INTERNATIONAL NEWSLETTER ON PLANT PATHOLOGY

ISPP Newsletter 45 (6) June 2015

News and announcements from all on any aspect of Plant Pathology are invited for the Newsletter. Contributions from the ISPP Executive, Council and Subject Matter Committees, Associated Societies and Supporting Organisations are requested.

Editor: Daniel Hüberli (E-mail)

Subscribe to the ISPP Newsletter by joining the ISPP mail list

In this issue:

- Feeding more than nine billion by 2050: challenges and opportunities
- 49th Congress of the Southern African Society for Plant Pathology, 19-21 January 2015
- Xiangming Xu wins Horticultural Award
- Book review: Feeding 9 billion - The contribution of new genetic technologies to global food production
- Scientific webinars available on demand
- Africa's food security threatened by deadly maize disease
- Leafcutter ants use chemical secretions to prevent fungal infections
- To predict disease researchers ask if plant neighbours are relatives
- A fungus that enhances crop roots and could be a future bio-fertiliser
- Rust tames a vine in New Zealand
- The Plant Doctor Game app
- New 'break' fumigant for stored-grain pests
- Associations with rhizosphere bacteria can confer an adaptive advantage to plants
- Acknowledgements

Feeding more than nine billion by 2050: challenges and opportunities

Australian National University (ANU) College of Asia & the Pacific and Department of Food and Resource Economics University of Copenhagen.

On 22 April 2015, the ANU Crawford School of Public Policy together with the Department of Food and Resource Economics at the University of Copenhagen, the FE2W Network and the OECD Co-operative Research Programme on Biological Resource Management for Sustainable Agricultural Systems launched a special issue of the Springer /ISPP Journal Food Security journal (Volume 7 Issue 2) with events in both Canberra and Copenhagen. The special issue looks at challenges and opportunities of sustainable food supply noting that the next 35 years represents a critical transition period in terms of food, energy, the environment and water. While markets will provide some of the solutions, policies and governance arrangements are needed to ensure that markets operate efficiently, and effective governance arrangements are required to respond to the multi-dimensional nature of food security and to ensure that domestic and international institutions coordinate across policy domains.

At the special event, experts from Australia, Bangladesh, China, Denmark, the Netherlands, New Zealand, UK, and USA presented their perspectives. Speakers who presented in Canberra included:

- Professor Justin Borevitz, Research School of Biology, ANU
- Dr Colin Chartres, University of Canberra
- Dr Dana Cordell, University of Technology, Sydney
- Dr Gary Fitt, CSIRO Biosecurity Flagships
- Professor Quentin Grafton, Crawford School, ANU
- Dr Fiona McKenzie, Australian Futures Project
- Dr Ejaz Qureshi, Australian Centre for International Agricultural Research
- Dr Nazmun Ratna, Lincoln University, New Zealand
- Dr Hang To, Crawford School, ANU
- Dr Dennis Wichelns, US
- Professor John Williams, Crawford School, ANU
- Mellissa Wood, Australian Centre for International Agricultural Research

The launch had a video link session with Copenhagen from 6-7 pm (Australian Time) with speakers:

- Professor Carsten Daugbjerg, Crawford School, ANU (in Copenhagen)
- Dr Miles Grafton, Massey University, New Zealand (in Copenhagen)
- Professor Jane Rickson, Cranfield University, UK (in Copenhagen)
- Professor Richard Strange, University of London (in Copenhagen)
- Dr Wusheng Yu, University of Copenhagen, Denmark (in Copenhagen)
- Emeretus Professor Richard Strange (Editor in Chief, Food Security)
- Dr Christophe Bene, University of Sussex
- Dr David Barling, City University London
- Dr Jessica Duncan Wageningen University, Netherlands

49th Congress of the Southern African Society for Plant Pathology, 19-21 January 2015

The 49th biennial Congress of the Southern African Society for Plant Pathology, organised by the University of the Free State, was held in Bloemfontein from 19-21 January 2015. The highly successful congress was attended by 202 delegates from seven countries and accommodated 68 oral and 80 poster presentations. In his opening address Dr John Purchase, CEO of Agbiz in Pretoria, shared his thoughts on current challenges in South African agriculture and emphasised the important role of plant pathologists in food security, both locally and throughout the southern African region.

