ISPP INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

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INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

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IN THIS ISSUE:

A VIRUS COMPLEX THREATENS ARGENTINA'S PAPAYA CROPS

FRESH PLAZA, 29 OCTOBER 2024

Photo: INTA

Diseases caused by viruses are the main obstacle to papaya production on a global scale. More than 45 viruses have been reported in tropical and subtropical regions. However, only the Papaya Ringspot Virus (PRSV) and the virus complex that causes the Meleira disease are considered threats to papaya production.

"A few years ago, we carried out evaluations in plantations in all the provinces of the northwest and the northeast and confirmed the presence of symptoms similar to those caused by viruses," stated Dariel Cabrera Mederos, Conicet researcher at the Plant Pathology and Agricultural Modelling Unit and INTA's Institute of Plant Pathology.

In Argentina, papaya is mainly grown in the subtropical region that includes the provinces of Salta, Jujuy, Chaco, Corrientes, Formosa, and Misiones. The area planted with papayas in the country has increased over the last decade because of this crop's economic benefits, mainly associated with its value in the national market and its profits in the industry.

According to the INTA researcher, during their tour in the NOA, they observed “mosaic symptoms in leaves similar to those induced by viruses, but which were not consistent with the viruses that had been reported.” He also said that the samples collected were subjected to different analyses and revealed their association with a new potexvirus that has not been previously reported worldwide called papaya virus X.

This virus is transmitted mechanically on papaya and was found in most of the areas inspected in Salta and Jujuy.

PRSV causes mosaic, leaf deformation, and fruit banding. Papaya virus X induces intense mosaic on leaves, but no symptoms on fruits. The virus associated with the complex that causes Meleira causes the fruits to spontaneously exudate latex, which generates its characteristic symptom after its oxidation. The high incidence and severity of symptoms observed in the field led researchers to conclude that they could affect crop yields.

"We have not carried out direct studies to determine the effects on yields, but we know that the incidence reaches 100% during the crop's first year," Cabrera Mederos stated. Furthermore, "the rapid spread of this disease has made it difficult to establish new plantations."

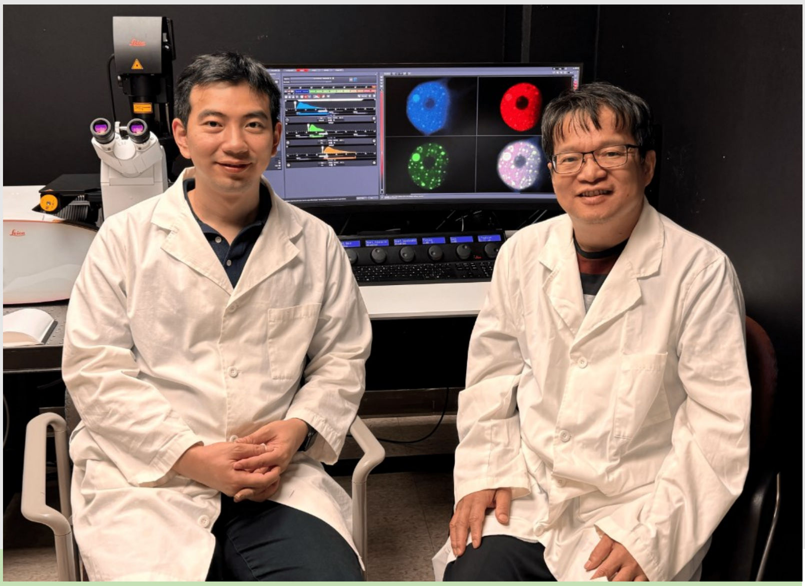
In Brazil, for example, after seeing the damage caused by the Meleira-associated complex, producers have opted to destroy their crops to prevent the disease from spreading.

Preliminary research results corroborate that the disease is transmitted mechanically. Thus, researchers suggest producers carry out preventive management, such as disinfecting the tools used in plots and implementing disinfection protocols when entering recently established plantations.

DISCOVERY OF A PROTEIN'S KEY ROLE IN RNA PROCESSES COULD IMPROVE DISEASE TREATMENT IN HUMANS AND PLANTS

ASHLEY VARGO, AGRILIFE TODAY, 31 OCTOBER 2024

Researchers from Texas A&M AgriLife uncovered a promising target for controlling gene expression and other cellular processes, which could lead to advancements in crop resilience and our understanding of certain human diseases. This target centers on RNA regulation, which, when disrupted in humans, is often linked to neurodegenerative diseases like Alzheimer's disease and Parkinson's disease, as well as many types of cancer. On the other hand, improvements in certain RNA production processes can lead to new therapeutics and improved crop resilience in plants.



