INTERNATIONAL NEWSLETTER ON PLANT PATHOLOGY

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News and announcements 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.

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In this issue:

Raindrops make soil bacteria take off and fly through air

When water falls to the ground, bacteria take to the skies. Cullen Buie and his colleagues at Massachusetts Institute of Technology used high-speed cameras to reveal how raindrops can disperse microbes from the soil into the air in tiny water droplets, possibly allowing them to travel long distances.

Read more.

https://youtu.be/JmYTTVHdTe8

(Grahame Jackson, PestNet, 15 March 2017)

Drought-quenching bacteria protect plants from climate stress

Although agricultural improvements have boosted food production in the past 50 years, drought and salinisation threaten more than half of the planet's arable land. A team of researchers at Northern Arizona University's (NAU) Center for Ecosystem Science and Society recently published findings in Plant and Soil showing soil-borne bacteria could help mitigate crop losses due to drought.

Led by NAU doctoral student Rachel Rubin, the researchers conducted a meta-analysis, reviewing more than 50 scientific studies from throughout the world. When plants in the studies were provided with growth-promoting rhizobacteria (PGPR), a diverse group of organisms known for their root and rhizosphere colonizing ability, vegetable and grain yields increased 20 to 45 percent. The benefits of rhizobacteria were even greater in plants grown in a drought compared to their well-watered

counterparts.

Like the human gut, plants have a tight relationship with their root microbiome, a relationship that has existed long before agriculture. Industrialised agriculture-extensive irrigation, inorganic fertilizers and artificial selection for high-yielding varieties- may have weakened this linkage, rendering plants more susceptible to extreme climate events.

Read more.

(Grahame Jackson, PestNet, 26 March 2017)

Healthy soil is the real key to feeding the world

"The innovative farmers I met showed me that regenerative farming practices can restore the world's agricultural soils. In both the developed and developing worlds, these farmers rapidly rebuilt the fertility of their degraded soil, which then allowed them to maintain high yields using far less fertiliser and fewer pesticides." An interesting opinion article by David R. Montgomery, Professor of Earth and Space Sciences at the University of Washington, that question the three pillars of conventional wisdom about today's industrialised agrochemical agriculture: that it feeds the world, is a more efficient way to produce food, and will be necessary to feed the future.

Read more.

(The Conversation, 4 April 2017)

A 'bionic leaf' - the next green revolution

The first "green revolution" in the 1960s saw the increased use of fertiliser on new varieties of rice and wheat, which helped double agricultural production. Although the transformation resulted in some serious environmental damage, it potentially saved millions of lives, particularly in Asia, according to the United Nations (U.N.) Food and Agriculture Organization. But the world's population continues to grow and is expected to reach more than 2 billion people by 2050. Providing food for everyone will require a multi-pronged approach, but experts generally agree that one of the tactics will have to involve boosting crop yields to avoid clearing even more land for farming.

To contribute to the next green revolution, Daniel Nocera, who is at Harvard University, is building on the artificial leaf he developed to make fertiliser. The artificial leaf is a device that, when exposed to sunlight, mimics a natural leaf by splitting water into hydrogen and oxygen. This led to the development of a bionic leaf that pairs the water-splitting catalyst with the bacteria, Ralstonia eutropha, which consumes hydrogen and takes carbon dioxide out of the air to make liquid fuel.

Nocera's team has designed a system in which Xanthobacter bacteria fix hydrogen from the artificial leaf and carbon dioxide from the atmosphere to make a bioplastic that the bacteria store inside themselves as fuel. "I can then put the bug in the soil because it has already used the sunlight to make the bioplastic," Nocera says. "Then the bug pulls nitrogen from the air and uses the bioplastic, which is basically stored hydrogen, to drive the fixation cycle to make ammonia for fertilizing crops."

Nocera's lab has analysed the amount of ammonia the system produces. The researchers have used their approach to grow five crop cycles. The vegetables receiving the bionic-leaf-derived fertiliser weigh 150 percent more than the control crops. The next step, Nocera says, is to boost throughput so that one day, farmers in India or sub-Saharan Africa can produce their own fertiliser.

(Scienmag, 3 April 2017)

IV International Symposium on Postharvest Pathology, 28 May - 2 June 2017

The IV International Symposium on Postharvest Pathology for the International Society for Horticultural Sciences (ISHS) and for the International Society for Plant Pathology (ISPP) will be hosted in the Kruger National Park at Skukuza camp from 28 May to 2 June, 2017. The symposium will bring together the postharvest pathology researchers from across academic spheres from

around the globe and delegates will share their scientific research, develop new collaborations and strengthen existing networks.

