWV incidence in different vegetable and ornamental crops were analysed by the Netica program. This identified which factors were important in

suppressing virus spread, and quantified their impacts for a diverse range of scenarios. Jerome Kubiriba (Uganda) then spoke on "Spread of *Banana streak virus* in Uganda". The pattern of virus spread in initially healthy plots of banana located within infected fields at different sites suggested that both primary and secondary virus spread was occurring, but clustering of infected plants was limited. Isolation is of pivotal importance as a control measure. Next, Lava Kumar (ICRISAT, India) spoke on "Epidemiology and management of *Pigeonpea sterility mosaic virus*". The virus and its mite vector depend on pigeonpea and its wild relatives. Early infection causes greatest yield losses and volunteer plants and neighbouring crops are the main sources of infection. Control is achieved through virus resistant cultivars and phytosanitary measures. Carl Spetz (Norway) then contributed on "Potato mop-top virus in Nordic countries". This virus is one of the biggest problems that potato industries in Nordic countries are facing. More than one virus strain seems present. Soils in limited areas still remain free of infestation with the virus. Next, Giovanna Muller (CIP, Peru) discussed "Alternative hosts of *Potato yellow vein virus*". The virus, which is transmitted in the field by the glasshouse whitefly, was first introduced to Peru in 1990 and spread rapidly subsequently. Volunteer potatoes and weeds belonging to several different plant families, especially Polygonaceae, act as infection reservoirs. Overuse of insecticides greatly increased populations of its vector and infection was dispersed widely by planting infected seed potato stocks.

The afternoon session started with a special topic presented by Forest Nutter (USA) on "The role of plant virus epidemiology in risk assessment and risk mitigation". The potential for introduction of damaging plant viruses and their vectors to new countries remains a serious threat to crop biosecurity worldwide. The risk of an epidemic is dependent on quantitative knowledge concerning the host, vector and virus population, and how the environment influences the risk of disease development. In the *Tobacco etch virus* – bell pepper pathosystem in south east USA, perennial horsenettle and groundcherry are the key alternative hosts. Relative source efficiency depends on virus concentration and receptivity to the particular aphid vector species present. Early infection is critical but reducing rate of virus spread by half (using partial resistance or reflective mulch) means that yield loss is much decreased.

Dirk Janssen (Spain) followed with an interesting presentation on "Viruses diseases in horticultural crops in Almeria, Spain". Over 28,000 hectares of plastic houses are used to grow vegetables all-year-round at Almeria. This high concentration at one location makes the system vulnerable to introduction of new viruses. During the past 5 years, several serious diseases caused by contact, seed and/or fungus transmitted viruses arrived. Phytosanitary and cultural control measures worked well against them, but control of newly arriving arthropod-transmitted viruses, especially ones spread by thrips and whitefly, has been less successful. A rural hygiene plan and physical protection against whitefly vectors assisted greatly in diminishing virus-induced losses. Keith Perry (USA) then spoke on "Strains of *Potato virus Y* in seed potatoes in Maine, USA". Both the ordinary and tobacco veinal necrosis strains of the virus occur. One isolate caused potato tuber necrotic ringspot disease, and others may represent different strain recombinants. Differentiation of strains relied on monoclonal antibodies and micro-arrays but not inoculation of cultivar differentials with hypersensitivity genes to different strains of the virus. Next, Joseph Ndunguru (Tanzania) spoke on "*Papaya ringspot virus* in East Africa". The crop is mostly grown in small plots for subsistence and local markets, and the incidence of infection