A recent study led by Xiuren Zhang, Ph.D., and Songxiao Zhong, Ph.D., shows a new link between mRNA modifications and microRNA production (Photo: Xindi Li, Texas A&M AgriLife).

With this in mind, a group of researchers led by Xiuren Zhang, Ph.D., Christine Richardson Endowed Professor in the Texas A&M College of Agriculture and Life Sciences Department of Biochemistry and Biophysics and jointly appointed professor in the Texas A&M College of Arts and Sciences Department of Biology, aimed to explore how RNA processes are coordinated within cells. Their study, published in *Nature Cell Biology*, showed that a protein called Serrate connects RNA modification and microRNA production, two essential cellular functions, in a way previously unknown.

"We found that, instead of working in isolation, certain RNA processes influence each other," Zhang said. "These new insights could allow us to regulate gene expression more precisely for applications in crop science and human health."

The study was led by Zhang and performed by postdoctoral researcher Songxiao Zhong, along with support from other scientists within Texas A&M AgriLife Research, the Texas A&M College of Medicine, the University of Nebraska and the Guangdong Provincial Key Laboratory of Biotechnology for Plant Development. The project was funded by the National Institutes of Health, National Science Foundation and the Welch Foundation.

RNA's role in plant and human health

RNA plays critical roles in the cell, ranging from acting as messengers to translating genetic code into proteins, catalyzing reactions and even regulating other RNA molecules to adjust gene expression. All of these are necessary to keep cells — and entire organisms — functioning properly. With RNA's diverse roles, Zhang said its production requires steps to ensure each molecule is precisely produced and properly decorated to perform its specific task. That's where RNA modifications come in.

"You can think of RNA modifications like punctuation in a sentence," Zhang said. "These modifications can act like an exclamation mark to emphasize certain instructions, like a comma to pause others, or even like a period to stop some RNA from being used altogether."

Serrate's role in RNA modification

Zhang and Zhong investigated the processes behind these modifications in their recent research study. In particular, they looked at the most abundant kind of modification, which involves adding a small chemical group onto the RNA molecule — called N6-adenosine methylation, or m6A modification. In agriculture, the yield of rice and corn has been shown to be influenced by m6A levels on messenger RNA, or mRNA, which are eventually translated into proteins. Levels of m6A also impact plant resilience to viral infections.

Zhang's lab uses *Arabidopsis thaliana*, a model organism in research, to explore fundamental processes in molecular genetics and RNA biology (Photo: Xindi Li, Texas A&M AgriLife).

Zhang's team examined the molecular machine responsible for making this type of modification to the mRNA. They found that the protein Serrate interacts with this molecular machine to keep a disordered part of the machine from becoming too tangled to function. They found that Serrate can also streamline the m6A modification process, making it more efficient, and prevent other enzymes from breaking it down.

While Serrate's roles in other biological processes were already well documented, its role in maintaining the m6A-adding machine is new. The discovery of Serrate's role in RNA modification reveals a connection between this process and the production of a different type of RNA: microRNA.

mRNA and microRNA connection

Zhang's lab has been investigating Serrate protein for years, but not for its role in mRNA modification — instead, they'd been studying it for its more well-known role in producing microRNAs. In the cell, microRNAs act as quantity control agents in protein production. These molecules can regulate gene expression by eliminating unnecessary RNAs or preventing certain RNAs from being translated into proteins. Zhang and Zhong's findings that Serrate is involved in both microRNA production and mRNA modifications show its unique position as a regulator of the fate of cells' RNAs.

"Both of these processes have been studied separately, but their cross-regulation has remained largely unnoticed until now," Zhong said. "We found that Serrate acts as a bridge between these two crucial mechanisms. This is an important step in our fundamental research. Understanding the coordination is essential for developing new treatments."

Impacts on health and agriculture

Zhang said this discovery opens the door to treatments that could target this RNA modification process to correct problems in gene regulation, in addition to telling scientists more about these fundamental processes.

"We now have a clearer understanding of how m6A is regulated in the cell, which opens up new possibilities for drug discovery," Zhang said. "By targeting the pathways we've identified, we could develop treatments for diseases that occur when these processes go wrong."

