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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IN THIS ISSUE:

INTERNATIONAL DAY OF PLANT HEALTH, 12 MAY

FOOD AND AGRICULTURE ORGANIZATION (FAO)

PLANTS ARE LIFE – we depend on them for 80 percent of the food we eat and 98 percent of the oxygen we breathe. But international travel and trade have been associated with the introduction and spread of plant pests. Invasive pest species are one of the main drivers of biodiversity loss and threaten the delicate web of life that sustains our planet. Pests and diseases have also been associated with rising temperatures which create new niches for pests to populate and spread. In response, the use of pesticides could increase, which harms pollinators, natural pest enemies and organisms crucial for a healthy environment. Protecting plant health is essential by promoting environmentally friendly practices such as integrated pest management. International standards for phytosanitary measures (ISPMs) in trade also help prevent the introduction and spread of plant pests across borders.

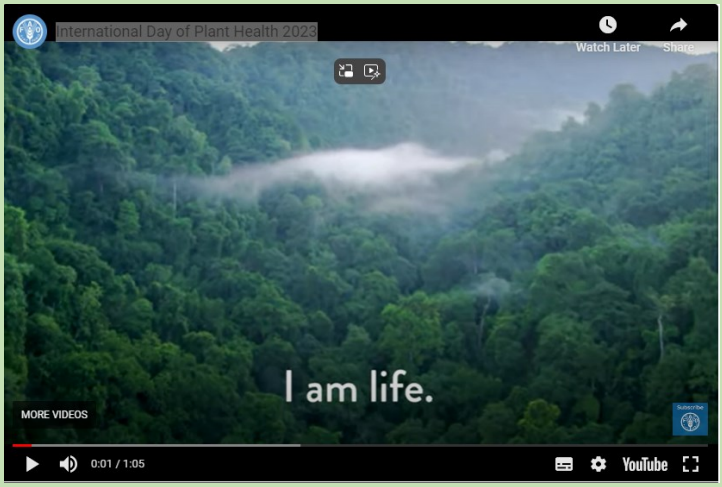
INTERNATIONAL DAY OF PLANT HEALTH 2024: PLANT HEALTH, SAFE TRADE AND DIGITAL TECHNOLOGY

Each year, over 240 million containers move between countries, carrying goods including plant products, posing biosecurity risks. In addition, about 80 percent of international trade consignments include wood packaging material, providing a pathway for pest transmission. As a result, damages from invasive pest species incur global economic losses of approximately USD 220 billion annually. Protecting plant health across borders is essential by promoting global collaboration and international standards, such as the International Standards for Phytosanitary Measures (ISPMs). Innovative solutions like electronic phytosanitary certification (ePhyto) streamline the process, making trade quicker and more secure.

The International Day of Plant Health 2024 calls on everyone to raise awareness and take action to keep our plants healthy and ensure food safety and safe trade for sustainable economies and livelihoods.

WHY AN INTERNATIONAL DAY OF PLANT HEALTH?

The United Nations designated 12 May the International Day of Plant Health (IDPH) to raise global awareness on how protecting plant health can help end hunger, reduce poverty, protect biodiversity and the environment, and boost economic development. The Day is a key legacy of the International Year of Plant Health 2020. **Get Involved Guide** available on FAO website.



GET INVOLVED!

Whether you're a government, city, private business, NGO, journalist, a civil society organisation or individual, FAO can provide you with a range of multimedia content in several languages to share, and to support your International Plant Health Day activity.

RESEARCH PAPER ON AFRICA'S 'FORGOTTEN' FOODS WINS PRESTIGIOUS COZZARELLI PRIZE IN WASHINGTON, DC

WORLD VEGETABLE CENTER PRESS RELEASE, 23 APRIL 2024

An international research team led by the World Vegetable Center (WorldVeg), and including scientists from the Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF), has won the 2023 Cozzarelli Prize for an article on the potential of 'forgotten' food crops in sub-Saharan Africa to provide healthy diets in a changing climate.

The paper was one of six selected by the editorial board of the *Proceedings of the National Academy of Sciences* (PNAS) – a prestigious scientific journal based in Washington, DC – to receive the annual award for scientific excellence and originality at a ceremony on 28 April 2024.

Papers were chosen from more than 3,000 open-access research articles that appeared in the journal last year and represent the six broadly defined classes under which the National Academy of Sciences is organised.

A Beninese farmer stands in his diversified farm field that includes Colocasia esculenta (taroyam), maize, Amaranthus spp. (amaranth), and Celosia argentea (celosia) within an agricultural landscape dominated by cassava. (Photo credit: World Vegetable Center).

The study – which was selected in the Applied Biological, Agricultural, and Environmental Sciences category of the Cozzarelli Prize – also involved multidisciplinary scientists from the University of Abomey-Calavi (Benin), the National Taiwan University, and Scotland's Rural College in Edinburgh.

The study used climate modelling to assess the potential of 138 traditional food plants that could diversify or replace staple crops, and identified 58 that are micronutrient-rich and are suitable for integration into cropping systems under current and projected climatic conditions. The authors concluded that diversifying food production in Africa with these neglected 'opportunity crops' improves both the dietary health and climate resilience of food systems in sub-Saharan Africa.

