PROMOTING WORLD-WIDE PLANT HEALTH AND FOOD SECURITY

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

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INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY (ISPP)

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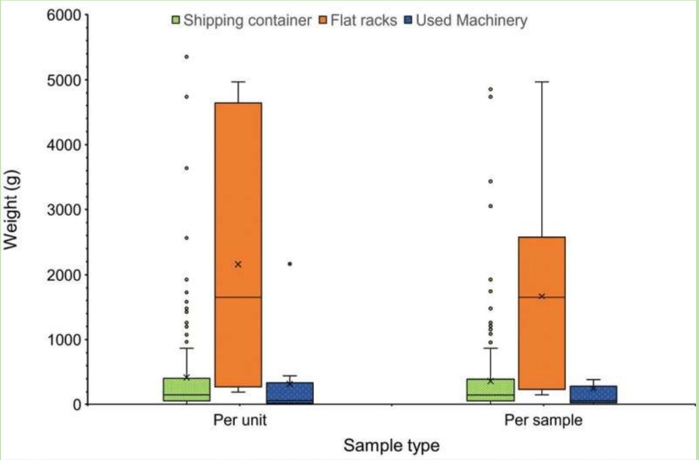
SOIL CARRIED ON SEA FREIGHT LOADED WITH DANGEROUS PESTS AND DISEASES

PENSOFT PUBLISHERS, 20 OCTOBER 2023

Often introduced unintentionally by human activities, invasive alien species can outcompete and overwhelm native flora and fauna, driving species to the brink of extinction and disrupting the balance of ecosystems. Understanding why exactly they establish in new locations and how they got there in the first place is crucial if we are to mitigate their destructive effects. Unfortunately, there isn't enough research on this, and the answers might not always be straightforward.



Boxplot indicating the amount of soil (g) (minimum, first quartile, median, mean, third quartile, and maximum) collected from shipping containers, used machinery and flat rack containers at New Zealand seaports per unit (individual freight or machinery item) and per sample, respectively (Credit: NeoBiota (2023). DOI: 10.3897/neobiota.88.98440).

A research team from AgResearch and Better Border Biosecurity (B3) investigated the biological risk posed by soil on the external surfaces of sea freight such as shipping containers or used machinery at sea ports in New Zealand. With their work, the researchers hope to facilitate the assessment of relative biosecurity risks between different introduction pathways and contribute to the development of more efficient measures against them.

The team found soil on most types of sea freight, irrespective of origin, with all soil likely to vector microbes, including plant pathogens. The amount of soil recovered from a single sea container was 5.3 kg, while the overall mean weight collected from sea freight was 417g, with most of the soil found on the underside of sea freight.

"While the presence of soil is perhaps not surprising, the presence of live bacteria, fungi, worms, seeds and insects associated with the soil was of greater concern. Various regulated biosecurity organisms were recovered from the samples, including plant-parasitic worms, seeds, insects and spiders that were not recorded as being present in New Zealand," says Mark McNeill of AgResearch, who led the study. "Not only does the spread of exotic species through these networks represent significant environmental, economic and social costs to natural and agricultural environments if invasive alien species were to establish, a loss of biodiversity is also an expected consequence of invasive alien species establishment."

"For islands, the implications can be significant, as they have high levels of endemism and invasive alien species establishment can lead to extinction of species as well as biodiversity declines," the researchers write in their paper, which was published in *NeoBiota*.

Compared to a previous study on contaminated footwear carried in luggage by international airline passengers, the number and diversity in soil on sea freight was smaller than soil transported in more protected environments (e.g., footwear in luggage). This showed that biosecurity risk can vary with pathway. However, prioritising one soil pathway over another according to the risks they present, and differentially allocating resources is problematic, because the relative risk is dynamic, dictated by factors such as new pests or diseases entering the respective pathways.

Even so, the researchers suggest that contaminated sea freight is an important introduction pathway for exotic species. The establishment of such species can be prevented by cleaning containers prior to departure, inspection at the border, and further cleaning where required.

NEWLY DISCOVERED FUNGUS HELPS DESTROY A HARMFUL FOOD TOXIN

TOKYO UNIVERSITY OF SCIENCE NEWS, 31 AUGUST 2023

Scientists identify a fungal strain that transforms patulin, a dangerous mycotoxin sometimes found in fruits, into less toxic byproducts.