Zhang said these findings are just as important for agriculture. RNA modifications help plants respond to environmental challenges like drought, unfavorable salinity conditions, and pressures from pathogens. The team believes that by manipulating these RNA processes, they could improve crop resilience and productivity.

Looking ahead, the research team plans to expand their work to study how these RNA processes operate in other crops and in human cells.

"This study gives us a new way to understand RNA regulation in a variety of species," Zhang said. "We're excited to explore how we can use this knowledge to improve the future of human health and agriculture."

PODCAST BY ANTHONY YOUNG ON RATOON STUNTING DISEASE IN SUGARCANE

THE CROP SCIENCE PODCAST SHOW, EPISODE 43, 8 OCTOBER 2024

In this episode of The Crop Science Podcast Show, Dr. Anthony Young from the University of Queensland discusses critical aspects of crop protection, focusing on managing plant health and combating ratoon stunting disease (RSD) in sugarcane. The conversation explores the latest research, practical challenges, and the economic, environmental, and social implications of effective disease management.

Watch to Podcast.

STUDY ANALYSES POTATO–PATHOGEN 'ARMS RACE' AFTER IRISH FAMINE

MICK KULIKOWSKI, NC STATE UNIVERSITY NEWS, 5 AUGUST 2024

In an examination of the genetic material found in historic potato leaves, North Carolina State University researchers reveal more about the tit-for-tat evolutionary changes occurring in both potato plants and the pathogen that caused the 1840s Irish potato famine.

The study used a targeted enrichment sequencing approach to simultaneously examine both the plant's resistance genes and the pathogen's effector genes – genes that help it infect hosts – in a first-of-its-kind analysis.

"We use small pieces of historic leaves with the pathogen and other bacteria on them; the DNA is fragmented more than a normal tissue sample," said Allison Coomber, an NC State former graduate student researcher and lead author of a paper in *Nature Communications* that describes the study. "We use small 80 base-pair chunks like a magnet to fish out similar pieces in this soup of DNA. These magnets are used to find resistance genes from the host and effector genes from the pathogen."

"This is a first for looking at both potato and pathogen changes at the same time; usually researchers look at one or the other," says Jean Ristaino, William Neal Reynolds Distinguished Professor of Plant Pathology at North Carolina State University and corresponding author of the paper. "The dual enrichment strategy employed here allowed us to capture targeted regions of genomes of both sides of the host-pathogen relationship, even when host and pathogen were present in unequal amounts. We couldn't have done this work 15 years ago because the genomes weren't sequenced."

The study's results show that the pathogen, *Phytophthora infestans*, is very adept at fighting off potato late blight disease resistance. For example, the study shows that the FAM-1 strain of the pathogen had the ability to defeat the resistance provided by the plant's R1 resistance gene – even before plant breeders deployed it in potato.

"The pathogen would have been able to resist this R1 resistance gene even if it had been deployed years earlier, probably because it was exposed to a potato with that resistance gene in the wild," Coomber said.

The study also shows that many of the pathogen's effector genes have remained stable, although different mutations have occurred to increase its infection prowess as plant breeders attempted to breed resistance – specifically after 1937 when more structured potato breeding programs commenced in the United States and other parts of the globe. The pathogen added a set of chromosomes between 1845 and 1954, the period of time in which the study's plant samples were collected.

"We show in this work that after 100 years of human intervention, there are some genes that haven't changed much in the pathogen," Coomber said. "They are very stable potentially because they haven't been selected on, or because they are really important to the pathogen. Targeting those genes would make it really hard for the pathogen to evolve an opposing response."

"It's hard to do effective plant breeding when we don't know enough about the pathogen. Now that we know what effectors have changed over time, breeders may be able use resistance genes that are more stable or pyramid multiple resistance genes from different wild hosts," Ristaino said.

"That's where I see the future for this type of study – applying it to slow changes in pathogen virulence or other traits such as fungicide resistance."

MICROBIAL ALLIES: HOW FRIENDLY FUNGI IS HELPING RICE THRIVE

UNIVERSITY OF WESTERN AUSTRALIA (UWA) NEWS, 11 SEPTEMBER 2024

Researchers from The University of Western Australia, in collaboration with Chinese scientists, have uncovered a fascinating aspect of plant-microbe interactions, revealing how a specific leaf fungus enhances rice disease resistance through chemical signalling.

Published in *Nature Microbiology*, the research offers new insights into the complex relationships between rice, its resident microbiota and invasive pathogens.

