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:





# ICPP2023: One Health for all Plants, Crops and Trees. Closing plenary presentation by Monica Höfte on 25th August 2023 at the 12th International Congress of Plant Pathology in Lyon, France

MONICA HÖFTE, 27 NOVEMBER 2023

## The future of plant pathology in a one health world

ICPP2023 took place in the beautiful city of Lyon in France amidst a sweltering heat wave that kept participants indoors in the coolness of the convention centre. The central theme at the conference was "one health", a strategy for enhancing interdisciplinary collaborations and communications about all aspects of health care for humans, animals and the environment, in which plant health is usually not included.

I have centered my concluding remarks around the main topics of the conference.

## Plant pathology in a one health world

After hearing the various talks this week, the main conclusion is that **"Plants deserve a more prominent place in one health"** for a number of reasons.

Firstly, plants provide various ecosystem services such as: (i) Supporting: they are the base of the food chain; (ii) Provisioning: they provide food, feed, fibre, fuel, medicine, and, as we discovered this week, also shade! (iii) Regulating: they regulate climate, soil, air and water, and (iv) Cultural: they play a role in recreation, beauty, spirituality, art and wisdom. Thinking back about the anecdote that Jan Leach told us in her opening speech (see newsletter September 2023) about the doctor from WHO asking her "so what do you do"? and her answer: "I am an agricultural scientist who specialises in plant diseases. We feed the people that you keep alive." I would paraphrase this as: "We feed, but also cloth, shield, warm, cool and comfort the people that you keep alive".

Secondly, there are common factors in disease risks for plants, animals and humans such as increased globalisation, climate change, and resistance to antimicrobials and fungicides.

Thirdly, plant diseases pose a threat to both humans and animals by jeopardising food and feed security. Moreover, the potential for mycotoxin production impacts food and feed safety. Additionally, plants can serve as reservoirs of human pathogens, and certain plant pathogens are capable of infecting immunocompromised humans. Furthermore, the use of pesticides to manage plant pests can have detrimental effects on both human and animal health.

Plant pathologists with their multidisciplinary background can bring valuable expertise to the One Health community. Plant health managers can make the connection to soil health to close "the poop lope" as we heard from Cindy Morris.

Finally, the principles of One Health, traditionally applied to humans and animals, are also relevant for plant pathology. Potential pathogens can be everywhere so we should pay attention to reservoirs of plant pathogens beyond agriculture. We should be aware about the dissemination routes of plant pathogens, and global disease surveillance is needed.


So, a new One Health logo should be designed that includes plant health.

## FOOD SECURITY, INVASIVE AND EMERGING PATHOGENS

A quote to remember: **"Instead of resolving yesterday's problems tomorrow we should be resolving tomorrow's problems today."**

Our agricultural system is vulnerable since food security heavily relies on a few important crops mainly grown in monoculture. As a results, threats are global with transboundary pathogens, but also pests and weeds.

Our plants, crops and trees are threatened by invasive pathogens, new pathogens, evolution of existing pathogens or re-emerging pathogens. We learned about the various mechanisms by which pathogens emerge and evolve including host jumps, whole genome duplication, hybridisation, horizontal gene transfer and transposon activity.

Reservoirs of plant pathogens include soil, water, wild species, introduction of new crops, seeds, and planting material produced in third countries. Drivers for evolution and spread are ecological speciation, agricultural practices and climate change. These pathogens rapidly spread by globalisation (increased travel and trade) and via seed and planting material (vegetables, banana).

So prevention is key. We heard about risk assessment and the legal procedures to prevent introduction and spread of pathogens in Europe. The trend is to move from pest risk assessment to commodity risk assessment, but the system is leaky.

## GLOBAL HEALTH ASSESSMENT

This topic dealt with the global state and evolution of plant health and its impact on ecosystem services. Global plant health in keystone plant species defined in 16 main plant systems was evaluated by experts. Since plant health is difficult to define, ecosystem services as defined above were assessed. The trend is a global decline in plant health with the situation being particularly poor in Sub-Sahara Africa. The result is food insecurity and rural poverty with social, economic and political consequences. Health decline is also worrying in urban and managed forests. The drivers for health decline are the same as for global change: climate change, human activities and biodiversity collapse. Questions that arose were: Are we losing the battle against plant diseases and are we doing enough to improve plant health?

## PLANT-MICROBE INTERACTIONS

The general theme that emerged in this topic is the importance of the pathobiome/holobiome; plant-microbe interactions should be considered in a wider environmental context. We learned that effectors and virulence factors of plant pathogens not only target plants but also have antimicrobial activity and suppress antagonists. Effectors can even modulate plant development to make plants attractive for insect vectors. Plants rely on their microbes to survive in nature and boundaries between pathogens and beneficials are not clear-cut. The environment plays a role how plants, pathogens and vectors interact. Lastly, we should not overlook the importance of disease complexes, where more than one pathogen contribute to a disease.