Patulin ($C_7H_6O_4$), a mycotoxin produced by several types of fungi, is toxic to a variety of life forms, including humans, mammals, plants, and microorganisms. In particular, environments lacking proper hygienic measures during food production are susceptible to patulin contamination as many of these fungi species tend to grow on damaged or decaying fruits, specifically apples, and even contaminate apple products, such as apple sauce, apple juice, jams, and ciders.

Responsible for a wide variety of health hazards, including nausea, lung congestion, ulcers, intestinal hemorrhages, and even more serious outcomes, such as DNA damage, immunosuppression, and increased cancer risk, patulin toxicity is a serious concern worldwide. As a result, many countries have imposed restrictions on the permitted levels of patulin in food products, especially baby foods as infants are more vulnerable to the effects of patulin.

Treatment of patulin toxicity include oxygen therapy, immunotherapy, detoxification therapy, and nutrient therapy. However, as prevention is often better than cure, scientists have been on the lookout for efficient ways to mitigate patulin toxicity in food products. To this end, a research team including Associate Professor Toshiki Furuya from Tokyo University of Science (TUS) in Japan, recently screened for soil microorganisms that can potentially help keep patulin toxicity in check. Their study, published online in MicrobiologyOpen was co-authored by Ms. Megumi Mita, Ms. Rina Sato, and Ms. Miho Kakinuma, all from TUS.

The team cultured microorganisms from 510 soil samples in a patulin-rich environment, looking for those that would thrive in presence of the toxin. Next, in a second screening experiment, they used high-performance liquid chromatography (HPLC) to determine the survivors that were most effective in degrading patulin into other less harmful chemical substances. Accordingly, they identified a filamentous fungal (mold) strain, *Acremonium* sp. or "TUS-MM1," belonging to the genera *Acremonium*, that fit the bill.

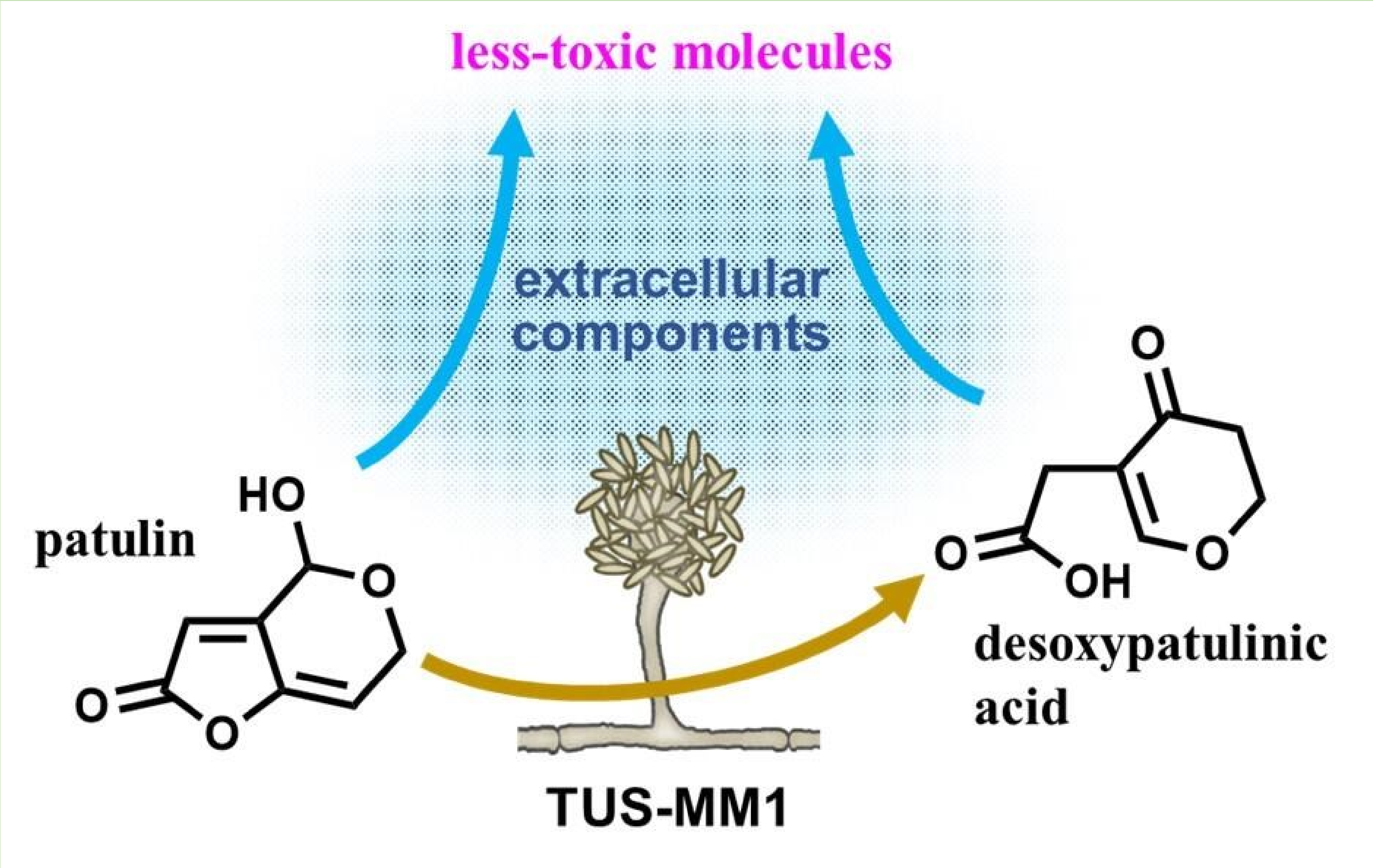
The team then performed various experiments to shed light on the mechanisms by which TUS-MM1 degraded patulin. This involved incubating the mold strain in a patulin-rich solution and focusing on the substances that gradually appeared both inside and outside its cells in response to patulin over time.

