ISPP INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

PROMOTING WORLD-WIDE PLANT HEALTH AND FOOD SECURITY

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

ISPP NEWSLETTER

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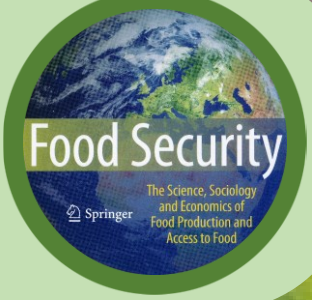


ISPP PRESIDENT'S GREETINGS FOR 2024

YONG-HWAN LEE, ISPP PRESIDENT

The International Society for Plant Pathology (ISPP) was founded in 1968 to promote the worldwide development of plant pathology and the dissemination of knowledge about plant diseases and plant health management. Over the years, significant efforts have been made in research and education related to plant pathology, achieving numerous accomplishments. Now, once again, we are welcoming a new year, 2024!

Over the past five years, under the leadership of President Jan Leach and Executive Members: Khaled Makkouk (Vice President for SMCs), Nathalie Poussereau and Mathias Choquer (Vice Presidents for Co-Chairs of ICPP 2023), Brenda Wingfield (Secretary General), Mathews Paret (Treasurer), Greg Johnson (Immediate Past President), and the Secretariat Members and volunteers, our society has evolved into a higher-level association. Above all, I sincerely want to express gratitude to the Executive and Secretariat Members who have led ISPP during this time. Without them, we could not have achieved such progress.

Last year, we successfully concluded the International Conference of Plant Pathology (ICPP 2023), hosted by the French Society of Plant Pathology, with the theme "ONE HEALTH for all plants, crops and trees." Despite the challenges posed by the prolonged COVID-19 pandemic, we conducted a profound and high-level conference. I extend deep gratitude to the French Society of Plant Pathology, Co-Chairs Nathalie Poussereau and Mathias Choquer, and the organising committee members for their dedicated efforts. Looking ahead, we are preparing for ICPP 2028, which will be hosted by the Australasian Plant Pathology Society. The conference website is already prepared, and Andrew Geering as a Chair and organising committee members are working diligently. We are confident that this will be an opportunity for our society to take another significant leap.

In recent years, the world has faced immense challenges, including the COVID-19 pandemic, wars, and earthquakes. During these times, ISPP established the Resilience Bursary Fund to assist plant pathologists in regions facing difficulties. I extend deep gratitude to Dr. Greg Johnson and the many volunteers and donors who contributed to these wonderful initiatives. We will continue to strive towards creating a world based on such compassion.

Among the many tasks our society performs, one of the crucial ones is the publication of the *Food Security* Journal. Thanks to the efforts of outstanding editorial teams, the journal has made tremendous progress. Last year, it achieved an impact factor of 7.15, positioning it as the top journal in the field. Furthermore, starting this year, ISPP has 100% ownership of the journal, marking a new beginning for further leaps. I am pleased to note that Serge Savary, who served as the Editor in Chief, has committed to continuing in this role for the next five years, raising expectations.

Special thanks to Daniel Hüberli for editing the monthly ISPP Newsletter with rich content for an extended period. Additionally, thanks to Peter Williamson for managing and updating our website. Andrea Masino, our Business Manager, deserves gratitude for handling the tasks of our modest society.

Recently, due to climate change and other factors, plant disease outbreaks are occurring in many regions, and predicting their impact on food security has become increasingly challenging. As before, ISPP believes that collaborative efforts across all aspects of plant pathology are essential to actively address humanity's food supply issues. Particularly, addressing the problems of plant diseases in less developed countries requires collaboration between scientists in those regions and developed countries. We must also focus on translational research to develop technologies that can apply the fundamental scientific knowledge gained over the years to practical solutions. As you know, ISPP has established Subject Matter Committees (SMC) for in-depth research and education in various areas of plant pathology. Moving forward, we should also conduct in-depth research on how to better nurture the future generation in addition to our research in each field.

The newly elected Executive Committee Members, including myself, Laura Mugnai (Vice President for SMCs), Andrew Geering (Vice President for ICPP 2028), Teresa Coutinho (Secretary General), Mathews Paret (Treasurer), and Jan Leach (Immediate Past President), will do their best to ensure that the achievements made so far are not compromised. I want to express my gratitude once again to Mathews Paret, Serge Savary, Daniel Hüberli, Peter Williamson, and Andrea Masino for their continued efforts.

In the new year, I wish everyone good health and success in their endeavors.