Rice is a staple food for more than half of the world's population, providing a major source of calories and nutrition and a vital agricultural commodity, supporting the livelihoods of millions of farmers, particularly in Asia, where 90 percent of the world's rice is produced and consumed.

Study co-author Xiaoyu Liu from the ARC Centre for Plant Energy Biology at UWA's School of Molecular Sciences, said the research offered a significant leap towards understanding plant defence mechanisms, and in particular rice.

"We already knew that microbes, known as phyllosphere microbiota, that live on the above-ground parts of plants, established symbiotic relationships with their host plants through nutrient exchange and signal communication," Ms Liu said.

"These microorganisms significantly influence plants' different characteristics and fitness, and play an essential role in pathogen defence systems, however, the mechanisms by which they did this have remained largely unknown, until now."

Lead author Professor Mengcen Wang said after extensive greenhouse and field experiments, the team discovered the distinct differences in disease resistance among various rice varieties vanished when the phyllosphere microbial community was disrupted.

"Guided by this interesting phenomenon, we found besides disease resistance genes, phyllosphere microbiota also played an important role in regulating rice disease resistance," Professor Wang said.

Researchers selected three rice varieties – Teqing, Nipponbare, and Lemont – for further investigation and through microbiome analysis and high-throughput screening, identified a phyllosphere fungus, Aspergillus cvjetkovicii, which was a key player in enhancing rice disease resistance.

"We found that a metabolite known as 2,4-DTBP, produced by the fungus, boosted rice's disease resistance by neutralising harmful molecules that build up during the growth of harmful fungi and prevented the fungi from causing infections," Ms Liu said.

"Our experiments showed that both the fungus and the metabolite were effective in protecting rice from diseases."

The findings offered new ways to develop stable and efficient methods for controlling plant diseases, the researchers said.

A TOMATO BUSHY STUNT VIRUS-BASED VECTOR FOR SIMULTANEOUS EDITING AND SENSING TO SURVEY THE HOST ANTIVRIAL RNA SILENCING MACHINERY

A paper by April DeMell *et al.* titled "A tomato bushy stunt virus–based vector for simultaneous editing and sensing to survey the host antiviral RNA silencing machinery" was published in January 2024 by *PNAS Nexus* (Vol. 3, Issue 1, pgad436). The abstract is as follows:-

A tomato bushy stunt virus (TBSV)–derived vector system was applied for the delivery of CRISPR/Cas9 gene editing materials, to facilitate rapid, transient assays of host–virus interactions involved in the RNA silencing pathway. Toward this, single guide RNAs designed to target key components of the virus-induced host RNA silencing pathway (AGO2, DCL2, HEN1) were inserted into TBSV-based GFP-expressing viral vectors TBSV-GFP (TG) and its P19 defective mutant TGΔP19. This produced rapid, efficient, and specific gene editing in planta. Targeting AGO2, DCL2, or HEN1 partially rescued the lack of GFP accumulation otherwise associated with TGΔP19. Since the rescue phenotypes are normally only observed in the presence of the P19 silencing suppressor, the results support that the DCL2, HEN1, and AGO2 proteins are involved in anti-TBSV RNA silencing. Additionally, we show that knockdown of the RNA silencing machinery increases cargo expression from a nonviral binary Cas9 vector. The TBSV-based gene editing technology described in this study can be adapted for transient heterologous expression, rapid gene function screens, and molecular interaction studies in many plant species considering the wide host range of TBSV. In summary, we demonstrate that a plant virus can be used to establish gene editing while simultaneously serving as an accumulation sensor for successful targeting of its homologous antiviral silencing machinery components.

Read paper.

BACTERIA CAN ANTICIPATE THE SEASONS: PHOTOPERIODISM IN CYANOBACTERIA

A paper by Maria Luísa Jabbur *et al.* titled "*Bacteria can anticipate the seasons: Photoperiodism in cyanobacteria*" was published on 5 September 2024 by *Science* (Vol. 385, Issue 6713, pp. 1105-1111). The abstract is as follows:-

Photoperiodic time measurement is the ability of plants and animals to measure differences in day versus night length (photoperiod) and use that information to anticipate critical seasonal transformations, such as annual temperature cycles. This timekeeping phenomenon triggers adaptive responses in higher organisms, such as gonadal stimulation, flowering, and hibernation. Unexpectedly, we observed this capability in cyanobacteria—unicellular prokaryotes with generation times as short as 5 to 6 hours. Cyanobacteria exposed to short, winter-like days developed enhanced resistance to cold mediated by desaturation of membrane lipids and differential programs of gene transcription, including stress response pathways. As in eukaryotes, this photoperiodic timekeeping required an intact circadian clockwork and developed over multiple cycles of photoperiod. Therefore, photoperiodic timekeeping evolved in much simpler organisms than previously appreciated and enabled genetic responses to stresses that recur seasonally.