is so high that production of papaya is severely diminished. Monoclonal antibodies to the virus were ineffective at detecting some local virus isolates. Herve Lecoq (France) then presented on "Molecular epidemiology of *Watermelon mosaic virus* in cucurbits: from simple to complex patterns". The approach used involved monitoring the spread of a newly introduced and an indigenous strain of the virus within plots of squash over several years. Samples from all plants were tested weekly by ELISA and PCR to follow the spatial and temporal progress of the epidemics of the two strains. The new strain spread earlier each year but the ratios of the two strains and their rates of spread varied greatly. Complex interactions and mixed infections between strains influenced the epidemics and patterns of spread found. Next, Paul Guy (New Zealand) spoke on "Plant virus records for New Zealand". A comprehensive review of the 170 plant virus records in New Zealand was made; 30 new virus species records were added since 1989. However, no records were for viruses native to the country. This contrasts with nearby Australia where there are several despite its shorter history of crop introduction and cultivation. Some introduced viruses have invaded the native flora causing damaging disease outbreaks in New Zealand native plants. Roland Sigvald (Sweden) then spoke on "Epidemiological studies on *Potato virus Y* and *Barley yellow dwarf virus"*. A revision of his predictive simulation model for epidemics of PVY in potato in Sweden was presented. The proportion of tubers infected are now included in the predictions. The model was validated with data from 500 potato fields with good agreement between predicted and observed values. With BYDV, key factors to use in risk assessment were identified.

<u>*Tuesday 5th April*</u> commenced with an important keynote address by Pamela Anderson (CIP, Peru) entitled "Ecological epidemiology: review, synthesis and application of models for insect-transmitted viruses". She reviewed the types of mathematical models used for epidemics of insect-transmitted viruses. She then presented the generic model 'Epivirus' which has broad application in different plant virus-crop pathosystems. She used epidemics of the whitefly-transmitted Bean golden mosaic disease complex in common bean to illustrate how this and other models are used to identify gaps in current knowledge and to advise on the intervention strategies and virus control measures most appropriate to deploy. The generic 'Epivirus' model will soon be made available on the world-wide-web for use by others.

Juan Alvarez (USA) followed with a presentation on "The epidemiology of *Potato leaf roll virus* in Idaho, USA". He emphasised the importance of hairy nightshade as a reservoir host of the virus for epidemics. Infected plants of this species were introduced into potato plots and disease progress followed using ELISA to test samples. Next, Enrique Moriones (Spain) spoke on "Virus resistance breakdown in tomato associated with mixed infection between *Tomato chlorosis virus* and *Tomato spotted wilt virus*". A marked synergism was observed when the two viruses were inoculated simultaneously to susceptible tomato, killing the plants. Presence of both in plants carrying TSWV resistance gene Sw-5 broke this resistance. Forest Nutter (USA) then spoke on "Spread of *Soybean mosaic virus* in transgenic soybeans". Soybeans transformed with the CP of the virus were evaluated for epidemic rate-reducing resistance by quantifying the temporal and spatial spread of the virus from point sources in field plots. Two transformed lines had low infection rates, less clustering of infected plants and greater yields than untransformed controls. Alberto Fereres (Spain) then presented on "Temporal and spatial spread of *Lettuce mosaic*

virus in Spain". In lettuce nursery and field epidemics, the primary inoculum source was seed-infected lettuce plants and spread was by non-colonising winged aphids. The Gompertz model described disease progress best. Clustering of infected plants was followed using the SADIE program and contour maps. Next, John Randles (Australia) spoke on "Mundella yellows disease in eucalypts". The spatial distribution of this lethal dieback disease in tree plantings is patchy. Because small RNA's are present along with virus-like inclusions, virus-like agents seem a possible cause of the disease which is not associated with phytoplasma. Brendan Rodoni (Australia) then described "The first detection of *Potato virus Y* NTN strain in Australia". Potato tubers showing the typical necrotic rings caused by this PVY strain were shown to contain it using PCR, sequencing and by inoculation to potato cultivar differentials. The sequences found indicated introduction from Europe.

The afternoon session started with a special topic presented by Mike Irwin (USA) concerning "Aerial dispersal of aphids and its implications for IPM". He emphasised that the whole concept of IPM first started when DDT-resistant pests appeared in cotton in the nearby coastal Canete Valley in Peru. Using the *Soybean mosaic virus*-soybean pathosystem as an example, he stressed the need to always consider vector movement in IPM approaches, with long distance and short distance movement of vectors both being important. In general, non-persistently aphid-borne viruses are best managed at their source while persistently aphid-borne viruses can also be addressed at their sink (ie. in the infected crop).