Yong-Hwan Lee

ISPP Executive and Secretariat 2018-23 and 2023-28 - Back Row, L to R - Greg Johnson, Nathalie Poussereau, Khaled Makkouk, Brenda Wingfield, Andrea Masino, Mathias Choquer. Front Row, L to R - Laura Mugnai, Teresa Coutinho, Yong-Hwan Lee, Jan Leach, Andrew Geering, Mathews Paret.

ANCIENT AUSTRALIAN WOLLEMI PINE GROWING IN UKRAINE

GREG JOHNSON

At the 11th International Congress of Plant Pathology (ICPP2023) in Lyon, France during August 2023, in the session *Impacts of War and Conflicts on Plant Pathology Research and Food Safety of Countries* (link here at 47.00 min), Dr Kateryna UDOVYCHENKO (Head of Department at Institute of Horticulture, National Academy of Agrarian Sciences of Ukraine, Novosilky, UKRAINE) presented a paper *Keep Calm and Grow Plants, Or How Horticulture Survives in War in Ukraine*.

I was reminded of her talk and the aspiration to "Keep Calm and Grow Plants" when my colleague in Ukraine, Dr Alex Shevchenko, emailed to say that during November 2023, the O.V. Fomin Botanical Garden in Kyiv had received Australia's Ambassador Extraordinary and Plenipotentiary to Ukraine, Bruce Edwards, as well as Shaun Hopkins and Jenny Jenkins from small town of Tredegar in South Wales British volunteers with the charity UK4UR, which has helped get much needed medicines and supplies to Poland and Ukraine for almost two years.

H.E. Bruce Edwards (Above, second from right) inspecting the Wollemi pine at the unveiling of the plaque

In June 2023, the Garden's collection of plants of the tropics and subtropics had received a rare plant – a Wollemia pine (*Wollemia nobilis*), which was presented by H.E. Mr. Bruce Edwards in honour of the 30th anniversary of the establishment of diplomatic relations between Australia and Ukraine. The tree had been delivered to Kyiv by Shaun and Jenny in June 2023 on Shaun's 28th run from Wales to Poland and Ukraine.

During a visit to Kyiv in November 2023, Ambassador Edwards met the Garden's Director, Maria Gaidarzhy, and was able to check on the progress of the tree that Shaun and had delivered in June, speak with the botanical garden workers, see how the collection of greenhouse plants are kept in winter, and find out how volunteers can help the botanical garden.

A highlight of the visit was the unveiling by the Ambassador of an explanatory information board next to the tree, a gift from the Australian Embassy. Ambassador Edwards was pleased to see the tree thriving in the greenhouse complex, forming cones and lateral shoots. "Great trees from small seedlings grow" and the Wollemia in the Botanic Garden is a symbol of strong friendship and partnership.

Fortuitously, Shaun (Above, far right) and Jenny (Above, second from left) were also in Kyiv on another delivery run, and they were able to catch up with Ambassador Edwards. This time their van was also loaded with Christmas presents and hotels intended for children's homes, inclusive and medical centres.

View video story: https://www.youtube.com/watch?v=8I10hcqB8oA

WOLLEMI PINE. Previously known only from the fossil record, 3 small groves on the Wollemi were discovered in secluded canyons of Wollemi National Park near Sydney in 1994. Propagated by the Royal Botanic Gardens in Sydney, two trees sent to Kew Gardens in the UK in 1997 with another 15 sent in 2005. Seed from some of those trees were collected in 2011, while the tree now in Kyiv was propagated from one of those first trees in Kew.

BOTANICAL GARDEN. The O.V. Fomin Botanical Garden, is named after botanist, Oleksandr Vasylyovytch Fomin (1869-1935) and is one of the oldest botanical gardens in Ukraine, founded in 1839 and planned by architect V. Beretti and botanist R. E. Trautfetter. as part of the then Saint Volodymyr Imperial University of Kyiv which since 1939 has been known as the Taras Shevchenko National University of Kyiv.

The Garden encompasses 22.5 hectares in central Kyiv, with 17 greenhouses and 12 orangeries and collections focused on in woody plants of the temperate and subtropical regions - over 8,000 species, including c. 4,000 tropical and subtropical. Among the largest in Ukraine, the collection was formed by several generations of botanists and deserve to be preserved for future generations.

The Garden has a tumultuous history: virtually destroyed in WW1 after being shelled and then looted by soldiers. In WW2, the Nazi cut down many old trees for firewood and looted dozens of palms and orchids. In 1974, city authorities reconstructed the garden. - the drainage system restored and new trees planted. In 1978 the greenhouse complex was built with the highest in the world at that time, the 32-metre Klimatron. It now houses many tropical plants and palms including a 30 m tall Livistona palm, which was planted in 1839. It flowers regularly and is a tourist drawcard.