"Our study shows that in most locations where major staples are currently grown in sub-Saharan Africa, one or more forgotten food crops from different food groups will be suitable for cultivation under 2070 climate conditions – and can diversify major staples to support more nutrient-rich diets," says Maarten van Zonneveld, head of genetic resources at WorldVeg in Taiwan.

The research was part of various initiatives that the study's collaborating partners are involved in. WorldVeg is the only organisation with a global mandate for vegetable research and development – including traditional crops – and works closely with the paper's co-authors in Benin and Taiwan. CIFOR-ICRAF scientists were involved in the modelling and data analysis, and built on their rich experience with tree and shrub foods.

"Our results suggest that diversifying sub-Saharan African food production with forgotten food crops could improve climate resilience and dietary health," says Stepha McMullin, a development specialist at CIFOR-ICRAF in Kenya. "But to successfully mainstream these foods, it is crucial that we work closely with both local producers and consumers. At CIFOR–ICRAF, we already work with rural communities in East and Southern Africa to do this, by designing and implementing locally tailored food tree portfolios."

WILD PLANTS FACE VIRAL SURPRISE

SAMANTHA BRICHTA, MICHIGAN STATE UNIVERSITY NEWS, 28 MARCH 2024

Just as many people battle seasonal colds and flu, native plants face their own viral threats. People have long known that plants can succumb to viruses just like humans. Now, a new study led by Michigan State University and the University of California, Riverside reveals a previously unknown threat: non-native crop viruses are infecting and jeopardizing the health of wild desert plants.

By analyzing native plants, such as this wild squash, in the Californian desert, a team of researchers from Michigan State University and the University of California, Riverside revealed that non-native viruses from agriculture are invading these habitats (Photo credit: Tessa Shates).

"For years, the ecological field assumed wild plants were immune to invasive viruses that damage crops," said Carolyn Malmstrom, a professor in the Department of Plant Biology and a co-leader of the study. Kerry Mauck, an associate professor and Alfred M. Boyce Endowed Chair in Entomology, was the team leader at UC Riverside and adviser for the lead author Tessa Shates, who was a graduate student in the Mauck Lab.

"But we've found that we need to be just as concerned about protecting indigenous plants as we are agricultural ones," said Malmstrom, who is also a faculty member with the Ecology, Evolution and Behavior program, or EEB, at MSU.

Published in the *Phytobiomes Journal*, this discovery holds significant implications for conservation efforts. The research utilises advanced genetic sequencing and field experiments to demonstrate how insects, acting as unwitting infectors, ferry harmful pathogens from cultivated fields to native ecosystems.

The study focused on desert regions of Southern California, where the Cucurbita species of wild squash thrived alongside irrigated agriculture. The team meticulously identified, marked and collected samples from the wild plants.

Then, analysing the genetic makeup of viruses within these wild plants, the researchers discovered a surprising presence of crop pathogens like cucurbit yellow stunting disorder virus and cucurbit aphid-borne yellows virus, or CABYV.

In fact, they found that infection rates with CABYV — a non-native pathogen — could reach as high as 88% in some wild Cucurbita populations, with visible impacts on plant growth and root health, both vital for the plants' survival in the harsh desert environment.

"These wild plants are crucial components of desert ecosystems, providing food and habitat for other species," Malmstrom said. "Their decline from crop virus infections could have cascading effects on entire ecological communities."

"Our findings should help the greater community recognize that our impact on the landscapes around us are not always obvious or clear to see," Shates said. "It's easy to see the landscape changes of a clear-cut forest, but it is harder to recognize how hitchhiking microbes might change plant community structure over time."

PLANT VIROLOGY AND RESEARCH AT MSU

Collaboration across the country and fields of research was an important facilitator of this research. Having leading experts in plant biology and entomology contributed to the scientific success of the project, as well as the growth of its early-career researchers.

"In addition to her own contributions, Dr. Malmstrom has been a great mentor throughout this study," said Shates, who is now an infectious disease scientist with the research company Quest Diagnostics.

"Doing this research, especially during the pandemic, required learning new skills and expanding my research toolkit," Shates said. "Dr. Malmstrom was a great resource for recommending technical methods to try for data analysis and generating 'genomes' for the viruses in our samples."