Steve Castle (USA) followed with a presentation on "Monitoring Pierces disease of grapevine in glassy-sharpshooter populations in California, USA". The proportion of the vector population that is infective and the concentration of the pathogen in them were determined. Both factors were important in establishing the upper threshold numbers of the insect vector for decisions on use of chemical control measures. Next, Jorg Schubert (Germany) spoke on "Sequence variations in *Potato virus Y* strains". Several isolates from Germany and Poland were sequenced fully, and the sequences compared with those of other already published isolates from Europe and North America. This comparison revealed several recombination points where new variants are likely to arise. Next, Paul Guy (New Zealand) spoke on "Plant viruses in wild plants". Contrary to generally accepted views, there are a number of examples from different parts of the world of wild populations of plants suffering high virus incidences and severe viral symptoms (damage). This is so whether these viruses are endemic to the wild plants or biological invaders coming from introduced cultivated plants. Examples of diverse pathosystems where this occurs in native plants in Australia, USA and the UK were provided. Forest Nutter (USA) then talked on "Post-introduction mapping of plant virus spread with GPS and GIS technologies". He described the USA National Plant Diagnostic Network, which provides a plant disease biosecurity system now operating from five hubs in the USA. Gathering temporally and geo-spatially referenced diagnostic data is one of its roles. GIS is proving a powerful tool to provide maps that identify production areas with different degrees of risk for specific plant virus pathosytems. Next, Gerhard Pietersen (South Africa) spoke on "Spatial and temporal patterns of spread of grapevine leaf roll disease in South Africa". Grapevine leaf roll is the most important virus disease affecting grapevine in South Africa. Most spread occurred along rows and there was secondary spread by mealybugs. The main infection sources were nearby infected grapevine plantings and use of contaminated rootstocks. Then, Martin Verbeek (the

Netherlands) talked about "Epidemiological developments with *Potato virus Y*". The O, C and N strains of the virus are all present in seed and ware potato crops in the Netherlands, with increasing incidences of the virus found despite decreasing numbers of *Myzus persicae*. Based on molecular data, recombination between strains occurs often in the field. Next, Rene Van Der Vlught (the Netherlands) described "Natural variation in *Pepino mosaic virus*". Since 1990, a new strain of this contact-transmitted virus became widespread in tomatoes in European countries. The genetic diversity of >60 Dutch isolates was compared with those published from other countries. Two isolates from the USA grouped separately from the European ones.

This session ended with an open meeting that elected three new regional representatives to the IPVE Committee of the ISPP (Lava Kumar - Asia, Joseph Ndunguru - Africa and Stewart Gray – North America) and discussed the possible location of the next symposium sponsored by the Committee. Provisional offers to host the next symposium were received from India and Uganda, and, following their confirmation, it was left to the IPVE Committee to decide which offer to accept.

Wednesday 6th April commenced with an interesting keynote address by Tim Chancellor (UK) entitled "Spatio-temporal virus disease dynamics: the case of rice Tungro in the Philippines". The spatio-temporal dynamics of virus spread over four cropping cycles was analysed in a continuous 150 hectare block of fields that contained rice crops at varying stages of maturity. There was marked clustering of infected plants. Infection of newly-planted fields depended on proximity to older infected fields, relative abundance of leafhopper vectors and the susceptibility of the rice cultivar planted. A spatial simulation model predicted the effectiveness of different control tactics: virus resistant cultivars and fallow periods were more effective than roguing or application of insecticide.