The thought-provoking Vanderplank and Ethyl M. Doidge Memorial Lectures were delivered by Dr Sandra Lamprecht (ARC-PPRI Stellenbosch) and Dr Conrad Schoch (NCBI, Maryland, USA), respectively. The topic of Dr Lamprecht's presentation was "Confessions of a serial soilborne plant pathologist - 30 years of digging holes, and finding my way out of them." Dr Schoch addressed the issue of "Do names still matter for fungi?" Additional keynote lectures were given by Dr Paul Fourie (Citrus Black Spot: a scientific and political conundrum), Prof Mike Wingfield (Global Tree Health: New developments and emerging challenges) and Dr Gary Harman (Emerging opportunities for use of plant beneficial microbes: demystifying the interaction between beneficial microbes and plants).

Technical sessions covered ecology and epidemiology, pathogen identification and genetics, various aspects of disease management, and mycotoxins. Concurrent workshops on fungicide application technology and new technologies for identifying fungi were well attended. A lively evening social program complemented the scientific sessions and several members of the society were honoured at a gala dinner held in the Centenary Hall on the UFS campus including Prof Brenda Wingfield (Christiaan Hendrik Persoon gold medal), Dr Sandra Lamprecht (Fellow of the Society), Dr Bradley Flett (Applied Plant Pathology Award), Dr Gideon van Zyl (Mildenhall Award) and Palesa Madupe (BSPP Grace Waterhouse Fellowship). The honours in the student oral and poster competitions went to I.L. du Plessis and A. Baloyi respectively, both from Stellenbosch University.

Past and present recipients of the Christiaan Hendrik Persoon Medal - Mike Wingfield, Petro Crous, Zakkie Pretorius and Brenda Wingfield.

(Zacharias Pretorius, Neal McLaren and Teresa Coutinho)

Xiangming Xu wins Horticultural Award

Xiangming Xu, plant disease epidemiologist and leader of the Genetics and Crop Improvement Programme at East Malling Research, UK, has been awarded the Jones-Bateman Cup by the Royal Horticultural Society (RHS). Xu was recognised for his significant scientific contributions and excellence in horticultural research, particularly in applying mathematic and statistical modelling to develop strategies for management of diseases on fruit crops. The RHS Jones-Bateman Cup is awarded only once every three years in recognition of those conducting outstanding original research in fruit culture. Xu's main research areas include disease epidemiology, developing and implementing disease forecasting models, fungal population genetics, disease management measures, and statistical data analysis/modelling. He has developed disease forecasting models for several diseases in apple and strawberry that are used in commercial horticulture. Over recent years, Xu has been actively engaged in both theoretical and practical studies of biocontrol of foliar pathogens in collaboration with Mike Jeger of Imperial College, contributing towards developing strategies for better exploitation of biocontrol in disease management. Currently, he has been engaging in research to understand soil health in relation to soil microbial population composition. He and his colleagues have successfully applied amplicon-based metagenomics to understand soil microbial population composition in relation to crop production potential.

(Laurence V. Madden)

Book review: Feeding 9 billion - The contribution of new genetic technologies to global food production

In the June issue of Food Security, Jonathan Gressel from the Weizmann Institute of Science, Rehovot, Israel, reviews the book 'Feeding 9 Billion - The contribution of new genetic technologies to global food production' edited by Peter Evans, David Bennett and Richard C. Jennings.