One important finding was that TUS-MM1 cells transformed any absorbed patulin into desoxypatulinic acid, a compound much less toxic than patulin, by adding hydrogen atoms to it. "When we started this research, only one other filamentous fungal strain had been reported to degrade patulin," comments Dr. Furuya. "However, prior to the present study, no degradation products had ever been identified. In this regard, to our knowledge, TUS-MM1 is the first filamentous fungus shown to be capable of degrading patulin into desoxypatulinic acid."

Moreover, the team found that some of the compounds secreted by TUS-MM1 cells can also transform patulin into other molecules. By mixing patulin with the extracellular secretions of TUS-MM1 cells and using HPLC, they observed various degradation products generated from patulin. Encouragingly, experiments on E. coli bacterium cells revealed that these products are significantly less toxic than patulin itself. Through further chemical analyses, the team showed that the main agent responsible for patulin transformation outside the cells was a thermally stable but highly reactive compound with a low molecular weight.

Overall, the findings of this study take us a step closer toward efficient solutions for controlling the levels of patulin in food. Dr. Furuya speculates: "Elucidating the pathways via which microorganisms can degrade patulin would be helpful not only for increasing our understanding of the underlying mechanisms in nature but also for facilitating the application of these organisms in biocontrol efforts."

Let us hope that these efforts will pave the way for safer fruit-based foods and beverages!



Patulin toxicity is a serious food safety hazard, and scientists are looking for ways to control it. Now, researchers from TUS, Japan, have identified, for the first time, a mold strain that can convert patulin into desoxypatulinic acid and other less toxic substances, with potential applications for patulin biocontrol. (Image credit: The Authors. *MicrobiologyOpen* published by John Wiley & Sons Ltd. Image Source Link: https://onlinelibrary.wiley.com/doi/10.1002/mbo3.1373).

OBITUARY OF MILTON SCHROTH, 1933-2023

UNIVERSITY OF CALIFORNIA, BERKELEY NEWS, 31 OCTOBER 2023

Milton Neil Schroth, a world-renowned plant pathologist and professor emeritus with more than three decades of service to University of California (UC) Berkeley, died on 11 October. He was 90.

Schroth was born on 25 June 1933, and grew up in Southern California. While earning his BA in Botany from Pomona College, he also played football and was twice named to the All-Pacific Coast football team and later inducted into the Pomona-Pitzer Athletics Hall of Fame. Schroth continued his education at Berkeley, earning his PhD in 1961. He subsequently joined the College of Agriculture as a professor and Plant Pathologist with the Agricultural Experiment Station (AES).