Nilsa Bosque-Perez (USA) contributed next on "The effect of transgenic resistance to *Barley yellow dwarf virus* on aphids in wheat". Although its *Rhopalosiphum padi* vector normally grows better on infected than healthy plants, it had diminished population growth on transgenic plants infected with the virus. Also, it was less attracted to and less efficient at acquiring virus from them. Deploying transgenic partial resistance in wheat crops is therefore likely to decrease virus spread. Then, Wilmer Cuellar (Finland) talked on "RNA silencing suppression controlled by *Sweetpotato chlorotic stunt virus*". Infection with SPCSV suppresses the natural RNA silencing in the upper leaves of sweetpotato explaining why 'sweet potato virus disease' (SPVD) results from mixed infection of SPCSV with potyviruses. SPVD is the most economically important disease of this crop. A combination of RNase3 and the protein p22 was shown to block the RNA silencing, paving the way to understanding the suppression mechanism. Stewart Gray (USA) contributed next on "Transmission of two viruses that cause Barley yellow dwarf disease is controlled by different loci in the aphid *Schizaphis graminum*". Two genotypes of the aphid that differ in their abilities to transmit *Barley yellow dwarf virus* and *Cereal yellow dwarf virus* were crossed and the transmission efficiencies of their F1 progenies determined. There was no genetic correlation between transmission of the two viruses, indicating that more than one locus is involved. Liezel Herselman (South Africa) then spoke on "Molecular markers for a resistance gene to the aphid vector involved in groundnut rosette disease". This is the most destructive disease of groundnut (peanut) in Africa, and the causal viruses are transmitted by *Aphis craccivora*. Development and

application of molecular markers for use in breeding aphid-resistant groundnut was described.

A Scientific Excursion to CIP followed where a comprehensive oversight of the organisations diverse programs was provided, along with a guided tour of the extensive Laboratory and Glasshouse facilities, and an explanation of the potato and sweetpotato virus projects currently underway. Delegates were then treated to a traditional Andean Pachamanca lunch: the delicious food was cooked in an underground oven heated by hot stones, and dug up in front of them following a brief traditional "blessing" ceremony. The day finished with a guided city tour of Lima which included a visit to the impressive archaeological museum, sightseeing and a visit to a large market selling traditional Peruvian handicrafts.

Thursday 7th April commenced with a stimulating keynote address by Mike Jegger (UK) entitled "Evolutionary epidemiology of plant viruses". The drivers of evolutionary change in plant virus population structure include mutation rates, relative fitness, selection pressures, genetic drift, host dynamics and vector interactions. Re-assortment allows deleterious mutations to be eliminated. Information on the likely contribution of altered cropping practices and crop protection measures such as pesticide use, host resistance and cultural control to emerging plant virus disease problems can be obtained from retrospective analysis of historical epidemics. This applies especially to situations involving new virus or vector variants or novel virus-vector-host combinations. New approaches that augment a population dynamic model with varying fitness traits and the derivation of evolutionary stable states can offer new insights into the strategic management of plant virus diseases.

Claudia Martins (Brazil) contributed next on "Grapevine leafroll-associated virus 3 genetic variability in Brazil". Sequenced viral polymerase and CP genes showed that isolates from north-east Brazil were similar to North American isolates, but with some minor amino acid sequence differences. Keith Perry (USA) then spoke on "Structural determinants in virions for non-persistent aphid vector transmission". A surface charge or structure in the virion seems necessary for successful non-persistent transmission of *Cucumber mosaic virus* by aphids. Dynamic properties of the virions may play a role in their ability to bind to or release from aphid mouthparts. Benny Raccah (Israel) then presented on "The role of helper component (HC) in binding to aphid cuticular proteins and to capsid proteins". HC serves as a bridge between virion and aphid stylet. To evaluate the role of HC in transmission, the N-terminal of *Turnip mosaic virus* CP was exchanged with the respective fragment of *Zucchini mosaic virus* CP creating a chimeric virus. This exchange allowed the TuMV HC to transmit the chimeric virus but not the wild type ZYMV.