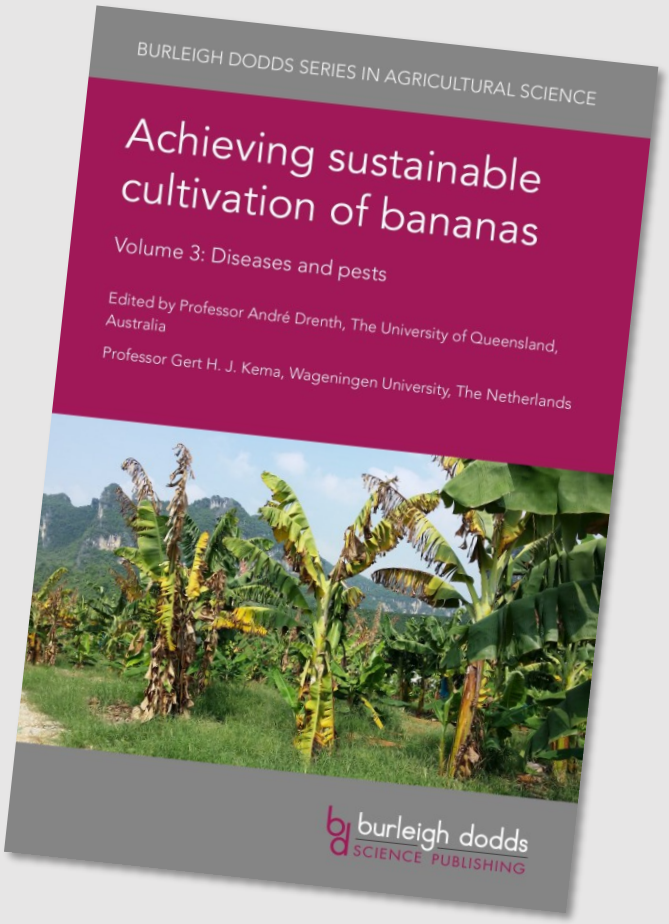
As an AgBioResearch scientist, Malmstrom was also able to tap into both agricultural and natural systems expertise at MSU.

"This project bridges the gap between agriculture and natural systems, reminding us that nature and agriculture are intricately linked," said Malmstrom. "It also underscores the need for a more holistic approach to managing plant health and shows that understanding the complex dynamics of viruses in natural systems is essential for developing sustainable solutions that benefit both agriculture and biodiversity."

ACHIEVING SUSTAINABLE CULTIVATION OF BANANAS – VOLUME 3: DISEASES AND PESTS. NEW BOOK

André Drenth and Gert H. J. Kema, Editors (2024). Achieving sustainable cultivation of bananas – Volume 3: Diseases and Pests. Burleigh Dodds Science Publishing, UK. 684 pp.

Burleigh Dodds Science Publishing are delighted to announce the publication of the final book in their three-volume collection on sustainable banana cultivation!



Achieving sustainable cultivation of bananas – Volume 3: Diseases and Pests, edited by Professor André Drenth, The University of Queensland, Australia and Professor Gert H. J. Kema, Wageningen University, The Netherlands is available now!

This new book provides a comprehensive review of the major pests and diseases affecting global banana production including Tropical Race 4, black Sigatoka and banana streak virus.

The book also explores existing methods for pest/disease diagnosis and identification, current management strategies used to control and/or prevent outbreaks, as well as the development of disease-resistant cultivars and integrated pest and disease management programmes.

Find out more here.

This title is accompanied by two companion volumes:

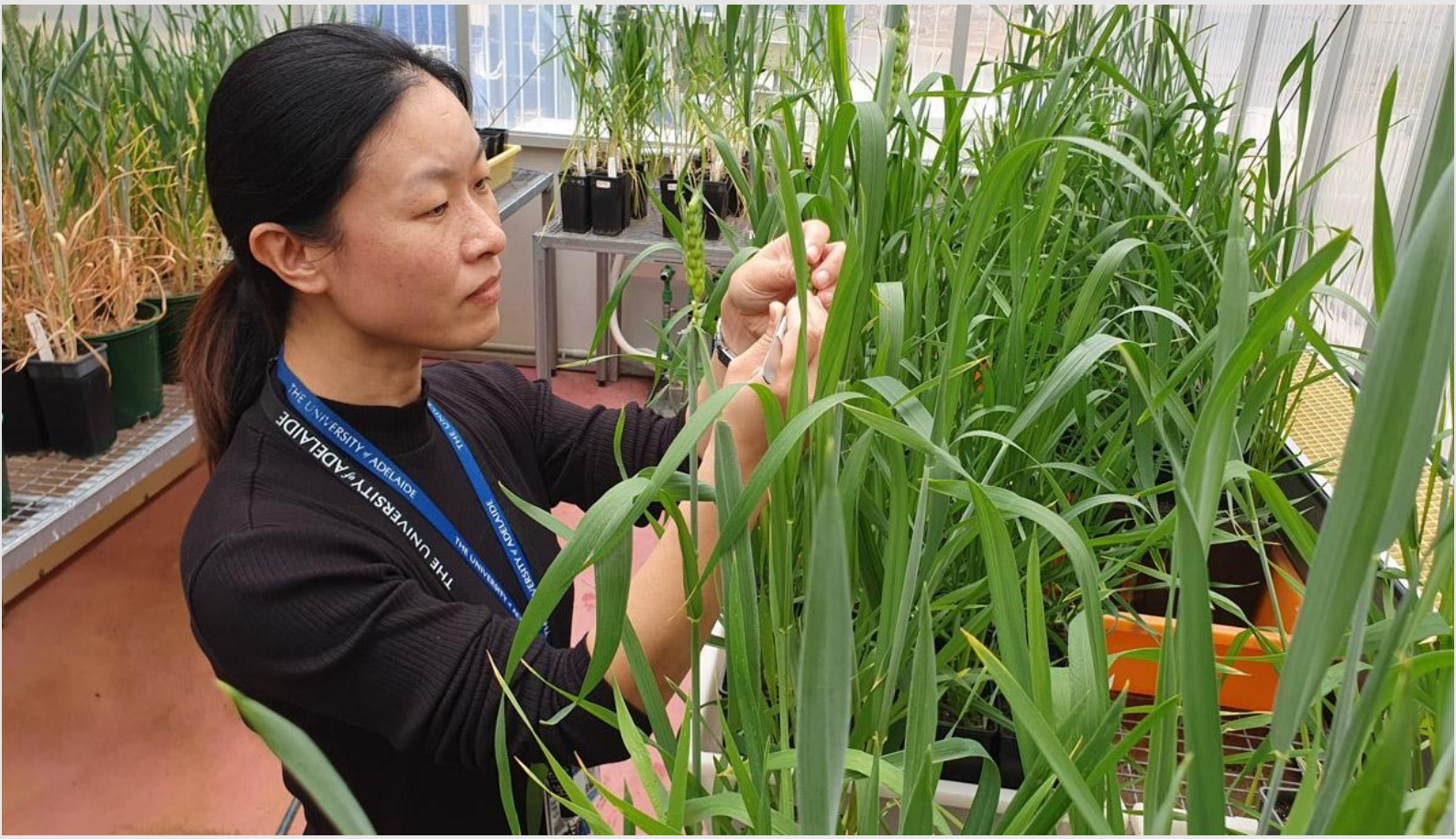
- Volume 1: Cultivation techniques
- Volume 2: Germplasm and genetic improvement