During his tenure at Berkeley, Schroth made major contributions to research on bacterial diseases, systematics, and biocontrol. He published over 300 articles—half in major peer-reviewed journals including Nature, Phytopathology, and the Journal of Bacteriology—and found a way to cure crown galls, the tumor-like growths that certain bacterial pathogens cause on many trees, without harming healthy plant tissue. He also discovered the causes of several unknown diseases that affected papaya, sugar beets, and oak trees, and showed that *E. coli* could multiply rapidly in vegetables like lettuce in moist, warm conditions.

He is best known for defining a type of soil bacteria that colonise root systems and enhance plant growth, spearheading worldwide research into so-called "plant growth promoting rhizobacteria." Schroth also identified a separate soilborne bacterium capable of producing an antibiotic that plant roots could absorb as a result of that work. Further inquiries into soil bacteria discovered that certain strains of internal bacteria within plants could aggravate or reduce the extent of a disease.

Schroth's research often questioned concepts that were popular and widely accepted among academics. A paper he co-authored with graduate student David C. Sands ended the debate on whether there is a genetic difference between the typical soil bacterium *Pseudomonas* spp. and plant pathogenic pseudomonads. With the help of a medical microbiologist, Schroth reported that *Pseudomonas aeruginosa*—a drug-resistant bacterial pathogen associated with serious illnesses—could colonise both flowering plants and humans.

During his career, Schroth served as chair of the Department of Plant Pathology, associate dean of the College of Natural Resources, assistant director of the AES, and assistant to the vice president for the University of California's Division of Agriculture and Natural Resources. A lifelong advocate for democratising scientific knowledge, Schroth took a groundbreaking step in curating a comprehensive repository of images and data of the world's most critical bacterial plant disease, which remains freely accessible to all at plantdiseases.org.

To many of his students, Schroth is remembered as a dedicated educator and mentor. He established the "Graduate Excellence Award Fund" to support graduate students, the "Endowment for Early Career Professionals," and a student travel fund in the American Phytopathological Society (APS). He and his wife Nancy also established the "Schroth Faces of the Future Symposium," highlighting research from the best and brightest early career professionals in plant pathology.

"Milt Schroth was a true leader in the field of plant bacteriology," said Steven Lindow, a professor emeritus in the Department of Plant and Microbial Biology. "He made many seminal contributions in plant disease diagnosis and control through his work, which often challenged the common dogma in the field."

In addition to his impactful research in the field of plant pathology, Schroth made significant contributions to the College," said David Ackerly, dean of Rausser College of Natural Resources. "We are thankful for his years of service through leadership in the College and in the UC Division of Agriculture and Natural Resources."

Schroth was named a Fellow of the American Phytopathological Society in 1975 and received the Berkeley Citation in 1996 for his service and contributions to the University.

He is survived by his wife of 64 years, Nancy; his two sons, Eric and Steven; his daughter Holly; and 5 grandchildren.

WHEAT PATHOGEN SURVEILLANCE SYSTEM SET TO EXPAND THROUGH NEW INVESTMENT

CIMMYT NEWS, 18 OCTOBER 2023

One of the world's largest crop pathogen surveillance systems is set to expand its analytic and knowledge systems capacity to protect wheat productivity in food vulnerable areas of East Africa and South Asia.

Researchers announced the Wheat Disease Early Warning Advisory System (Wheat DEWAS), funded through a $7.3 million grant from the Bill & Melinda Gates Foundation and the United Kingdom's Foreign, Commonwealth & Development Office, to enhance crop resilience to wheat diseases.

The project is led by David Hodson, principal scientist at CIMMYT, and Maricelis Acevedo, research professor of global development and plant pathology at Cornell University's College of Agriculture and Life Sciences. This initiative brings together research expertise from 23 research and academic organizations from sub-Saharan Africa, South Asia, Europe, the United States and Mexico.

Wheat DEWAS aims to be an open and scalable system capable of tracking important pathogen strains. The system builds on existing capabilities developed by the research team to provide near-real-time model-based risk forecasts and resulting in accurate, timely and actionable advice to farmers. As plant pathogens continue to evolve and threaten global food production, the system strengthens the capacity of countries to respond in a proactive manner to transboundary wheat diseases.

The system focuses on the two major fungal pathogens of wheat known as rust and blast diseases. Rust diseases, named for a rust-like appearance on infected plants, are hyper-variable and can significantly reduce crop yields when they attack. The fungus releases trillions of spores that can ride wind currents across national borders and continents and spread devastating epidemics quickly over vast areas.