Several presentations on sweetpotato viruses followed. Setumba Mussaka (Uganda) spoke on "Sweetpotato virus disease complexes in sweetpotato in Uganda". *Sweetpotato feathery mottle virus* (SPFMV), *Sweetpotato mild mottle virus* (SPMMV), *Sweetpotato chlorotic fleck virus* (SPCFV) and *Sweetpotato chlorotic stunt virus* (SPCSV) were found singly and in combination. SPCSV, SPFMV and SPMMV were detected in 90% of plants found showing viral symptoms. Although the vector of SPMMV is not known, regression analysis suggested that it and SPCSV are transmitted either by different biotypes of whitefly or by entirely different vectors. Emmanuel Byamukama (IITA, Uganda) talked on "Sweetpotato virus disease (SPVD)

in Rwanda". SPCSV, SPFMV, SPMMV and SPCFV were present. Incidence of the SPVD complex was generally low, except in a highland province where the crop is grown continuously. Segundo Fuentes (CIP, Peru) presented on "Sweetpotato virus disease in Peru and its control". High incidences of SPVD caused by co-infection with SPFMV and SPCSV were found in the costal Canete Valley. SPFMV alone did not diminish yield, but SPCSV alone did so while a combination of the two viruses (ie. SPVD) caused much greater yield losses. A healthy stock program that employs propagation by cuttings under screenhouse conditions, roguing and insecticide application against vectors provides local farmers with healthy planting materials. This healthy stock triples the yields they obtain. Arthur Tugume (Uganda) spoke on "Viruses infecting wild *Ipomoea* in Uganda". About 90 wild *Ipomoea* species occur in East Africa. More than 1,500 wild plants were surveyed in 22 districts of Uganda: 36% of plants tested positive to viral antibodies, with SPCSV, SPFMV, SPMMV and SPCFV all detected. Multiple infections were common in perennial wild *Ipomoea* species. Peter Sseruwagi (South Africa) contributed on "Diversity of *Bemisia tabaci* in Uganda". Phylogenetic analysis revealed eight distinct genotype clusters of this whitefly species in Uganda. Both the B and Q biotypes that are important vectors elsewhere were found and the host ranges of the Uganda1 and Uganda8 types were expanded. These findings have important implications over the ease of spread of whitely-transmitted viruses locally.

The final afternoon session was on Begomoviruses. It started with an interesting special topic presented by Frank van den Bosch (UK) concerning "The effect of cropping practices on Begomovirus evolution." Plant disease management tactics introduce selection pressures that can actually make things worse by selecting for evolutionary changes that enable viruses to get round them. Such evolutionary responses nullify the beneficial effects of deploying the management tactics so ones that put minimal pressure on the system and so avoid provoking such responses are preferable. Mathematical models were used to simulate how tactics such as roguing, selection of cuttings and deployment of virus-resistant cultivars affect virus virulence. Roguing diminished virus titre but most other tactics increased it. Not taking virus evolution into account can lead to incorrect control measures being deployed so 'evolutionary stable approaches' are preferable.

Yeheskel Antignus (Israel) then contributed with an important paper on "Light manipulation by soil mulches to protect crops from spread of Begomoviruses". Begomovirus diseases are so damaging to tomato in Israel that all tomato crops are now grown in protected houses. However, cucurbit crops are still grown outside and are suffering severe yield losses from Begomoviruses. In field experiments, deploying yellow plastic mulches delayed epidemics of *Squash leaf curl virus* in zucchini more than other plastic mulches providing the greatest yield benefit. Whitefly vector landing rates were seven times lower with yellow as opposed to no mulch. The yellow colour diminishes the contrast between the background (mulch) and the target (plants). The IDM strategy now recommended involves yellow mulch, limited insecticide sprays and virus-tolerant zucchini cultivars. Richard Gibson (UK) spoke on "Farming practices that delay selection of virus-resistant land races of vegetatively propagated crops". Crop seedlings are rare in subsistence farmers' fields and tend to be hoed out. With sweetpotato in East Africa, only 1% of farmers had ever grown crops from seedlings and the findings for cassava, another vegetatively propagated crop, were similar. Evolution of new land races was speeded up