SPECIAL OFFER

Receive **20%** off your order of **ANY** of the three books if purchased via the Burleigh Dodds website. Enter code **BANANA20** at checkout to redeem this discount. **Discount code expires 31st May 2024**.

GENETIC HOPE IN FIGHT AGAINST DEVASTATING WHEAT DISEASE

JOHNNY VON EINEM, UNIVERSITY OF ADELAIDE NEWSROOM, 26 APRIL 2024



Dr Xiujuan Yang examining the health state of wheat flowers (Photo credit: University of Adelaide).

Fungal disease Fusarium head blight (FHB) is on the rise due to increasingly humid conditions induced by climate change during the wheat growing season, but a fundamental discovery by University of Adelaide researchers could help reduce its economic harm.

While some types of wheat are resistant to FHB thanks to the action of the TaHRC gene at the Fhb1 locus, how this gene functions in wheat cells was unknown until now.

Collaborating with Nanjing Agriculture University, the University of Adelaide research team has shown TaHRC works in the nucleus of wheat cells, and it can either increase or decrease a plant's susceptibility to FHB.

"There are two variants of TaHRC that have opposing effects on the condensation of a specific protein complex within the nucleus," says Dr Xiujuan Yang, from the University's School of Agriculture, Food and Wine.

"When condensed, the complex leads to susceptibility to FHB, whereas when diffused, it provides resistance against FHB.

"We are the first to reveal the function of protein complex condensation in response to a major crop fungal disease, providing insight into the mode of action of protein complexes in cereal defence responses."

FHB has caused significant harm to Australia's wheat industry in recent years, with crops in the 2022 season suffering up to 100 per cent yield losses.

The disease has been on the rise globally since the 1970s, but climate change has increased its prevalence.

"Australia's reputation for producing high-quality wheat has been built on fortuitous climate conditions during flowering and grain fill, typically coinciding with the dry season, which helps avoid many fungus-caused diseases that thrive in humid weather," says Dr Yang.

"However, in the background of climate change, a wet spring in 2022 led to Fusarium head blight becoming widespread across eastern Australia."

Australian durum wheat varieties are all highly susceptible to FHB, but it is unclear what level of resistance exists in bread-wheat varieties.

Dr Yang hopes this fundamental discovery, published in *Cell Host & Microbe*, will counteract the growing prevalence of FHB and provide assurance to Australian growers.

"Our findings offer exciting prospects for developing new and enhanced forms of Fusarium head blight resistance," Dr Yang says. "By understanding the underlying mechanisms beyond Fhb1, we can innovate breeding strategies to diversify resistance sources. Our research opens the door to the development of more resilient and sustainable wheat varieties for future agriculture, and might shed light onto other Fusarium-caused diseases, such as crown rot."