As the reviewer, Jonathan Gressel says in his review, "Doubling the food supply is a complex problem, which the editors endeavour to parse by dividing the book into four sections, and each section into 5-7 chapters. The first two sections deal with needs and technologies, and the second two deal with policy, social, legal and ethical issues. The book is peppered throughout with text boxes containing excellent case studies, often with critical discussions of the pros and cons of successful technologies. Each chapter ends with a list of research, discussion and essay topics, and a reading/website list. There is a glossary of scientific terms at the end of the book."

Read the full review.

Scientific webinars available on demand

In May, APS co-hosted two well-attended scientific webinars. The first discussed zebra chip research in the United States, and the second covered the exotic Cowpea mild mottle virus (CPMMV).

Zebra chip, named for the characteristic striping and discoloration in potato chips produced from infected tubers, is putatively caused by a bacterium, Candidatus Liberibacter solanacearum, which is vectored by the potato psyllid (*Bactericera cockerelli*). This disease was first reported in the US from South Texas in 2000, but now has spread to other major production regions across the western US and is widespread throughout Mexico, Central America and New Zealand. In an effort to mitigate the impact of zebra chip disease outbreak, components of a response and recovery plan that include its etiology, epidemiology, detection, economics, and disease management strategies were covered in the webinar by Charlie Rush, Texas A&M AgriLife Research. In addition, priorities needed in research, extension and education to this high consequence plant disease were identified.

In the CPMMV webinar, Judith Brown from the University of Arizona addresses the exotic seed borne virus that infects a wide range of cultivated legumes that poses a threat to US soybean production. The virus causes severe mosaic and/or necrotic symptoms in leaves, stems, and pods in many bean (*Phaselous* species), cowpea (*Vigna* species), and soybean (*Glycine max*) varieties grown in the Americas. CPMMV is believed to have been introduced first into South America from western Africa where it is presumed to be endemic, from where it spread into the Caribbean region. In the US mainland, an isolate has been detected using Next-Generation Sequencing (Illumina) in DNA extracts of the whitefly vector *Bemisia tabaci* (Genn.) in Florida during 2014.

(APS News Capsule, 21 May 2015)

Africa's food security threatened by deadly maize disease

More than 150 participants gathered in Nairobi for an international conference on 12-14 May 2015 to share knowledge on the latest diagnostics and screening methods for the maize lethal necrosis (MLN) disease, and assess ways of curbing its spread across Africa to help mitigate its effects, particularly large-scale crop losses for smallholders and seed companies. The event which brought together scientists, policymakers, seed companies and regulators was organised by Alliance for a Green Revolution in Africa, the Bill & Melinda Gates Foundation and the International Maize and Wheat Improvement Center (CIMMYT) in collaboration with the Kenya Agricultural and Livestock Research Organization (KALRO).

MLN is a serious new disease of maize which appeared in farmers' fields in eastern Africa in 2011. It is caused by a combination of two viruses that are difficult to differentiate individually based on visual symptoms. Read more.

(CGIAR Press Release, 11 May 2015)

Leafcutter ants use chemical secretions to prevent fungal infections

A team of researchers working in Panama has learned more about how leafcutter ants use chemical secretions to ward off fungal infections. In their paper published in Proceedings of the Royal Society B, the researchers describe how they set up multiple ant colonies and subjected them to various fungal infections, and observed how a unique type of worker ant appeared, one with an enlarged metapleural gland, which secreted the phenylacetic acid to be eradicating fungal infections. The team acknowledges that their study did not shed much light on how the insects have managed to keep their antifungal agent working for so long, but suggest that it might have something to do with the way the ants apply their chemical.

(Phys.org, 29 April 2015)

To predict disease researchers ask if plant neighbours are relatives

Disease is an invisible hand, shaping plant communities across the globe and determining the outcomes of environmental change, weed invasions and agriculture and forestry management strategies. Whether or not a disease devastates a plant community depends on how related the plant species are and on how many individual plants of each species are present, according to research from the Smithsonian Tropical Research Institute (STRI). Their results were published in Nature on 23 April 2015.