Wheat blast, caused by the fungus Magnaporte oryzae Tritici, is an increasing threat to wheat production, following detection in both Bangladesh and Zambia. The fungus spreads over short distances and through the planting of infected seeds. Grains of infected plants shrivel within a week of first symptoms, providing little time for farmers to take preventative actions. Most wheat grown in the world has limited resistance to wheat blast.

"New wheat pathogen variants are constantly evolving and are spreading rapidly on a global scale," said Hodson, principal investigator for Wheat DEWAS. "Complete crop losses in some of the most food vulnerable areas of the world are possible under favorable epidemiological conditions. Vigilance coupled with pathogen-informed breeding strategies are essential to prevent wheat disease epidemics. Improved monitoring, early warning and advisory approaches are an important component for safeguarding food supplies."

Previous long-term investments in rust pathogen surveillance, modelling, and diagnostics built one of the largest operational global surveillance and monitoring system for any crop disease. The research permitted the development of functioning prototypes of advanced early warning advisory systems (EWAS) in East Africa and South Asia. Wheat DEWAS seeks to improve on that foundation to build a scalable, integrated, and sustainable solution that can provide improved advanced timely warning of vulnerability to emerging and migrating wheat diseases.

"The impact of these diseases is greatest on small-scale producers, negatively affecting livelihoods, income, and food security," Acevedo said. "Ultimately, with this project we aim to maximize opportunities for smallholder farmers to benefit from hyper-local analytic and knowledge systems to protect wheat productivity."

The system has already proven successful, contributing to prevention of a potential rust outbreak in Ethiopia in 2021. At that time, the early warning and global monitoring detected a new yellow rust strain with high epidemic potential. Risk mapping and real-time early forecasting identified the risk and allowed a timely and effective response by farmers and officials. That growing season ended up being a production record-breaker for Ethiopian wheat farmers.

While wheat is the major focus of the system, pathogens with similar biology and dispersal modes exist for all major crops. Discoveries made in the wheat system could provide essential infrastructure, methods for data collection and analysis to aid interventions that will be relevant to other crops.

MANIPULATION OF THE HOST ENDOMEMBRANE SYSTEM BY BACTERIAL EFFECTORS VIRTUAL SEMINAR

You're invited to a FREE virtual seminar on 13 November 2023, at 7:00 P.M. CT.

Hyelim Jeon and Cécile Segonzac will present their trending Current Review "Manipulation of the Host Endomembrane System by Bacterial Effectors" from the latest Molecular Plant-Microbe Interactions (MPMI) Focus Issue.

Join host Jeanne Harris and colleagues worldwide in exploring the endomembrane system dynamics during bacterial infection in plants.

Jeon and Segonzac will discuss the dynamics of the endomembrane compartments for their essential contributions to the plant defense responses and, in parallel, for their emerging roles in bacterial pathogenicity; the diverse functions of the bacterial type III secreted effectors (T3Es) that associate with endomembranes and the underlying cytoskeleton; and several lines of questioning that may frame further investigations on the endomembrane-associated T3Es.

Register to learn more about this system that critically influences the plant response to pathogen infection. After registering, you will receive a confirmation email containing information about joining the seminar.

Register now

PHYTOBIOMES JOURNAL FOCUS ISSUE ON THE PHYLLOSPHERE

Editor-in-Chief Johan H. J. Leveau and Guest Editors Gwyn A. Beattie, Steven E. Lindow, and Walter F. Mahaffee are pleased to present the *Phytobiomes Journal* Focus Issue on the Phyllosphere.

This focus issue celebrates the tremendous growth and impact of phyllosphere science as a discipline and includes 14 articles by nearly 100 authors from more than 40 institutions.