WHY A STRATEGIC SHIFT IN ACTION IS NEEDED TO RECOGNISE AND EMPOWER INDIGENOUS PLANT PATHOLOGY KNOWLEDGE AND RESEARCH

A paper by H. Ehau-Taumaunu *et al.* titled "Why a strategic shift in action is needed to recognise and empower Indigenous plant pathology knowledge and research" was published on 17 April 2024 by *Australasian Plant Pathology* (online). The abstract is as follows:-

Plant pathology researchers play a pivotal role in thought leadership and its translation to action regarding the recognitionand demonstration of the value of Indigenous knowledge and science. For many scientists, navigating the space of Indig-enous rights and perspectives is challenging. In pursuit of a cultural shift in research and development within the field ofplant pathology, the 2019–2021 Management Committee of the Australasian Plant Pathology Society (APPS) undertooka review and modernization of the Society's Constitution. The aim was to ensure its alignment with principles that fosterinclusivity of Indigenous peoples in the development and implementation of relevant research projects impacting theircommunities. Additionally, a dynamic repository of guidelines and resources was compiled. These resources are designedto assist plant pathologists, while respecting and not superseding the guidance provided by local Indigenous researchers,practitioners, and advisors. The collective efforts of plant pathologists hold immense potential in championing IndigenousPeoples and their rights, steering the field toward a more inclusive and equitable future. This paper builds upon the thesispresented in the APPS Presidential Address at the Biennial APPS Conference in 2021, held virtually in lutruwita (Tas-mania) on the unceded lands of the Palawa people. It underscores the potential impact when plant pathologists unite inadvocating for Indigenous Peoples and their rightful place within the field.

Read paper.

SUGAR TRANSPORTERS SPATIALLY ORGANIZE MICROBIOTA COLONIZATION ALONG THE LONGITUDINAL ROOT AXIS

A paper by Eliza P.-I. Loo *et al.* titled "Sugar transporters spatially organize microbiota colonization along the longitudinal root axis of *Arabidopsis*" was published on 12 March 2024 by *Cell Host & Microbe* (vol. 32, p. 543-556). The abstract is as follows:-

Plant roots are functionally heterogeneous in cellular architecture, transcriptome profile, metabolic state, and microbial immunity. We hypothesized that axial differentiation may also impact spatial colonization by root microbiota along the root axis. We developed two growth systems, ArtSoil and CD-Rhizotron, to grow and then dissect *Arabidopsis thaliana* roots into three segments. We demonstrate that distinct endospheric and rhizosphere bacterial communities colonize the segments, supporting the hypothesis of microbiota differentiation along the axis. Root metabolite profiling of each segment reveals differential metabolite enrichment and specificity. Bioinformatic analyses and GUS histochemistry indicate microbe-induced accumulation of SWEET2, 4, and 12 sugar uniporters. Profiling of root segments from sweet mutants shows altered spatial metabolic profiles and reorganization of endospheric root microbiota. This work reveals the interdependency between root metabolites and microbial colonization and the contribution of SWEETs to spatial diversity and stability of microbial ecosystem.

Read paper.

WOMEN IN PLANT DISEASE MANAGEMENT

A review by Maria Lodovica Gullino titled "Women in plant disease management" was published on 20 March 2023 by *Frontiers in Agriculture* (vol. 5). The abstract is as follows:-

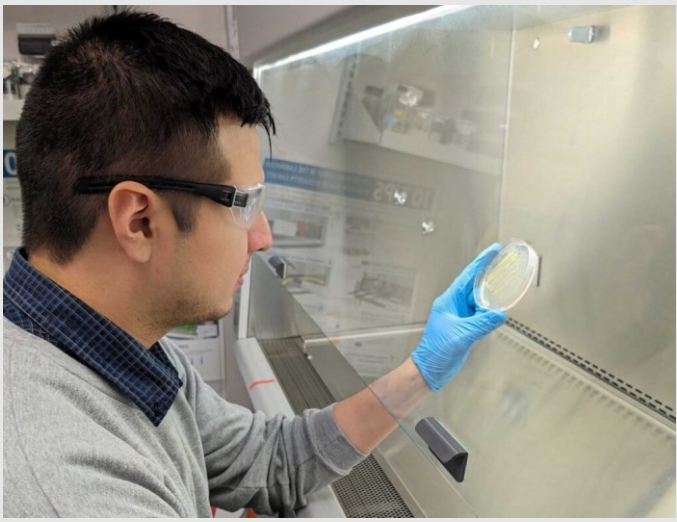
Women first began to take a stance in science over 50 years ago, and since then, they have produced a great number of publications. However, the first step towards science was a matter of accrediting women as rightful members of the scientific community. During the late nineteenth and early twentieth centuries, women started to enter into graduate programmes, and such a step helped them to make a difference. In many cases and many countries, botanists and mycologists were, in some way, pioneering in the plant pathology discipline. This manuscript considers some of the women who led the way in plant pathology, with a special focus on those who also dealt with the early aspects of plant disease management. Women who were active in different geographical areas are featured, and an attempt has also been made to provide some less well-known stories. Moreover, the importance of women behind the scenes, as is the case for many lab and field technicians, whose lives have not been chronicled, is acknowledged. Finally, some suggestions are given on how to improve the present situation and increase the number of women in science as well as in technical positions, with special emphasis on the positive effect of female mentors and role models.

Read paper.

RESEARCHERS FIND NEW WHEAT DISEASE IN COLORADO, USA

CHRISTOPHER OUTCALT, COLORADO STATE UNIVERSITY, 23 NOVEMBER 2023

Growing up in Peru, Diego Gutierrez, a graduate student at Colorado State University, formed a deep connection to agriculture. His grandmother owned a potato farm in the Peruvian highlands, and his father worked at a facility that processed the country's sought-after coffee beans. Those close ties meant that Gutierrez also learned early on about the disastrous impact an uncontrolled plant disease can have on a crop and a community.