Other Australian highlights at the gardens are an Illawarra Flame Tree, *Brachychiton acerifolius*. A cycad, *Livistona australis* (about 30 m), and a Kauri, *Araucaria bidwillii* (25 m),

Now the centre of another war, the gardens have again suffered from a combination of things: water shortages from bombed infrastructure and power cuts which meant the greenhouses could not be heated and some plants were lost. In 2022, the Ukraine Botanic Garden Appeal was launched and is ongoing.

The continuity of the O.V. Fomin Botanical Garden and its plants, and the remarkable story of survival of a Christmas tree from Australia now ensconced in Kyiv, the prehistoric Wollemi pine, symbolise friendship and hope for a brighter future for Ukraine: Keep Calm and Grow Plants!

Reference https://biomed.knu.ua/component/content/article/172-all-news/latest-news-new/5422-zustrich-z-povazhnimi-gostyami-druzyami-botanichnogo-sadu.html?Itemid=437

REVOLUTIONISING PLANT DISEASE DIAGNOSIS: NOVEL LIGHTWEIGHT DEEP LEARNING MODELS UNVEILED FOR MULTI-CROP PROTECTION

EUREKALERT NEWS RELEASES, 16 DECEMBER 2023

Swift plant disease diagnosis is vital to prevent extensive production losses and uphold food security. Recently, object detection-based methods using deep learning have shown promise in accurately identifying and locating crop diseases. However, these methods currently face limitations as they are generally restricted to diagnosing diseases in single crops and entail a high computational load due to their extensive parameter requirements. This poses challenges in deploying these models on agricultural mobile devices, as reducing parameters often leads to decreased accuracy. Therefore, there's a need for research to balance model efficiency and accuracy, aiming for lightweight yet effective models capable of diagnosing multiple diseases across various crops.

In June 2023, *Plant Phenomics* published a research article titled "Knowledge Distillation Facilitates the Lightweight and Efficient Plant Diseases Detection Model."

In this study, researchers introduced a novel lightweight and efficient method for plant disease diagnosis using object detection across multiple crops. The approach employs knowledge distillation, focusing on multistage knowledge distillation (MSKD) to enhance lightweight student models through a comprehensive teacher model. Specifically, the study was based on the PlantDoc dataset and utilised various hyperparameters and data cleaning to improve model accuracy. The student models, including YOLOR-Light and Mobile-YOLOR variants, were compared with both traditional and the latest image object detection methods. These models demonstrated superior performance in terms of parameters, computational requirements, and memory usage, while maintaining comparable accuracy. The effectiveness of the MSKD method was confirmed by comparing distilled models with non-distilled ones, demonstrating significant improvements in mean average precision (mAP). Visualisation analysis using Eigen-CAM revealed that the student models, post-distillation, allocated attention more effectively, enhancing disease localization and classification. The ablation study further established the efficacy of distillation on different parts of the student models, emphasising the head stage distiller's role in learning spatial information and diversity of plant disease categories. The study also evaluated the models' lightweight nature, crucial for real-world agricultural applications. The YOLOR-Light-v2 model emerged as a balanced choice, striking a harmony between lightweight and accuracy. The initial values of object boxes were also examined, highlighting the importance of dataset-specific knowledge for precise lesion localisation.

In summary, this comprehensive study not only advances plant disease diagnosis using object detection but also opens avenues for addressing broader challenges in agricultural image processing.

THE HUSTLE IS ON: ME AND BILL GATES

ERIC BOA, ONLY CONNECT, 14 DECEMBER 2023

My training to become a research scientist was lengthy, frustrating and absorbing. The future after getting my PhD in 1981 was uncertain and job prospects were few. Friends and family were puzzled when I described what I hoped to do for a career. They were also encouraging, though "that sounds interesting" wasn't the resounding assurance I was hoping for.

Yet the thrill of asking questions and sleuthing was and still is a powerful motivator. I knew it was going to be difficult to work with tree diseases for the rest of my career and wasn't even sure I wanted to continue in this area. No time for equivocation. I had to find a job. Suitable openings were few and far between but eventually I landed my first job, in Bangladesh, studying a bamboo disease, funded by the UK Government. Friends and families were even more puzzled. Bangladesh was newly independent, struggling to establish itself after a bloody war and widely known as a "basket case", Henry Kissinger's dismissive and contemptuous description.