Focus Issue features:

- Highlights the status of the field and offers ideas for future directions
- Explores topics related to phyllosphere biodiversity, community assembly and dynamics, and the adaptive capacity of species, populations, and communities on leaf surfaces and other phyllosphere compartments
- Delves into the multipartite relationships that phyllosphere colonizers have with each other and with their hosts, along with issues of global concern such as food security, food safety, and climate change
- Illustrates the international, transdisciplinary, and collaborative nature of phyllosphere science, the challenges that the discipline faces, and the importance of recruiting and training the next generation of phyllosphere scientists

View issue

LIVE PLANT PATHOGENS CAN TRAVEL ON DUST ACROSS OCEANS

KRISHNA RAMANUJAN, CORNELL CHRONICLE, 10 OCTOBER 2023

Plant pathogens can hitch rides on dust and remain viable, with the potential for traveling across the planet to infect areas far afield, a finding with important implications for global food security and for predicting future outbreaks. A study, "Assessing Long-distance Atmospheric Transport of Soilborne Plant Pathogens," published in the journal *Environmental Research Letters*, is the first to provide computer modeling evidence to support the idea that massive dust storms can transport viable pathogenic spores across continents and oceans.

The Earth system model simulated a major dust storm, nicknamed "Godzilla," that brought some 24 million tons of dust from North Africa across the Atlantic Ocean to the Caribbean and southeastern United States in summer 2022.

The researchers found that viable spores of the deadly fungal plant pathogen *Fusarium oxysporum* could be transported across the ocean and were likely deposited across a range of regions that include agricultural production zones, most significantly in southeastern Louisiana, Mexico, Haiti and the Dominican Republic, with particularly high risk in Cuba. "We found that this Godzilla dust event could have potentially brought over 13,000 viable live spores, which is not a lot, but it's never been shown before, by any means, that viable soilborne pathogens could be transported trans-oceanically with dust," said study co-author Kaitlin Gold, assistant professor of plant pathology in the College of Agriculture and Life Sciences at Cornell AgriTech and lead principal investigator on the NASA Interdisciplinary Sciences grant that funded this research.

The modeling effort included previous research of *F. oxysporum* viability to show that 99% of all spores are killed off within three days of being airborne due to ultraviolet radiation exposure, a factor that was included in the model along with variable spore size, weight and density.

"For long distance transport, when we just look at total spores, including ones that maybe deactivated while they're in the atmosphere, we see there are many that are traveling very long distances," said Hannah Brodsky '22, the paper's first author, who conducted the work as an undergraduate in the lab of Natalie Mahowald, the study's senior author and the Irving Porter Church Professor in Engineering in the Department of Earth and Atmospheric Sciences in Cornell Engineering.

"What really limits potential disease spread via long-distance transport is whether they're still viable by the time they land in an agricultural region," Brodsky said. The researchers also looked at intercontinental transport, areas closer to the source – where spores might be airborne for less time – that likely received the majority of the viable spore depositions. "There are certain regions of the globe where transport of viable spores is more likely to happen, for example, between Europe, Asia and Northern Africa," Brodsky said. These areas bear the most risk because of the probability that farmers would grow common crops near where dust and pathogens originate, Gold said.

Soil-adapted *F. oxysporum* is found on all six crop-producing continents and can infect more than 100 crops and other plants, leading to losses of up to 60% of crops and hundreds of millions of dollars in some areas. As a result, understanding how fungal diseases spread and identifying agricultural zones where viable spores could deposit is vitally important to ensure global food security, according to the paper.

Though *F. oxysporum* is soil adapted and not equipped to survive well when airborne, researchers have found that the pathogens attach to soil particles in dust clouds.

In the study, co-author Rocío Calderón, NASA-funded postdoctoral research associate at Cornell University, contributed extensively to an exhaustive literature search with more than 1,100 references for different species to create an interactive web map that showed variable spore concentrations in soils. This data improved the accuracy of the model's results by an order of magnitude, compared with uniform distributions of spores used in early versions.

The researchers found that sub-Saharan Africa was a source for 53% of all viable spores and 14% of viable spores that travelled across the Atlantic.

"This is the region that should likely be targeted for addressing the disease," Gold said.

The researchers note that the study is preliminary, with future work focused on gathering observational data for corroborating the model's results – including creating remote sensing maps of dust storms and genomic comparisons of F. oxy between dust sources and areas of disease outbreaks.

DETECTION DOGS SNIFF OUT PHYTOPHTHORA CINNAMOMI TO SAVE NATIVE PLANTS

NSW DEPARTMENT OF PLANNING AND ENVIRONMENT, 3 OCTOBER 2023

Two scent-detection dogs have been trained to sniff out a soilborne disease that damages native plants and threatens the health and resilience of national parks, nurseries and public gardens. With funding from the New South Wales (NSW) Government's Saving our Species program, expert trainers have been teaching Alice, a springer spaniel, and Echo, a Brittany spaniel, to identify the pathogen *Phytophthora cinnamomi*.