Diego Gutierrez, graduate student at Colorado State University, who found new wheat disease (Photo credit: Colorado State University).

When he was a teenager, a fungal infection known as yellow rust spread through local coffee fields. The crop was so hard hit that Gutierrez's father struggled to continue to find work at the processing plant. "So," Gutierrez said, "I've always been interested in plant pathology and trying to find and diagnose disease before it becomes a problem that can affect farmers' livelihoods."

This autumn, that's exactly what Gutierrez did. He discovered and identified a new bacterial disease affecting wheat plants in at least five counties in eastern Colorado. Gutierrez made the discovery while working toward his doctoral degree in a lab run by Robyn Roberts, an assistant professor in CSU's Department of Agricultural Biology.

What Gutierrez and Roberts found is a disease known as leaf blight. The leaf-attacking disease is caused by bacteria called *Pantoea*, which had previously only been reported to affect wheat in China and parts of eastern Europe. (*Pantoea* has been found to attack rice and soybeans in the United States, among other agricultural crops.)

Gutierrez and Roberts followed a thorough review process, including genetic mapping and consulting with the Colorado Department of Agriculture (CDA), to confirm the discovery. Roberts then worked with CSU colleagues and CDA to report the finding to the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, the federal regulatory agency that monitors invasive pests and diseases. Roberts also notified the Colorado Wheat Administrative Committee, a statewide association of wheat farmers.

At the moment, Roberts doesn't anticipate leaf blight will cause too much trouble. Best case scenario, she said, is that it's been around for a while and no one found it because it hadn't been problematic. Chances are that the environment shifted in a way that triggered the microbe's ability to infect Colorado-grown wheat. "Some microbes are just kind of ubiquitous and opportunistic," Roberts said. "When conditions are right, they become pathogens."

A LIGHT-BULB MOMENT

This kind of discovery is precisely the work of the Roberts lab, which attempts to better understand plant immunity and pathogens to help prevent major epidemics. Roberts focuses specifically on wheat and other field crops that are important in Colorado and beyond. "My research is strongly driven by the needs of the growers in Colorado," Roberts said. "One of our big goals is to detect pathogens before they become a significant issue."

The *Pantoea* discovery happened almost by accident. Gutierrez was looking for another plant disease called bacterial leaf streak. Leaf streak has been around since the early 1900s but has reemerged in the Midwest in the past 10 or 15 years, creating problems for farmers in Nebraska, Kansas and elsewhere. The disease can cause significant yield loss, and, depending on the variant, there are few options for controlling it. Gutierrez and Roberts figured leaf streak had likely already made it to Colorado, but that no one had picked up on it.

Gutierrez designed his thesis around studying the potential for bacterial leaf streak to impact the Centennial State. On a pre-planned field research day to the Eastern plains last year, Gutierrez thought he found it. He collected samples from multiple wheat fields that showed symptoms of leaf streak. He tested the samples, but everything came back negative. Not thinking too much more about it, Gutierrez stored the samples in a freezer and returned to his thesis.

Months later, at a regular lab meeting where researchers discuss their work, a colleague mentioned that a new bacterial pathogen called *Pantoea* had been found infecting U.S.-grown rice and soybeans. Gutierrez thought the symptoms sounded a lot like what he'd observed in eastern Colorado. He texted Roberts his light-bulb thought during the meeting; they connected afterward, and Roberts said she'd been thinking the same thing.

With the help of two undergraduate students, Libby Swanson and Emma Barrett, Gutierrez went back to those tissue samples in the freezer, isolated the bacteria and had it genetically sequenced. Sure enough, one of the samples he had collected was a 100% genetic match for the strain of *Pantoea* that had been reported in China. What's more, another sample matched a different strain of *Pantoea* that had never been reported to infect wheat.

PLANT HEALTH IS PUBLIC HEALTH

Amy Charkowski, research associate dean in the College of Agricultural Sciences, shares Roberts' feeling that the early signs suggest *Pantoea* will likely not cause significant issues in Colorado. Nevertheless, she said, the discovery itself is critical. "Plant health is basically public health," Charkowski said. "And if you don't have a problem identified, you can't really manage it." There are some known controls for *Pantoea* that work with onions, but no research has been done to determine what might work with wheat.

Climate change and global trade can further complicate the work of containing a disease, Charkowski said. "Plant resistance genes are often controlled by temperature — if it gets too warm, they don't work very well," she said. "And then all of these microbes are affected by temperature, too; as the climate changes we're going to see microbes that couldn't previously survive do well."