"Just as certain families get hit harder during flu season, some plant species are more vulnerable to disease than others," said Ingrid Parker, research associate at the STRI and professor at the University of California, Santa Cruz. "In the past, people have mostly looked at the relationship between a single plant species and a single pathogen. We study the spread of plant diseases in whole communities by figuring out which plants in an area are related, and estimating the number of individuals of each species and the level of infection for each. This lets us predict the impacts of disease at the community level for the first time."

Parker, Gilbert and their students measured the amount of leaf area showing disease symptoms on 43 different species in a coastal grassland in California and also determined how closely the plant species were related. Finally, they developed a model relating how susceptible each species is to fungal diseases.

They also set up a huge experiment in California, planting species in the same plant families but from other parts of the world. Some of them were closely related to locally common disease host plants and some more distantly related. Their prediction that close relatives would be more susceptible to local diseases panned out.

By considering how plants in a community are related, researchers will gain a much better understanding of why crop introductions sometimes fail in areas where wild relatives are sources of damaging diseases and how invasive weeds gain a foothold in areas where there are no diseases to control their spread.

(STRI News, 8 May 2015)

A fungus that enhances crop roots and could be a future bio-fertiliser

New research has found that the interaction of rice roots with a common mycorrhizal fungus changes the genetic expression of rice crops which triggers additional lateral root growth that enables the plant to absorb more nutrients. This is in addition to the phosphate provided by the fungal 'hyphae' tendrils. Plants colonised by the fungus received between 70 to 100% of their phosphate directly from these tendrils, an enormous mineral boost which may eventually mitigate the need for farmers to saturate crop fields with phosphate fertiliser to ensure maximum yield.

The hope is that mycorrhizal fungi could one day act as a 'bio-fertiliser' that ultimately replaces the need to mine phosphate from the ground for industrial fertiliser. Finding a replacement for mined phosphate is a critical

problem as not only is the resultant fertiliser a pollutant - causing algal growth which chokes water supplies - but the big phosphate mines are now depleted to the point where they are expected to run out in the next 30 to 50 years. Many experts are predicting a 'phosphate crisis'.

Rice is best grown in highly irrigated paddy fields, but there are many parts of the world where this isn't an option, and 40% of the world's area for rice crop is grown 'dry'. However, the plant-fungi relationship that creates enhanced crops actually works best in dry environments. Mycorrhizal fungi could be of huge benefit to those who rely on dry rice crops in some of the poorest areas of Asia and sub-Saharan Africa. Read more.

(University of Cambridge, Research News, 4 May 2015)

Rust tames a vine in New Zealand

A rapidly-growing vine (mile a minute) that is smothering trees and plants all over Rarotonga in New Zealand could be under control in a few years, thanks to a rust fungus, *Puccinia spegazzinii*. The rust has an impressive track record, having already been introduced to curb mile a minute's spread in countries including India, China, Fiji, Papua New Guinea and Vanuatu.

The mile a minute project is part of a $1 million plan to introduce biological controls for a number of the most invasive weeds in the Cook Islands. The project involves several agencies including New Zealand's Ministry of Foreign Affairs and Trade, Landcare Research New Zealand and the Cook Islands Ministry of Agriculture.

Concerns that the fungus, which comes from South America, will affect other plants are unlikely as the fungus is highly specific and only attacks the vine. While it's difficult to estimate how quickly the control will work on Rarotonga, a noticeable reduction in the vine after just two years has been reported.

In the future, biological controls will be introduced to the Cook Islands for a range of nuisance plants including the annual cropping weed cockleburr and the balloon vine, which is also spreading rapidly on Rarotonga.

(Cameron Scott, Cook Island News, 15 April 2015)

The Plant Doctor Game app

The Plant Doctor Game app, developed especially for Expo Milano 2015, enables visitors to gain an insight into the problems faced by smallholder farmers needing to safeguard their crops. It was developed by Plantwise, the Swiss Agency for Development and Cooperation (SDC) partner behind the creation of plant clinics.