The programme consists of 9 themes including:

- The Climate is changing, so must Postharvest Pathology
- Intellectual Property Rights and Novel Technologies
- Next Generation Postharvest Pathology from Transcriptomics to Metabolomics
- Elucidation of Host-Pathogen Interactions
- Nanotechnology and Biosensors for real- time Postharvest Sollutions
- The Microbiome in Postharvest Pathology
- Postharvest Food Safety for Food Security
- Chemical and Alternative Postharvest Disease Control
- Industry and Government Perspective and Needs

Around 120 abstracts have been received and an excellent programme has been put together. Registrants from more than 16 countries will be attending the meeting.

For more information and to register: www.postharvest2017.co.za

3rd International Conference on Global Food Security, 3-6 December 2017

Invited speakers for 3rd International Conference on Global Food Security to be held in Cape Town, South Africa, during 3 to 6 December 2017 have been announced and are available on the website.

Abstracts for oral and poster presentations are invited on the conference themes and should be submitted online. Submit abstracts by 31 May 2017.

The five core conference themes reflect an integrated approach to identifying solutions to the complex global challenge of food security:

- Food creation
- Food safety and bio security
- Food loss and waste
- Food in a changing society
- Food utilization

For more information and to register: http://www.globalfoodsecurityconference.com/

Practical Tools for Plant and Food Biosecurity - new book

Practical Tools for Plant and Food Biosecurity - Results from a European Network of Excellence. 2017. Gullino, M.L., Stack, J.P., Fletcher, J., Mumford, J. (Eds). Series: Plant Pathology in the 21st Century, Vol. 8. Springer, 384 p.

This volume is part of a series of volumes on Plant Pathology in the twenty-first Century and it stems from Plant and Food Biosecurity (PLANTFOODSEC), a Network of Excellence funded under the European 7th Framework Programme for Research and Technological Development focusing on biological threats having the capacity to affect and damage agriculture, infect plants and ultimately affect food and feed at any stage in the supply chain.

Biosecurity is a strategic and integrated approach for analysing and managing relevant risks to human, animal and plant life and health, and associated risks to the environment. Although most plant disease and food safety outbreaks have natural causes or are the result of inadvertent introductions of pathogens through human activities, the risk of a deliberate introduction of a high consequence plant pathogen or human pathogen on plant cannot be excluded.

The considerable amount of research on plant biosecurity and food safety promoted by the European Union - which has also involved non-EU countries such as the United States, Israel and Turkey - has made possible the development of a

comprehensive set of tools covering the entire risk management cycle - from prevention to preparedness, detection, response and recovery - which are presented in this book. In particular the different chapters cover the identification and regulatory analysis of biosecurity challenges; pest risk assessment; experimental and modelling approaches; decision tools and microbial forensics; diagnostics and detection tools. Moreover training, dissemination and networking subjects are also covered.

This book is aimed at researchers, graduates and policy makers in the field of Plant Health, Food Safety and Food Security. More details available from Springer.

Special issue on 'Microbial Local Adaption' in Molecular Ecology

The Molecular Ecology Special Issue on 'Microbial Local Adaptation' highlights different approaches that can be used to study patterns and mechanisms of adaptation in microbes, and this special issue compiles studies reporting evidence of local adaptation in natural populations, studies using experimental evolution for elucidating how selection can produce adaptation or what constraints exist that prevent optimal adaptation, and studies detecting footprints of adaptation in genomes and identifying the genetic basis of adaptation. Biological models in this special issue include viruses, bacteria, oomycetes and fungi, most of which are plant or animal (including human) pathogens, and some domesticated fungi (wine yeasts). Some papers in the present issue review the literature on a particular aspect of local adaptation, for instance on the genetic basis of local adaptation in crop pathogens or on insights obtained from experimental evolutionary studies of local adaptation in plant viruses or on trade-offs (Bono et al. 2017; Croll & McDonald 2017; Elena 2017).

Browse papers.

New Phytologist's top-cited papers of 2016

Read the ten papers that were most-cited in New Phytologist in 2016.