I ignored this. It was research and it sounded intriguing. I had money for equipment, field work and laboratory investigations for the next six years. Next stop Indonesia and a clove disease project, also with supporting research budget. I assumed this is how it would continue to work: get job and be provided with the necessary funds to ask questions and sleuth. Short-term contracts meant that job security was always a worry, but I was optimistic that prospects would improve as I delivered results and gained experience.

I returned to a UK-based post in 1991, still doing research linked to international development. The short-term contracts continued. I was nearly forty years old and job security was still shaky. Worse was to follow when I discovered that I had few funds provided by the research institute to do my work. I had to bid for every project in open competition with fellow scientists as well as those from other organisations. The hustle was on. My time was charged to projects and contract extensions were related to how much 'cover' I obtained. I enjoyed developing ideas and expanding my portfolio of interests, as well as working in new places. I was less enthusiastic about the effort this required and nervous about the consequences of failing.

The hustling slowly produced results. My first major project was on agroforestry trees in Central America, a region that I'd longed to visit after reading Paul Theroux's The Old Patagonia Express. The excitement at winning the bid was tempered by the fact that it was only for a year and only paid for three-months' staff time. I continued to hustle and hit the big time a year later when I got a three-year project on rural bamboo in India. Again, it only covered three months of my time in any one year, but it was further proof of showing I was a valuable member of staff.

Radical changes pushed by the Conservative Government continued to disrupt and threaten research careers. International development was particularly vulnerable because it was a low priority for the Tories, but eventually other scientists in the UK began to feel the pressures of having to fund their own jobs. I moved to a new organisation in 1995, also in the UK, because my first employer crumbled under the relenting demands for efficiencies and budget cuts. I found a hidden advantage with my bamboo project; I could transfer funds to a new employer, smoothing a move which I had initiated because of diminishing prospects. Have project, can travel.

In the late 1990s I began to work on wild edible mushrooms in Malawi. Money was available for topics not covered by other research programmes. The managers liked my three-year proposal, and so began a long association with wild edible mushrooms on a global canvas. I'd moved a long way from tree diseases as a result of hustling. All was not smooth bidding; there were many failed bids, but I was gaining wider experience and developing new collaborations, particularly with social scientists. International development was emphasising the involvement of people and communities in projects, articulated in the Millennium Development Goals agreed in 2000.

This set the scene for a new type of project with a sharper focus on applying knowledge for the benefit of people in the global South ('developing nations'). And so to my ultimate hustle and biggest challenge of all: an attempt to get money from the Big Daddy of international development funds, the Bill and Melinda Gates Foundation (BMGF). No disrespect to the ex Mrs Gates, who now has her own funds and programmes, but I always saw Bill Gates as the ultimate gatekeeper and decider of who got funds. The ultimate hustle began with an invitation to submit a proposal on plant health. Many years of developing a model for basic plant health clinics integrated with agricultural advisory services and supported by research institutes and other government organisations had finally brought the attention it deserved.

My employer, the Centre for Agriculture and Biosciences International (CABI), was thrilled. BMGF funded multi-million dollar projects. Having one showed that you had arrived and were a major player in international development. Success for me meant professional recognition and, more importantly, the biggest challenge and thrill of all: putting your ideas to work on a grand scale and making a real and lasting difference to peoples' live.

Nothing had prepared me for the effort required to prepare the proposal. We formed a small group and consulted widely across my organisation. We worked closely with a dedicated BMGF programme officer. Budgets were constructed, theories of change were created as the details and shape of our proposal slowly came together. First we had to produce a concept proposal. I was in Kathmandu when I received news that this had been accepted. I jumped up and down on my hotel bed and had an adrenaline rush that lasted for a day.

I also realised this was only the beginning. It took six months, long days and nights, countless meetings and lots of back and forward comments and revisions. We passed all the vetting and the proposal was officially submitted to the board. Hopes were high when I received the phone call from our dedicated programme officer, who had nursed, probed and encouraged us at every stage. He was deeply sorry. The ultimate hustle had failed. I was fifty-seven and this seemed like the end of the road.

The putting together of the proposal was an enthralling and deeply rewarding intellectual exercise. We were challenged to create an ambitious project that I'm immensely proud of. BMGF turned us down at the very last moment and, to their credit, recognized that they'd let us down. Fortunately other donors were more impressed and over the next twelve years CABI obtained huge funding from other donors. My own career had come to halt, at least with my employer, and I left CABI a year later.