It can cause disease in thousands of native plant species, permanently damaging ecosystems and destroying habitat for native wildlife including the southern brown bandicoot and smoky mouse.

Ten months into their training, Alice and Echo can now confidently discriminate infected from non-infected plants in a lab environment and are learning how to detect the pathogen lying dormant in soil as well as on vehicles, clothing and cutting equipment. They've been practising on plants provided by Northern Beaches Council, which is working to protect critically endangered Caley's grevillea (*Grevillea caleyi*) from infection.

Based on the success of this trial, the NSW Government is awarding a grant of a further $50,000 to fine-tune the dogs' skills and deploy them to test soil in Barrington Tops National Park and Scheyville National Park, where *Phytophthora* poses a significant threat to several threatened plant species.

GENE DISCOVERY MAY HELP GROWERS BATTLE GRAPE DOWNY MILDEW

ERIN RODGER, CORNELL CHRONICLE, 26 OCTOBER 2023

Researchers at Cornell have discovered a new grape downy mildew resistance gene – giving the wine and grape industry a powerful new tool to combat this devastating disease. "Of the downy mildew resistance genes found in the world to date, this is one of the strongest," said Lance Cadle-Davidson, adjunct professor in the School of Integrative Plant Science in the College of Agriculture and Life Sciences, and a research plant pathologist with the USDA's Grape Genetics Research Unit in Geneva. "The discovery could help breeders develop more resistant grape varieties."

Caused by the fungus *Plasmopara viticola*, grape downy mildew (GDM) is one of the most damaging grape diseases in the Eastern United States. Grape clusters are highly susceptible after the vines finish blooming, and late-season infections can defoliate vines right when the berries are trying to ripen. This damages maturation, winter hardiness and eventually crop return. The research discovery is outlined in the paper, "A Multitiered Haplotype Strategy to Enhance Phased Assembly and Fine Mapping of a Disease Resistance Locus," which published Sept. 14 in *Plant Physiology*.

The lead authors were Cheng Zou, research associate at Cornell's Bioinformatics Facility, Qi Sun, co-director of the Facility, Surya Sapkota, a former postdoctoral researcher and now grape breeder at the USDA and Cadle-Davidson.

The gene was discovered in a grapevine accession known as Vitis x doaniana, a naturally occurring hybrid of two wild grapevines, now maintained in the USDA-ARS grape germplasm repository located at Cornell AgriTech. Cadle-Davidson noticed that the accession seemed to be resistant to downy mildew in the field and turned to the Bioinformatics Facility for further investigation.

Using a three-step process developed through VitisGen2, a multidisciplinary project focused on decreasing the time, effort and cost involved in developing the next generation of grapes, the facility was able to find the gene responsible in just two months. Using low-resolution genetic mapping in a large breeding population, the team narrowed possible gene candidates down to a few hundred genes. Next, high-resolution mapping of the recombinants further narrowed down the gene candidates to a couple dozen. Finally, using phased assembly of the chromosomes of the Vitis x doaniana parent and comparative analysis of the resistant and susceptible alleles, the exact genetic basis of downy mildew resistance was identified.

"One of the most groundbreaking components of this research is the strategy that was used because it could be a gamechanger for specialty crop breeders everywhere," Sun said. "Breeders could use this process to quickly and efficiently identify genes in other heterozygous crops such as apples."

When it comes to the development of new grape varieties, the newly discovered gene could help growers battle GDM long term as climate change leads to upticks in GDM epidemics across the Northeast. "Growers commonly use fungicides to control GDM, but GDM can eventually build up resistance to fungicides," said Bruce Reisch, grape breeder and professor emeritus of horticulture in CALS. "Developing new grape varieties for growers with a variety of strong resistant genes is the ultimate solution."

A typical vinifera vineyard in the Northeast may require upwards of 12 sprays of fungicides for downy mildew, powdery mildew and other diseases. "If a grower were to produce grapes that had resistance to these diseases, the number of sprays in a vineyard could potentially go down to one to two per year," said Reisch. "With the tools we have now, there are endless possibilities to develop new grapes that deliver on both quality and disease resistance."