- Mycorrhizal ecology and evolution: the past, the present, and the future
- A metacalibrated time-tree documents the early rise of flowering plant phylogenetic diversity
- The importance of the microbiome of the plant holobiont
- Redefining fine roots improves understanding of below-ground contributions to terrestrial biosphere processes
- Carbon sequestration is related to mycorrhizal fungal community shifts during long-term succession in boreal forests
- Salinity tolerance of crops - what is the cost?
- Tree mortality from drought, insects, and their interactions in a changing climate
- The Chromosome Counts Database (CCDB) - a community resource of plant chromosome numbers
- The origins of reproductive isolation in plants
- Improving intercropping: a synthesis of research in agronomy, plant physiology and ecology

Myrtle rust confirmed on New Zealand christmas bush on Raoul Island

Myrtle rust, also known as guava rust and eucalyptus rust (Puccinia psidii), has been confirmed on pôhutukawa trees [Metrosideros excelsa; New Zealand Christmas bush] on Raoul Island (Kermadec Island group). If it were to enter mainland New Zealand, it could affect iconic New Zealand plants, as well as commercially-grown species such as eucalyptus, guava and feijoa.

New Zealand Ministry for Primary Industries' Geoff Gwyn says, "Our focus right now is to protect the unique Raoul Island ecosystem, and to prevent the further spread of the fungus to the mainland." New Zealand already has stringent biosecurity measures. Myrtle rust is well established along the eastern seaboard of Australia and in New Caledonia.

Read more.

(ProMED-mail, 4 April 2017)

New global guidelines for international exchange of plant material and seeds

The International Plant Protection Convention (IPPC)'s governing body, the Commission on Phytosanitary Measures (CPM) adopted new global standards to help ensure that the international trade in plants and seeds is safer. The rapid growth in agricultural trade via online marketplaces is making it harder to ensure that all shipments are free from bugs and diseases.

Of particular concern is the threat of pest transmission posed by seeds. Unlike other agricultural products destined for consumption, seeds are for planting, thus there is a greater risk that any pests they carry could establish themselves and spread. Addressing these risks presents a highly complex task. By proposing approaches to risk assessment and testing, the new standard will help harmonise the international seed trade.

The IPPC is the only organisation to set government-recognised plant health standards. "These standards, which are built on consensus, are the most effective way to prevent the introduction and spread of plant pests to new environments, and avoid devastating impacts on plants as well as biodiversity, food security and trade," said Jingyuan Xia, IPPC Secretary.

The CPM further considered guidelines for a regulatory system and a series of treatments that stop pests from burrowing into wooden packaging and methods to stop fruit flies.

Read more.

(ProMED-mail, 25 April 2017)

Cassava viruses cause Tanzania $50m in yearly losses

The International Institute of Tropical Agriculture (IITA) said that Tanzania was losing 50 million U.S. dollars annually from viruses in cassava crops. James Left, a principal scientist with IITA, said almost half of all crops produced in Tanzania were affected by diseases which hugely affected the country's agricultural sector. Victor Mayong, IITA Eastern Africa Director, said the institute was now focusing on inventing technologies that will reduce different crop threats and ensure that the agricultural sector will grow.

(Grahame Jackson, PestNet, 25 April 2017)

Plant roots use sound to find sources of water

A study led by The University of Western Australia (UWA) has found plants have far more complex and developed senses than we thought with the ability to detect and respond to sounds to find water. In the study "Tuned in: plant roots use sound to locate water" published in Oecologia, UWA researchers found that plants can sense sound vibrations from running water moving through pipes or in the soil, to help their roots move towards the source of water. The study also revealed that plants do not like certain noises and will move away from particular sounds.

Lead researcher Dr Monica Gagliano from UWA's Centre of Evolutionary Biology at the School of Animal Biology said water was a basic need for a plant's survival, and the study showed that sound plays a significant role in helping plants cater to this need. "We used the common garden pea plant (Pisum sativum) as the model for our study and put the plant into a container which had two tubes at the base, giving it a choice of two directions for the growth of its roots. We then exposed the plant to a series of sounds, including white noise, running water and then a recording of running water under each tube, and observed its behaviour."

The scientists found that the plants could tell where the source of the water was and their root systems grew towards that source based on sensing the sound of running water alone. The research has important implications for understanding the behaviour of plants and how it affects their survival.

(Phys.org, 11 April 2017)

A major advance in characterising downy mildew resistance genes in sunflower

A team of INRA scientists from Toulouse and Clermont Ferrand has developed a method that can identify the proteins responsible for the virulence of the parasite that causes downy mildew in sunflower. This disease can cause an almost total loss of yield in the event of a severe infestation. These findings have just been published in the journal Frontiers in Plant Science. This advance should facilitate the characterisation of genes for the resistance of sunflower to downy mildew.

Read more.

(INRA, The Newsletter for Industry, No. 91, April 2017)

Modified corn fights fungus with "Trojan horse" RNA

The Aspergillus family of fungi is a dangerous food contaminant, thanks to its tendency to produce aflatoxins. These carcinogenic compounds have been linked to stunted growth in children, liver cancer, and immune suppression, which in turn increases a person's vulnerability to conditions like HIV. Now, researchers at the University of Arizona have genetically modified corn plants to fight back, by letting them send "Trojan horse" molecules into the fungus to neutralise its ability to produce the toxins.