successfully when they were encouraged to select superior accessions from seedlings. James Legg (IIATA, Uganda) presented on "A continent-wide perspective on the epidemiology of cassava mosaic viruses in Africa". The current cassava mosaic disease pandemic in East Africa is expanding both westwards and eastwards to include Tanzania, Rwanda, Burundi and eastern Congo. This expansion is propelled by short distance migration of super abundant *B. tabaci* vector populations, synergistic interactions in susceptible cassava cultivars, and the greater virulence of recombinants between *East African cassava mosaic virus* (EACMV) and *African cassava mosaic virus* (ACMV). Deploying virus-resistant cassava germplasm is helping to manage the pandemic. Joseph Ndunguru (Tanzania) spoke on "Molecular epidemiology of *Cassava mosaic viruses* in Tanzania". Sequence analysis revealed a higher genetic variability among isolates of EACMV than of ACMV. This has important implications in providing a source of diversity and evolutionary change in the virus. Gowda Maruthi (UK) then spoke on "Molecular epidemiology of tomato leaf curl viruses in the Indian sub-continent". CP sequencing and phylogenetic analysis revealed at least six viral clusters, each with <85% sequence identity. Two clusters represented previously undescribed viruses. Tobacco, cotton and weed species were infected, and mixed infections were common. The B biotype of *B. tabaci* was found for the first time in the region. Next, Nilima Prabhaker (USA) talked about "The impact of neonicotinoid insecticides on the natural enemies of *Bemisia tabaci*". Before deploying chemical control, it is important to determine the effects of the chemicals used against valuable biological control agents. Although neotnicotinoid insecticides, such as thimethoxam and imidacloprid, were effective in suppressing whitefly vector populations, they killed beneficial parasitoids, such as *Encarsia* and *Eretmocerus spp.* Renato Resende (Brazil) contributed next on "Resistance to monopartite and bipartite tomato leaf curl disease-inducing Begomoviruses in tomato". Eight different TLCD-inducing Begomoviruses occur in tomato in Brazil including both monopartite and bipartite virus species. Tomato breeding line TX468-RG has good resistance to the bipartite Begomoviruses, which is controlled by recessive gene tcm-1. Three other tomato lines are resistant to the monopartite Begomoviruses, the resistance again being controlled by a single recessive resistance gene. Breeding of tomatoes with both resistance genes is underway. Aldo Rojas (Nicaragua) spoke next on "A complex of Begomoviruses affecting tomato". Phylogenetic analysis revealed that the indigenous Begomoviruses of the Americas belong to three major clades and to another intermediate grouping. *Tomato severe leaf curl virus* was subdivided into two strains which fitted in different clades due to past recombination of one of them with another Begomovirus. Mixed infections are common providing a high risk of evolution of new strains and species by recombination. Gration Rwegasira (Tanzania) presented the final talk which was on "The effect of vectors and environment on incidence and severity of sweetpotato virus disease in Tanzania". Data on the effect of insect vectors, different virus inoculum levels and climate variability on the incidence and severity of SPVD was collected from farmers' fields at six different locations in the Great Lakes region of East Africa. The findings were used to guide decision making over which control measures to recommend against SPVD.

One of the important features of the symposium not mentioned above was the large number of interesting posters, more than 35 in total on a very diverse array of topics. The four poster sessions were held after the afternoon sessions and provided a good opportunity to engage in further discussions.

At the end of the final oral session, presentations were made to Pamela Anderson, Francisco Morales and Luis Salazar to thank them for all their hard work in organising such a successful symposium and to Martha Huanes and her team for their invaluable conference support. At the conference dinner that followed, participants were treated to a delicious multiple course meal + the local "Pisco sour" drink and a choice of wines, followed by a most entertaining display of typical folk dancing from different regions of Peru including audience participation. An excellent evenings' entertainment was had by all.

This ninth in the series of triennial International Symposia on Plant Virus Epidemiology was not only scientifically stimulating but also very well organised. It successfully maintained the high standards set by past meetings of the IPVE. The attractive setting of the "El Pueblo" Hotel with its well maintained lawns and garden, extensive sports facilities, and delightful café + outdoor restaurant secluded within a its surrounding 'horseshoe of hills' all helped to provide an ideal 'backdrop' to the event. The Director General of CIP and her staff are to be congratulated warmly over a job well done.

Roger Jones, 30/6/05