NEW LIGHT ON HOW SOIL VIRUSES BEHAVE AND INTERACT WITH BACTERIA

EMILY DOOLEY, UC DAVIS BLOG, 2 OCTOBER 2023

Viruses in soil may not be as destructive to bacteria as once thought and could instead act like lawnmowers, culling older cells and giving space for new growth, according to research out of the University of California, Davis, published 28 September in the journal *Nature Ecology and Evolution*.

How viruses affect ecosystems, including bacteria, is challenging to untangle because they are complex and change over time and space. But the first annual rain on Mediterranean ecosystems, such as those in California, offers a kind of reset, triggering activity that can be observed.

Scientists took soil from four California grasslands, brought it back to their lab and simulated precipitation by watering the dry samples, which grew microorganisms and viruses. They tracked changes over 10 days.

"Viruses are really abundant in soil, but we didn't know whether they were doing much of anything," said Joanne B. Emerson, associate professor of plant pathology at UC Davis and corresponding author on the paper. "This level of extreme dynamics hasn't been observed."

The researchers found that the viral composition was diverse and changed so much that only 15% of the virus types were the same at the end of the experiment compared to the beginning. There was far less turnover when it came to bacteria. And the viruses preyed on the dominant types of bacteria but did not kill them off.

"Viral communities change much, much more over short temporal scales than bacterial communities from the same samples," Emerson said. "We see this massive change, what we call turnover, in viral community composition over time."

Viruses affect the makeup of bacterial communities, which can lead to differences in how ecosystems function because bacteria influence carbon and nutrient cycles in soil.

"Bacteria can affect plant health, ecosystem dynamics, all sorts of things," Emerson said.

The finding suggests that viruses behave differently than once thought and this knowledge could lead to a better understanding of soil dynamics when it comes to bacteria.

"Instead of the viruses totally obliterating everything, maybe they do this gentle culling," Emerson said.

The study also found that viruses behaved similarly across the four grasslands even though they had different compositions and came from different places. This suggests that viral patterns are similar, despite their specific characteristics.

"The much greater change in viral compared to bacteria types over time suggests that possibly we've been measuring bacteria wrong," Emerson said.

The lead author on the paper is Christian Santos-Medellín, who was a postdoctoral researcher at UC Davis, and now works at Corteva Agriscience. Researchers from Lawrence Livermore National Laboratory, UC Berkeley and UC Merced contributed to the research.

PHD OPPORTUNITIES

University of Florida's Department, Plant Pathology - ten graduate assistantships for Fall 2024

The University of Florida's Department of Plant Pathology is accepting applications for up to ten highly competitive graduate assistantships for Fall 2024.

Areas of research include:

- Disease modeling
- Food security
- Molecular and genomic aspects of plant responses to disease and drought
- Pathogen evolution and population structure
- Comparative microbial genomics and metagenomics
- Disease diagnostics
- Mycology
- Integrated disease management

Why choose the University of Florida?

We are known for our research on diseases of diverse crops including citrus; vegetables such as tomato, pepper and cucurbits; ornamentals including foliage plants and flowering and woody ornamentals; field crops including soybean, peanut and sugarcane; and tropical fruits. Our strengths also include expertise in epidemiology, molecular biology of host-parasite interactions, biological control, and post-harvest diseases.

University of Florida Plant Pathologists cover the entire state of Florida. Our researchers are located in Gainesville and at ten research centers around the state, providing unique opportunities to work with a wide variety of crops and plant diseases of national and international importance.

Applications are due **1 December 2023**. For more information, contact Academic Adviser Jessica Ulloa (julloa@ufl.edu) or visit https://plantpath.ifas.ufl.edu/academics/graduate-admissions/.

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

Thanks to Grahame Jackson and Greg Johnson for contributions.

Coming Events

24th Australasian Plant Pathology Society Conference
20 November - 24 November, 2023
Adelaide, South Australia
Website: eventstudio.eventsair.com/apps2023/

8th International Conference of Pakistan Phytopathological Society - "Sustainable Agriculture & Food Security: A nexus of Plant Pathogens, Climate Change and Water Challenges"
26 November - 28 November, 2023
Department of Plant Pathology, The Islamia University, Bahawalpur, Pakistan
Website: pakps.com/8icpps
Email: 8icpps@pakps.com

Plant-Parasitic Nematode Identification Course
8 December - 12 December, 2023
Clemson University, South Carolina, USA
Website: www.clemson.edu/cafls/nematology/

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

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 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

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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