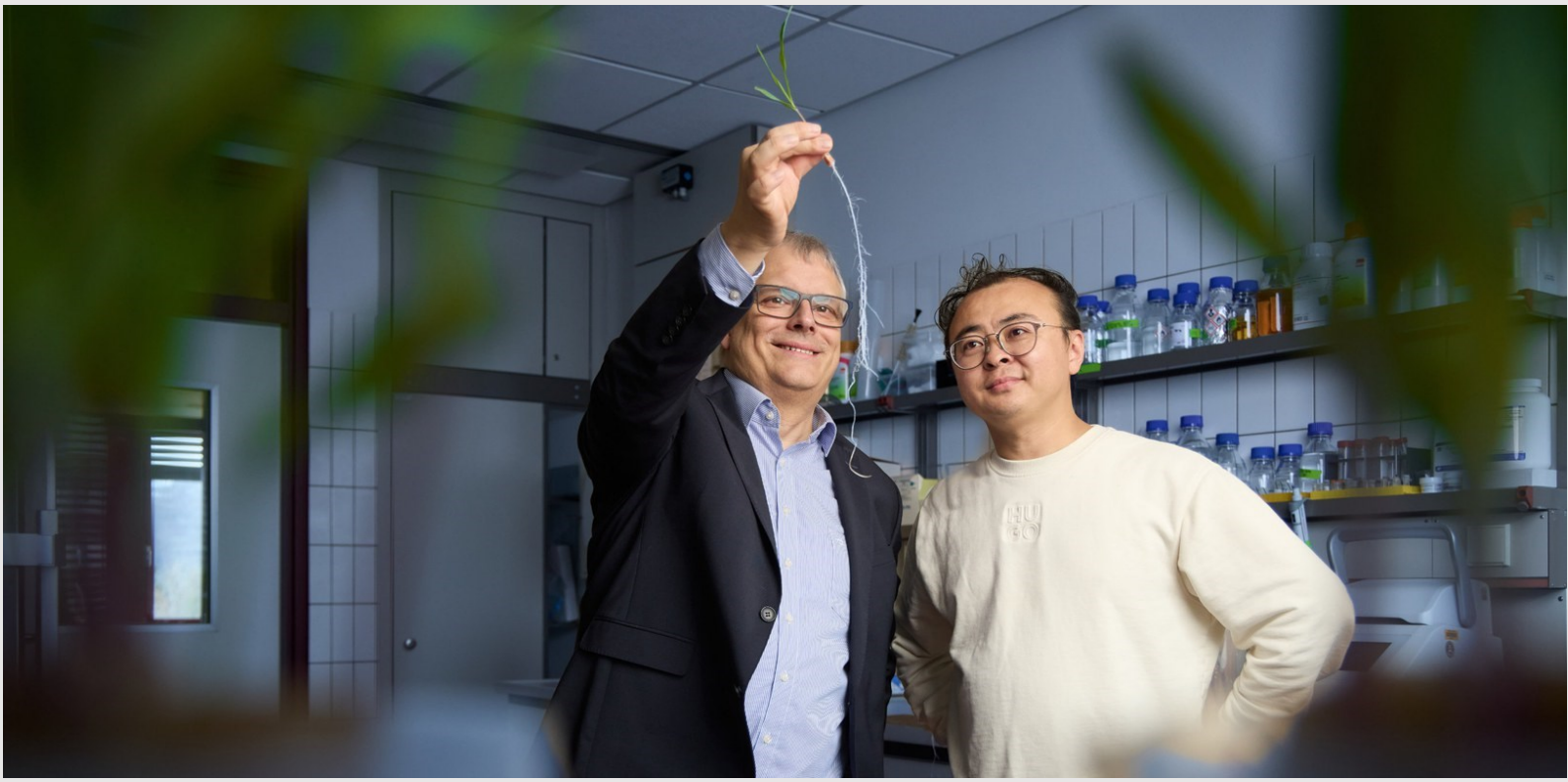
Roberts hopes to find additional funding to keep an eye on *Pantoea*. One immediate question is whether it can be transmitted on seeds. "If it's traveling on seed, it's a big concern," she said. "It could be broadly distributed very quickly."

What's more, a changing climate could present new challenges. "There's always the potential that if conditions change, or the variety changes enough," Roberts said, "it could become an issue."

For now, though, Gutierrez is focusing on his bacterial leaf streak thesis. But he's glad to have stumbled upon the *Pantoea* discovery; it reminded him of why he wanted to do this work in the first place. "It's definitely rewarding for me to see the research that I've done having an impact," Gutierrez said. "Hopefully this can help farmers."

MAIZE GENES CONTROL LITTLE HELPERS IN THE SOIL

UNIVERSITY OF BONN NEWS, 21 MARCH 2024



Inspecting the root system of a maize seedling: - Prof. Dr. Frank Hochholdinger (left) and Dr. Peng Yu (right) from the Chair of Crop Functional Genomics at the University of Bonn (Photo credit: Volker Lannert, University of Bonn).

Tiny organisms such as bacteria and fungi help to promote the health and function of plant roots. It is commonly assumed that the composition of these microbes is dependent on the properties of the soil. However, an international team of researchers led by the University of Bonn has now discovered when studying different local varieties of maize that the genetic makeup of the plants also helps to influence which microorganisms cluster around the roots. The results, which have now been published in the prestigious journal *Nature Plants*, could help to breed future varieties of maize that are better suited to drought and limited nutrients.