I continue to hustle as an independent consultant, but on a smaller scale and in a more gentle manner. Twenty years of bidding for projects was exhausting, often disappointing but ultimately thrilling. Projects have taken me around the world, allowed me to work with wonderful people in enthralling places and delivered huge professional and personal rewards. None of this would have happened without a fight to have my ideas accepted. Research careers in international development are still uncertain and constantly under threat but it is possible to succeed with a little hustle here and there.

Another article by Eric Boa: Is Planting Native Trees Preferable?

Plant Clinic in Nicaragua (Photo credit: Eric Boa).

ENDOPHYTIC BACTERIAL COMMUNITIES IN UNGERMINATED AND GERMINATED SEEDS OF COMMERCIAL VEGETABLES

A paper by Jacquelinne J. Acuña *et al.* titled "Endophytic bacterial communities in ungerminated and germinated seeds of commercial vegetables" was published on 14 November 2023 by *Scientific Reports* (vol. 13, 19829). The abstract is as follows:-

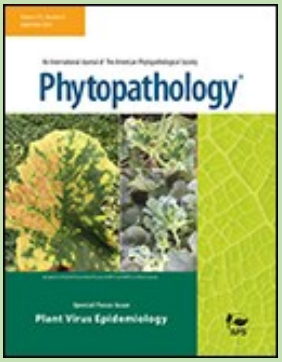
Chile is a prominent seed exporter globally, but the seed microbiome of vegetables (46% of seeds) and its role in the early stages of plant growth have remained largely unexplored. Here, we employed DNA metabarcoding analysis to investigate the composition and putative functions of endophytic bacterial communities in ungerminated and germinated seeds of the commercial vegetables *Apiaceae* (parsley and carrot), *Asteraceae* (lettuce), *Brassicaceae* (cabbage and broccoli), and *Solanaceae* (tomato). Bacterial quantification showed 104 to 108 copies of the 16S rRNA gene per gram of ungerminated and germinated seeds. Alpha diversity analysis (e.g., Chao1, Shannon, and Simpson indices) did not indicate significant differences (Kruskal–Wallis test) between ungerminated and germinated seeds, except for *Solanaceae*. However, beta diversity (PCoA) analysis showed distinctions (Adonis test) between ungerminated and germinated seeds, except Apiaceae. Pseudomonadota and Bacillota were identified as the dominant and specialist taxa in both ungerminated and germinated seed samples. Chemoheterotrophy and fermentation were predicted as the main microbial functional groups in the endophytic bacterial community. Notably, a considerable number of the 143 isolated endophytic strains displayed plant growth-promoting traits (10 to 64%) and biocontrol activity (74% to 82%) against plant pathogens (*Xanthomonas* and *Pseudomonas*). This study revealed the high variability in the abundance, diversity, composition, and functionality of endophytic bacteria between ungerminated and germinated seeds in globally commercialized vegetables. Furthermore, potential beneficial endophytic bacteria contained in their seed microbiomes that may contribute to the microbiome of the early stages, development, growth and progeny of vegetables were found.

Read paper.

SPECIAL PHYTOPATHOLOGY FOCUS ISSUE: PLANT VIRUS EPIDEMIOLOGY

A special issue of *Phytopathology*, originating from presentations made at the 15th International Symposium on Plant Virus Epidemiology, features research from six continents covering a range of topics that influence plant virus epidemiology.

More than half of the articles in this issue are open access. Read the issue today!



A FUNGAL PLANT PATHOGEN DISCOVERED IN THE DEVONIAN RHYNIE CHERT

A paper by Christine Strullu-Derrien *et al.* titled "A fungal plant pathogen discovered in the Devonian Rhynie Chert" was published on 1 December 2023 by *Nature Communications* (vol. 14, article number: 7932). The abstract is as follows:-

Fungi are integral to well-functioning ecosystems, and their broader impact on Earth systems is widely acknowledged. Fossil evidence from the Rhynie Chert (Scotland, UK) shows that Fungi were already diverse in terrestrial ecosystems over 407-million-years-ago, yet evidence for the occurrence of *Dikarya* (the subkingdom of Fungi that includes the phyla *Ascomycota* and *Basidiomycota*) in this site is scant. Here we describe a particularly well-preserved asexual fungus from the Rhynie Chert which we examined using brightfield and confocal microscopy. We document *Potteromyces asteroxylicola* gen. et sp. nov. that we attribute to *Ascomycota incertae sedis* (*Dikarya*). The fungus forms a stroma-like structure with conidiophores arising in tufts outside the cuticle on aerial axes and leaf-like appendages of the lycopsid plant *Asteroxylon mackiei*. It causes a reaction in the plant that gives rise to dome-shaped surface projections. This suite of features in the fungus together with the plant reaction tissues provides evidence of it being a plant pathogenic fungus. The fungus evidently belongs to an extinct lineage of ascomycetes that could serve as a minimum node age calibration point for the *Ascomycota* as a whole, or even the *Dikarya* crown group, along with some other *Ascomycota* previously documented in the Rhynie Chert.