Read paper.

PRODUCTION VULNERABILITY TO WHEAT BLAST DISEASE UNDER CLIMATE CHANGE

A paper by Diego N. L. Pequeno *et al*. titled "Production vulnerability to wheat blast disease under climate change" was published in 1 February 2024 by *Nature Climate Change* (Vol. 14, pp. 178-183). The abstract is as follows:-

Wheat blast is a devastating disease caused by the fungal pathogen *Magnaporthe oryzae* pathotype *Triticum* that has spread to both neighbouring and distant countries following its emergence in Brazil in the 1980s. Under climate change conditions, wheat blast is predicted to spread primarily in tropical regions. Here we coupled a wheat crop simulation model with a newly developed wheat blast model, to provide quantitative global estimates of wheat blast vulnerability under current and future climates. Under current climatic conditions, 6.4 million hectares of arable land is potentially vulnerable to wheat blast. A more humid and warmer climate in the future (Representative Concentration Pathway 8.5) is likely to increase the area suitable for wheat blast infection, particularly in the Southern Hemisphere, and reduce global wheat production by 69 million tons per year (13% decrease) by mid-century. Impacts of climate change could be further exacerbated and food security problems increased.

Read paper.

CURRENT VACANCIES

Assistant Professors: Horticulture and Plant Pathology, Clemson University

The Department of Plant and Environmental Sciences in the College of Agriculture, Forestry and Life Sciences at Clemson University is seeking to fill two 9-month, tenuretrack positions at the Assistant Professor level (75% research and 25% Extension) to work on small fruit crops. The positions are located on the main campus in Clemson, South Carolina. Clemson University is an R1 Land Grant University located on the shores of Lake Hartwell within view of the Blue Ridge Mountains in the upper Piedmont region of South Carolina, USA. The 1,400-acre campus is part of the 18,000 acres of University Farms and Forests devoted to teaching and research.

The successful candidates are each expected to develop a vigorous, innovative, and extramurally supported research program. The first successful candidate should have a strong background in horticulture and focus on the cultivation of economically important small fruit crops in South Carolina and the southeastern United States. The second successful candidate should have a strong background in Plant Pathology and focus on the management of fungal diseases in small fruit crops. The research must be responsive to grower and stakeholder needs. Successful candidates are expected to collaborate with other faculty members in the department and college and interact with stakeholders and commodity groups in the region and around the country. There is an expectation of excellence in grantsmanship, timely communication of research findings through publication of peer-reviewed journal articles, and active participation in the training and mentoring of graduate students and postdocs. In addition to the above responsibilities, the successful candidate will be expected to communicate findings effectively with stakeholders and to assist in teaching activities.

Deadline: For full consideration, please apply by 15 November, 2024. Applications will be reviewed as they are received. The position will remain posted until it is filled.

More information on job and submit application.

Professor and Department Head (Academic Administrator, Pennsylvania State University

The Department of Plant Pathology and Environmental Microbiology at The Pennsylvania State University is seeking an outstanding individual to provide leadership and vision as Department Head. The Department thrives on understanding the nature of how diverse factors impact food safety, crop quality/productivity, and agricultural and ecosystem health with the goal to develop effective strategies for sustainable food and feed production. Specifically, the Department supports integrated extension programs in field crops, fruits, mushrooms, and vegetables. The faculty lead basic and applied research programs on biological control, fungal biology, microbial ecology, genomics and evolution, and plant/microbe/environment interactions. The Department fosters a highly ranked graduate program in Plant Pathology and actively participates in undergraduate and inter-college graduate programs to provide an intellectually stimulating, diverse, and inclusive environment for education and professional development.

Responsibilities:

The Head serves as the Departmental program leader and administrative officer and reports directly to the Dean of the College of Agricultural Sciences. The Head works with faculty to develop and meet strategic goals and to engage with diverse internal and external stakeholders.