The game starts by briefing players about the context. Players receive some information about the situation of the world's smallholder farmers and a general outline of the role and activities of the plant clinics that have been set up worldwide. Then the game begins in earnest. Players are shown a photo of a food and have to guess its main ingredient (coffee, cocoa, maize, etc.). They then meet the farmer who produces the ingredient, before being invited to step into the farmer's shoes and choose the right time to sow the crop.

At this point, things take a turn for the worse: the crops are suddenly struck by disease. Players have to take action to ensure the food security of both their own family and many other people. They will have to seek the aid of a plant doctor in order to identify the disease and determine the most effective way to treat it.

The interactive Plant Doctor Game sets out to show how modern technology can be used to improve the lives of smallholder farmers. Players aim to earn as many 'food security points' as they can - they will then be able to compare their scores with other players and add their points to the total achieved by all the participants. The app is now available for downloading to a smartphone or computer. Read more and download app.

(SDC Newsletter, May 2015)

New 'break' fumigant for stored-grain pests

A large-scale evaluation of sulfuryl fluoride to control phosphine-resistant stored-grain pests has found that it offers a viable alternative to phosphine, which could help break the resistance cycle. Grain insect pests are proving more difficult to control on-farm and in bulk storage sites across Australia. Resistance to several chemical treatments, including the key fumigant phosphine, have reduced available control options.

In a project led by Dr Manoj Nayak, the Plant Biosecurity Cooperative Research Centre (PBCRC) has been working with the grains industry to develop sulfuryl fluoride as a phosphine-resistance breaker. Sulfuryl fluoride is used to fumigate closed structures, controlling a range of insect pests. It is non-flammable, non-corrosive and can be used on a range of commodities and structures, including flour mills.

Dr Nayak and his research team have recently completed a large-scale evaluation of the fumigant at an industry storage site at Yelarbon, Queensland. The insect pests used in the trial included lesser grain borers (pictured), rice weevils, red-rust flour beetles and rusty grain beetles; all were strongly resistant to the fumigant phosphine. The screening of the test insects after the fumigation revealed complete control of all four

pests.

The research team concluded that the time to re-infestation after sulfuryl fluoride fumigation is at least three months.

More information is available in a GRDC GroundCover article or on PBCRC's website.

(The Bud - PBCRC News, Edition 51, 11 May 2015)

Associations with rhizosphere bacteria can confer an adaptive advantage to plants

A paper by C.H. Haney et al. titled "Associations with rhizosphere bacteria can confer an adaptive advantage to plants" was published in May 2015 by *Nature Plants* (vol. 99, pp. 176-187). The abstract is as follows:-

Host-associated microbiomes influence host health. However, it is unclear whether genotypic variations in host organisms influence the microbiome in ways that have adaptive consequences for the host. Here, we show that wild accessions of Arabidopsis thaliana differ in their ability to associate with the root-associated bacterium *Pseudomonas fluorescens*, with consequences for plant fitness. In a screen of 196 naturally occurring Arabidopsis accessions we identified lines that actively suppress Pseudomonas growth under gnotobiotic conditions. We planted accessions that support disparate levels of fluorescent Pseudomonads in natural soils; 16S ribosomal RNA sequencing revealed that accession-specific differences in the microbial communities were largely limited to a subset of Pseudomonadaceae species. These accession-specific differences in *Pseudomonas* growth resulted in enhanced or impaired fitness that depended on the host's ability to support *Pseudomonas* growth, the specific Pseudomonas strains present in the soil and the nature of the stress. We suggest that small host-mediated changes in a microbiome can have large effects on host health.

See: http://www.nature.com/articles/nplants201551

Acknowledgements

Thanks to Teresa Coutinho, Grahame Jackson, Greg Johnson, Laurence Madden, Gert Marais, Neal McLaren, Zacharias Pretorius, Richard Strange, and Peter Williamson for contributions and photos.