Read paper.

DOUBLE-STRANDED RNA PREVENTS AND CURES INFECTION BY RUST FUNGI

A review by Rebecca M. Degnan *et al.* titled "Double-stranded RNA prevents and cures infection by rust fungi" was published on 6 December 2023 by *Communications Biology* (vol. 6, article number 1234). The abstract is as follows:-

Fungal pathogens that impact perennial plants or natural ecosystems require management strategies beyond fungicides and breeding for resistance. Rust fungi, some of the most economically and environmentally important plant pathogens, have shown amenability to double-stranded RNA (dsRNA) mediated control. To date, dsRNA treatments have been applied prior to infection or together with the inoculum. Here we show that a dsRNA spray can effectively prevent and cure infection by *Austropuccinia psidii* (cause of myrtle rust) at different stages of the disease cycle. Significant reductions in disease coverage were observed in plants treated with dsRNA targeting essential fungal genes 48 h pre-infection through to 14 days post-infection. For curative treatments, improvements in plant health and photosynthetic capacity were seen 2–6 weeks post-infection. Two-photon microscopy suggests inhibitory activity of dsRNA on intercellular hyphae or haustoria. Our results show that dsRNA acts both preventively and curatively against myrtle rust disease, with treated plants recovering from severe infection. These findings have immediate potential in the management of the more than 10-year epidemic of myrtle rust in Australia.

Read paper.

BACTERIA USE LIGHT CUES TO ANTICIPATE, PREPARE FOR COMING STRESS

IOWA STATE UNIVERSITY NEWS, 12 DECEMBER 2023

Scientists know that many bacteria have proteins that give them the ability to sense light. This ability helps some bacteria use light for energy. Many other bacteria cannot use light as energy but can still sense light. How these non-photosynthetic bacteria benefit from using light cues has not been well understood.

Iowa State University researchers are illuminating the role of light sensing in the lives of these simple organisms. The scientists discovered that several types of bacteria that grow on plants and in soil can use light to anticipate an imminent, potentially deadly loss of water from their environment.

At the very onset of light – even before warming and evapotranspiration begin – the bacteria express genes that allow them to accumulate compounds to protect themselves from water loss in preparation for daily warming and drying conditions.

"We tend to think of bacteria as a family of simple organisms that just react to their environments," said Gwyn A. Beattie, the Robert Earle Buchanan Distinguished Professor of Bacteriology for Research and Nomenclature at Iowa State. "This work demonstrates a level of sophistication not usually attributed to bacteria. We documented that the bacteria we studied used light as a cue, anticipating something that was going to happen, something which they have learned happens almost every day."

Beattie led the research team that reported these findings recently in the *Proceedings of the National Academy of Science*. They were studying *Pseudomonas syringae*, a bacterial species that is a common resident of plant leaves. It is often swept up into the air where it moves long distances, having been found in clouds and even glacial ice. In all of these environments, the bacteria are exposed to daily changes in light and moisture.

The study was originally inspired by pure curiosity, according to Beattie, whose foundational research often focuses on trying to understand how bacteria interact with their environment. She was looking at genes in the bacteria, trying to identify how and why they express genes differently in different environments.

As she and her graduate students kept digging deeper into *P. syringae*'s genome, they had some surprising moments of discovery. One was finding light-sensing proteins. The second was that these proteins influence the expression of genes that help bacteria survive periods of drying. "We first imagined that bacteria living in dew on plants leaves would simultaneously experience sunlight and evaporation of morning dew, making it unclear how they were benefitting from sensing light," Beattie said. "But then, in an 'aha' moment, we realised that the bacteria may activate changes as light hits the leaves, before the leaves heat up and evaporation occurs."

"To confirm this finding, we set up experiments to check and double-check our results, to convince ourselves these things weren't all happening simultaneously." Their experiments included climbing to the rooftop of the agronomy building at 4:30 a.m., on a day predicted to be without clouds. They hauled equipment for measuring light and evaporation from simulated leaves to a clear spot where morning rays would not be interrupted by shade.

"It was early, and it was freezing. But it was worth it," LaSarre said. "We proved to ourselves that the bacteria's responses are, in fact, based on discrete events – first exposure to light, then exposure to drying." In fact, they eventually learned that light affected almost one-third of the microbe's genes, indicating that the response is significant in its evolutionary history. They hypothesize that this ability to respond to light preemptively before a drying event gives the bacteria a competitive edge for survival.