In order to grow properly, plants take in water and nutrients through their roots. But they have the assistance of some tiny helpers: A layer of bacteria and fungi, just a few millimeters thick, can be found directly around the roots. "These microorganisms are essential for the health and fitness of the plants," says Dr. Peng Yu, head of the junior research group "Root Functional Biology" at the Institute of Crop Science and Resource Conservation (INRES) at the University of Bonn. The microbes help with the absorption of water and nutrients and protect the plants against harmful organisms – similar to how the "microbiome" in the intestines of humans helps to determine whether we become ill or stay healthy.

The traditional view is that the composition of the microbiome is mainly determined by the properties of the soil. This includes things such as the type of soil and whether it is more acidic or alkaline. However, an international team of researchers led by the University of Bonn has now demonstrated in maize plants that the genetic makeup of the host plants has a significant influence on the composition of the root microbes.

"Our study also showed that the microbiome around the roots has a crucial influence on how resilient the maize plants are when faced with stressful conditions such as a nutrient deficits or lack of water," says Prof. Dr. Frank Hochholdinger from the Crop Functional Genomics department in INRES at the University of Bonn. In view of global climate change and the limited supply of the nutrient phosphorous, resilience of these plants to drought and a lack of nutrients could play an even greater role in the future.

ADAPTING REGIONAL VARIETIES OF MAIZE TO ENVIRONMENTAL CONDITIONS

The various varieties of maize have very different genetic composition. Regional varieties have adapted themselves to very different environmental conditions depending on whether they are cultivated, for example, in cooler highland or the warmer lowland areas of South America. "The fact that farmers have continued to select those varieties of maize suited to the local climate over many centuries has led to very different genotypes that we were able to utilise for our study," says Dr. Yu, who is head of an Emmy Noether junior research group funded by the German Research Foundation and also a member of the PhenoRob Cluster of Excellence and the transdisciplinary research area "Sustainable Futures" at the University of Bonn.

In cooperation with scientists from Southwest University in Chongqing (China), the researchers studied a total of 129 different varieties of maize. Some of these were cultivated under "normal" conditions while others experienced deficiencies in phosphorus, nitrogen, or water. Additionally, the team sequenced the DNA of the microbes from 3168 samples taken from the layer found directly around the roots that is just a few millimeters thick.

The role played by the genetic makeup of the roots became apparent in those plants grown under stressful conditions. Interestingly, the lack of nutrients and water had a significant influence on the composition of the microbes. Furthermore, the team discovered important characteristic differences in the microbiome between different varieties of maize under the same stressful conditions. "We were able to prove that certain maize genes are able to interact with certain bacteria," says Dr. Yu to explain on the most important results. Using data on the growth conditions at the place of origin of a certain variety of maize and on its genetic composition, the researchers were even able to predict which key organisms would be found in the microbiome around the roots.

THE BACTERIUM MASSILIA PROMOTES THE GROWTH OF LATERAL ROOTS

The results for bacteria of the genus *Massilia* especially stood out: "It was very noticeable that very few specimens of this microbe were found when there was a sufficient supply of nitrogen," says Prof. Dr. Gabriel Schaaf from the Ecophysiology of Plant Nutrition department at INRES and member of the PhenoRob Cluster of Excellence. If there was a lack of nitrogen, however, lots of *Massilia* could be found clustering around the roots. The team then inoculated maize roots with this bacterium. The plants grew a lot more lateral roots as a result and were therefore able to significantly improve their uptake of nutrients and water.

Following further studies, the researchers discovered that the roots actually attracted the *Massilia* bacteria using flavones. This substance is one of many secondary metabolites in the plant and stimulates the growth of lateral roots with the aid of the bacteria. "However, this was dependent on whether the maize plant had a microtubule-binding gene," says Dr. Peng Yu. If this gene was missing, the plant did not produce more lateral roots.

The international team of researchers hopes that they will also be able to predict yield in the medium term. "We are carrying out basic research," says Hochholdinger. "However, these results could act as the basis for cultivation of maize varieties better suited to drought and a lack of phosphorous by using genome and microbiome data."

CURRENT VACANCIES

No vacanices.

ACKNOWLEDGEMENTS

Thanks to Grahame Jackson, Greg Johnson, and Katherine Lister for contributions.

COMING EVENTS

International Symposium on Grapevine Epidemic Diseases
16 May – 18 May, 2024
Austin, Texas, USA
Website: web.cvent.com/event/7b4a5e7f-3901-4d94-b035-5c96932142a1/summary

6th European Bois noir workshop and Prophylactic and Agro-Ecological Control of flavescence dorée and other Grapevine Yellows (Pro-AECOGY)
14 June – 16 June, 2024
Bordeaux, France
Website: https://boisnoirwkshop.sciencesconf.org/

10th International conference on *Pseudomonas syringae*
4 June – 7 June, 2024
Porto, Portugal
Website: psyringae2024.com

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

miCROPe 2024 conference - Microbe-assisted crop production – opportunities, challenges and needs
15 July – 18 July, 2024
Vienna, Austria
Website: www.micrope.org

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: acpp2024.tri-think.cn

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

International Phytobiomes Conference 2024
8 October – 10 October, 2024
St. Louis, MO, USA
Website: phytobiomesconference.org

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

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

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,e-mail: 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

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

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