Even small quantities of aflatoxin can ruin a large harvest, and the US Food and Drug Administration (FDA) has strict guidelines in place that limit the amount allowed in food to a mere 20 micrograms per kilogram, or 20 parts per billion (ppb). The problem is, in developing countries that limit is much harder to enforce, meaning that aflatoxin levels could soar as high as 100,000 ppb.

The new technique works by taking advantage of the fact that RNA molecules are passed between the infected corn and the Aspergillus fungus. Knowing this, the UA researchers modified the corn plants' genetic code so it produces hairpin-shaped RNA molecules within the kernel, and when the fungus takes hold, these are sent into it. Once there, these molecules target a particular section of the fungus' RNA, preventing it from producing a certain enzyme and shutting down the creation of aflatoxin.

The research was published in Science Advances and Schmidt describes the study in the video below.

https://youtu.be/OiUdk-WdmxQ

Read more.

(Grahame Jackson, PestNet, 26 March 2017)

Key mechanism in the plant defense against fungal infections discovered

A team from the Centre for Research in Agricultural Genomics (CRAG), in Spain, has found that the regulation of the protein activity in the plant by the mechanism known as SUMOylation is crucial for the plant protection against fungal infections. The study, which has just been published in Molecular Plant, is the result of a collaboration between two researchers at CRAG: Maria Lois, expert in protein regulation, and María Coca, expert in plant immune responses to pathogen infection. As Maria Lois explains, "the results of this research will be used to develop new strategies for crop protection against fungal infection."

SUMO protein binding to other cellular proteins (SUMOylation) is a key process for many cellular functions. In plants, it is known that SUMO conjugation regulates plant development and their responses to environmental stresses. Until now SUMOylation roles have been difficult to study because, its complete inhibition causes plant death at the seed stage. To overcome these limitations, Maria Lois' research group has developed a new tool to inhibit the SUMOylation only partially, so the plant can develop normally. Using genetic engineering techniques, the CRAG researchers introduced in the plant a small protein fragment that partially inhibits the SUMOylation.

Using this new approach, CRAG's team found that plants with compromised SUMOylation showed an increased susceptibility to necrotrophic fungal infections by Botrytis cinerea and Plectosphaerella cucumerina. "These two fungi cause plant death and feed on dead tissues. B. cinerea is a geographically widespread fungus which infects many species of plants. P. cucumerina is a

model of study, but is also an important pathogen of vegetable crops such as melon," explains Maria Coca.

In addition, the researchers observed that shortly after the fungal infection, protein SUMOylation was decreased in the infected plants. This observation suggested that the necrotrophic fungi reduce protein SUMOylation as a mechanism of pathogenicity. Thus, this study opens new opportunities for developing novel strategies for crop protection against pathogenic fungi, as well as for the development of more specific fungicides

Read more.

(Grahame Jackson, PestNet, 23 April 2017)

Nematodes in cropping systems: identification and techniques workshop, Fiji, 2017

The workshop suits researchers and professionals working in agriculture, quarantine, green keeping, and soil biology, who need to understand the principles and practice of handling soil, plant and insect nematodes. It will provide hands-on experience in sampling, extraction, specimen preparation, culturing, diagnosis, and identification. There will be opportunity for interaction with experts in the field. Participants should have a degree which includes biology, agriculture, or soil science or have appropriate work experience to undertake the workshop. Less experienced participants can be supplied with recommended reading material prior to the workshop.

This course is being held in Suva to allow access to many nematodes of tropical crops which are of considerable importance for quarantine, trade and agriculture in Australia, New Zealand, the Pacific and southeast Asia. Nematodes from other places such as Australia, New Zealand and elsewhere will be treated during the course, but through fixed material. Suva is about a 4 hour direct flight from Sydney or 3 hours from Auckland.

The workshop will be conducted by: Dr. Mike Hodda (National Research Collections Australia and Biosecurity Flagship, CSIRO, Canberra), Dr. Kerrie Davies (School of Agriculture, Food & Wine, The University of Adelaide), and Dr. Sunil Singh (Biology Discipline, University of The South Pacific).

The workshop requires 9 participants to proceed. Send expressions of interest as soon as possible, and definitely before the end of September 2017. For further enquiries or to book a place, email the course coordinators: mike.hodda@csiro.au or sunil.singh@samoa.usp.ac.fj

Read more

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