"That's one thing that's exciting about this finding," Breah said. "Many have suggested that bacteria are evolving anticipatory strategies to improve their fitness, but there are few cases where this has been clearly demonstrated with experimental data. This helps build the case."

The discovery has broad implications for applied research in the future, suggested Beattie. For example, she wants to learn more about how broadly this ability to use light as a cue is shared by other bacteria.

"It would be interesting to learn how other microbes could have evolved to use light to signal other oncoming stresses – or opportunities. Or maybe they use different signals altogether," she said. "This could inform research on ways to use these types of microbial responses to develop smarter, more sustainable crop protection products, such as microbial products that use a flash of light to activate protective functions before they are applied on a field."

RESEARCHERS PREDICT CLIMATE CHANGE-DRIVEN REDUCTION IN BENEFICIAL PLANT MICROBES

PENN STATE UNIVERSITY NEWS, 20 NOVEMBER 2023

Bacteria that benefit plants are thought to be a critical contributor to crops and other ecosystems, but climate change may reduce their numbers, according to a new study by an international team of researchers. They published their findings in *Nature Food*.

The collaboration, including Francisco Dini-Andreote, professor of plant science at Penn State, characterised the abundances and distributions of plant beneficial bacteria (PBB) from soils collected across the globe. The researchers then modeled how these microbial communities may be impacted by fossil-fuel dependent climate change in the next century.

Leveraging existing data from the Earth Microbiome Project, the researchers identified microbes that may provide services to plants such as biocontrol or limiting impacts of pathogens, plant growth promotion and stress resistance. Such services implicate these bacteria as key components of productive agroecosystems, which primarily yield food.

"Plants are colonised by a diverse set of microbes on and in their roots, leaves and stems," Dini-Andreote said. "These plant-associated microbiomes represent an extension of the plant metabolic capacity — often termed the second genome of plants."

This notion echoes the hologenome concept, which considers the total set of genes contained by an organism and its associated microbiome to make inferences about organismal health and evolution. According to the researchers, characterising the biogeography of PBB sets the stage for understanding the variables that govern global microbial community patterns and predicting their future in a rapidly shifting world.

Their analysis revealed several trends in PBB diversity, including higher levels of diversity and richness in lower latitudes, with the highest concentration in North America and Africa. A total of 396 genera, the taxonomic rank above species level, were identified. The researchers found that local environmental variables — climate, in particular — were strong predictors of PBB community composition, likely exerting strong influences on PBB distribution. This suggests that climate influences what bacteria are found where and in what proportion.

To investigate how PBB abundances and distributions may change over the next century, the researchers modeled several climate scenarios based on projections from the Intergovernmental Panel on Climate Change. Under the fossil-fueled development scenario,which assumes tripled green house gas emissions by 2075, the model predicted that PBB associated with biocontrol and stress resistance would decline by 0.60% in 80% of global regions, as opposed to 0.07% under a Sustainability scenario. Under all scenarios, middle-latitude regions are projected to experience steady declines, whereas increases in PBB are anticipated in polar and equatorial regions.

Dini-Andreote noted that predictive studies such as this are broadly impactful but cautioned that models are limited and must be experimentally validated. For instance, in controlled settings, plant-soil systems can be exposed to warming or drought conditions, after which researchers can evaluate shifts based on the impact and adaptation of PBB communities relative to controls. In other words, experimentation is required to know how PBB will be affected under climate-related stress, and what levels of PBB decline will have a critical impact on plant health.

In addition to informing community ecology research, the researchers said they hope to spark agricultural innovation and applications for increased food security. But those innovations are unlikely to include soil probiotics to restore diminished PBB. Dini-Andreote said that such bioinoculants can often have several shortcomings such as requiring continual application. Additionally, only a small fraction, about 5% to 10%, of soil microbes can be cultured, which limits the development of full-spectrum probiotics.

Dini-Andreote offered an alternative. "By advancing our understanding of how these distinct PBB survive in association with plants, for instance in the plant rhizosphere, we can develop strategies to engineer crops to produce compounds that feed these beneficial microbes," Dini-Andreote said.

Through this approach, the researchers suggested, plants could recruit beneficial bacteria with no need for the external input of probiotics. The potential impacts of applications like this are untold, Dini-Andreote said, but underscore the importance of exploring the rapidly advancing frontier of microbiomes.

"We hope this paper serves as a catalyst for more empirical studies of PBBs," Dini-Andreote said.