Duties include:

Academic program leadership in research, graduate and undergraduate instruction and extension. Administrative responsibility for academic affairs, departmental personnel, financial matters, and physical facilities. Leadership and coordination of Departmental relations with other Penn State units and programs, agricultural producers, agricultural industries, government agencies, and citizens of the Commonwealth of Pennsylvania. Creating an environment that supports and cultivates diversity, equity, inclusion and belonging.

More information on job and submit application.

ACKNOWLEDGEMENTS

Thanks to Aleš Eichmeier, Grahame Jackson, Greg Johnson, and Jan Leach for contributions.

COMING EVENTS

9th ISHS International Postharvest Symposium
11 November – 15 November, 2024
Rotorua, New Zealand
Website: sciencevents.co.nz/postharvest2024

16th International *Trichoderma* & *Gliocladium* Workshop
12 November – 14 November, 2024
Lincoln University, Canterbury, New Zealand
Website: www.tg2024.org

Plant & Animal Genome 32 Conference (PAG 32)
10 January – 15 January, 2025
San Diego, USA
Website: www.intlpag.org/PAG32/

International Organization of Citrus Virologists (IOCV) XXIII Conference
16 March – 20 March, 2025
Mildura, Victoria, Australia
Website: www.iocvaustralia2025.org.au

Joint meeting of the 70th Conference on Soilborne Plant Pathogens and the APS Pacific Division
25 March – 27 March, 2025
University of California, Davis, USA
Website: soilfungus.wsu.edu

International Symposium on Plant Pathogenic Sclerotiniaceae - BotryScleroMoni 2025. Joint meetings of XIX International *Botrytis* Symposium, XVII International *Sclerotinia* Workshop, and II International *Monilinia* Workshop
25 May – 30 May, 2025
Thessaloniki, Greece
Website: botryscleromoni.com

Australasian Plant Pathology Society Conference
26 May – 28 May, 2025
International Convention Centre at Darling Harbour, Sydney, Australia
Website: www.apps2025.org

14th Conference of the European Foundation for Plant Pathology (EFPP)
2 June – 5 June, 2025
Uppsala, Sweden
Website: www.efpp2025.com

XVII Working Group "Biological and integrated control of plant pathogens." From single microbes to microbiome targeting One Health.
11 June – 14 June, 2025
University of Torino, Torino, Italy
Contacts: Davide Spadaro and Monica Mezzalama
Email: iobc2025@symposium.it
Website: www.iobctorino2025.org

17th Congress of the Mediterranean Phytopathological Union - New phytopathology frontiers of research and education for plant health and food safety
7 July – 10 July, 2025
Ciheam-Bari, Italy
Contact and Email: Anna Maria D'Onghia
mpu2025@iamb.it
Website: www.mpunion.org

13th International Workshop on Grapevine Trunk Diseases
21 July – 25 July, 2025
Ensenada, Baja California, México
Contact and Email: Rufina Hernández
13iwgtd@cicese.mx
Website (under construction): 13iwgtd.cicese.mx

Plant Health 2025
2 August – 5 August, 2025
Honolulu, Hawaii
Website:
www.apsnet.org/meetings/annual/PH2025/Pages/default.aspx

Conference of the IOBC/WPRS Working Group "Integrated Protection in Viticulture"
13 October – 15 October, 2025
Mikulov, Czech Republic
Website: event.fourwaves.com/ipvc/pages

14th Arab Congress of Plant Protection Sciences
3 November – 7 November, 2025
Algeria
Contact and Email: hou.boureghda@gmail.com
Website will be developed soon.

8th International Bacterial Wilt Symposium (IBWS)
22 March – 26 March, 2026
Wageningen, the Netherlands
Website: event.wur.nl/ibws2026

13th International Congress of Plant Pathology 2028
19 August – 25 August, 2028
Gold Coast, Queensland, Australia
Website: www.icpp2028.org

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY (ISPP)

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The ISPP List is an e-mail list server which broadcasts messages and announcements to its subscribers. Its goal is to facilitate communication among members of the International Society for Plant Pathology and its Associated Societies. Advertised vacancies in plant pathology and ISPP Newsletter alerts are also sent to members of the ISPP List.

In accordance with the guidelines and recommendations established by the new EU General Data Protection Regulation 679/2016 (GDPR), the International Society for Plant Pathology has created a Privacy Information Notice containing all the information you need to know about how we collect, use and protect your personal data.

This policy explains when and why we collect personal information about our users, how we use it, the conditions under which we may disclose it to third parties, how we keep it safe and secure and your rights and choices in relation to your personal information.

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