Seth Bordenstein, director of the One Health Microbiome Center and professor of biology and entomology who holds the Dorothy Foehr Huck and J. Lloyd Huck Endowed Chair in Microbiome Sciences, echoed the sentiment and praised the work. "This high-profile research is a testament to Dr. Dini-Andreote's impactful and original research on plant-microbe interactions in a One Health context, spanning soil, plant and human health," Bordenstein said. "His vision for plant hologenome studies and integration with global environmental and geographic data is not only driving textbook-level knowledge, but it also raises the alarm on evidence-backed sustainability challenges."

CURRENT VACANCIES

Assistant Professor of Plant Pathology - University of Florida

We at the University of Florida are excited to share the attached faculty position opening at the Everglades Research and Education Center (EREC). We are currently accepting applications for an Assistant Professor of Plant Pathology to primarily focus within the sugarcane, sod, and rice cropping systems. We are looking for excellent candidates ready to develop a world-class Extension and Research program that will address the unique plant disease challenges of agriculture in beautiful South Florida. Our ideal candidate will be eager to seize the opportunity to join an academically-diverse faculty at the EREC while also becoming an active member of a top Plant Pathology Department worldwide. Please consider sharing this announcement with your best and brightest finishing Ph.D. students, post-docs, and junior faculty. Questions about the application process, the position duties, as well as nominations of deserving candidates for recruitment efforts may be directed to Dr. Phil Harmon, Chair of the Search and Screen Committee at pfharmon@ufl.edu. To apply, please see the official UF job description at: https://explore.jobs.ufl.edu/en-us/job/523459/assistant-professor-of-plant-pathology. More info about the position and further instructions in the PDF.

For full consideration, candidates should apply and submit additional materials by 1 November 2023. The position will remain open until a viable applicant pool is determined.

Assistant Professor of Plant Pathology - University of California, Davis

The Department of Plant Pathology at the University of California, Davis is recruiting a tenure track, Assistant Professor with an emphasis in disease ecology. Applicants should have a strong quantitative background and broad training in plant pathology, ecology, epidemiology, and/or population biology to focus on current or newly emerging plant diseases. The candidate is expected to develop an independent, productive and competitively funded research program on diseases in orchard, vegetable, field and/or native plant communities. The appointee will be responsible for teaching at the undergraduate level in courses supporting the Global Disease Biology major and the graduate program in Plant Pathology. More info about the position and further instructions in the PDF.

Applications should be submitted by 23 October 2023 at https://apptrkr.com/4526762 (full position announcement at this site).

ACKNOWLEDGEMENTS

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COMING EVENTS

International Plant and Animal Genome (PAG 31)
12 January – 17 January, 2024
San Diego, California, USA
Website: intlpag.org/31/

7th International Research Conference on Huanglongbing (IRC-HLB)
26 March – 29 March, 2024
Riverside, California, United States
Website: web.cvent.com/event/7c12d9c3-01db-4e6e-b781-aafeb0f7109a/summary

International Plant Molecular Biology (IPMB) Congress
24 June – 28 June, 2024
Cairns, Queensland, Australia
Website: www.ipmb2024.org/

XX International Plant Protection Congress
1 July – 5 July, 2024
Athens, Greece
Website: www.ippcathens2024.gr

International Conference on Plant Pathogenic Bacteria & Biocontrol 2024
7 July – 12 July, 2024
Virginia Tech, Blacksburg, Virginia, United States
Website: icppbbiocontrol2024.org

Triennial Conference of the European Association for Potato Research (EAPR)
7 July – 12 July, 2024
Oslo, Norway
Website: nibio.pameldingssystem.no/eapr2024

Plant Health 2024
27 July – 31 July, 2024
Memphis, Tennessee, USA
Website:
www.apsnet.org/meetings/annual/Pages/default.aspx

Asian Conference on Plant Pathology 2024
3 August – 7 August, 2024
Changchun, Jilin, China
Website: tba

Australasian Soilborne Disease Symposium 2024
26 August – 29 August, 2024
Kingscliffe, New South Wales, Australia
Website: www.asds-apps.com/

Australasian plant virology workshop (APVW 2024)
29 October – 31 October, 2024
Gold Coast, Australia
Contact and Email: Fiona.Filardo@daf.qld.gov.au
Website: apvw-2024-.w.kamevents.currinda.com

11th IUFRO Phytophthora in Forests and Natural Ecosystems working party
8 September – 13 September, 2024
Bay of Islands (Paihia), New Zealand
Website: www.scienceevents.co.nz/iufro2024

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

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.

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)

WWW.ISPPWEB.ORG

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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