## NEW DEVELOPMENTS IN DISEASE MANAGEMENT

Significant advances have been made in enhancing surveillance methods, early disease warning systems, and rapid diagnostics. Among the noteworthy tools driving progress are high-throughput sequencing for diagnostics, advanced omics technologies, large-scale systems biology, and impressive advancements in analysing complex data—spanning models, statistical tools, as well as cluster and network analysis.

Novel concepts were put forward during this meeting. Drawing an analogy from animal science's ecological immunity, a new concept, agroecological immunity was introduced, recognising that plant immunity is shaped by factors like the host, nutrition, pathogens, the biotic environment, landscape, and even neighboring plants. The resistobiome, involving microbes linked with pathogens that enhance plant resistance, and the pursuit of breeding for biocontrol and a healthy microbiome were emphasised. In the evolution toward smart crop protection, the utilisation of cultivar mixtures can be a valuable approach. In addition, we can draw inspiration from natural and resilient systems.

In the field of disease control, diverse methods are evolving, featuring new bioprotectants, RNA strategies, innovative delivery methods, and a revived interest in bacteriophages. Advances in disease resistance and breeding include structural-based design for disease resistance genes, swift trait discovery for breeding (NLRseek), and the application of genome editing for disease resistance.

A recurrent theme is the rise of collaborative networks, fostering global community collaborations in integrated crop disease management. Collaborative efforts focus on the management of transboundary pathogens in major food crops such as wheat, maize, banana and cassava. The initiatives encompass global surveillance systems, rapid diagnostics, mobile phone alerts, capacity building, systems led by national scientists, and the creation of awareness.

## THE FUTURE

Looking ahead, the future of plant pathology is characterised by keywords such as complexity, uncertainty, multidisciplinarity, and collaboration.

It is crucial to prevent the further spread of invasive and emerging pathogens, a challenge that requires collective action.

Dealing with vast amounts of data is another imperative on our horizon, demanding innovative approaches to manage and make sense of this information.

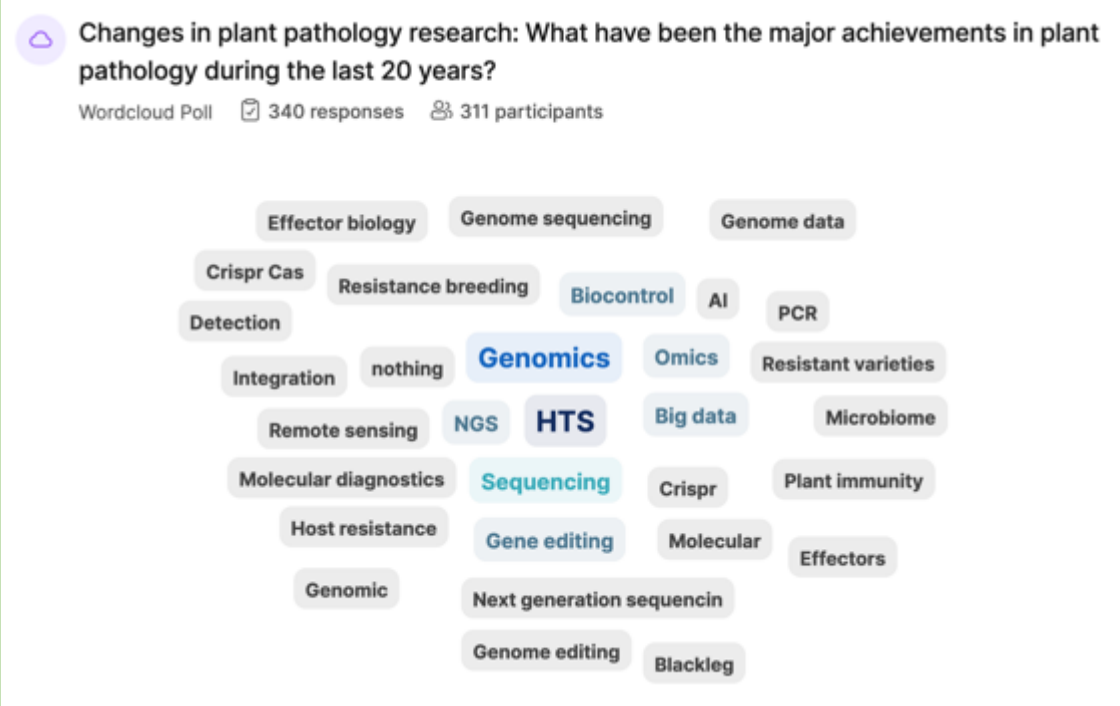
Breaking away from monoculture practices is key, necessitating the introduction of biodiversity into our crops for a more resilient agricultural system.

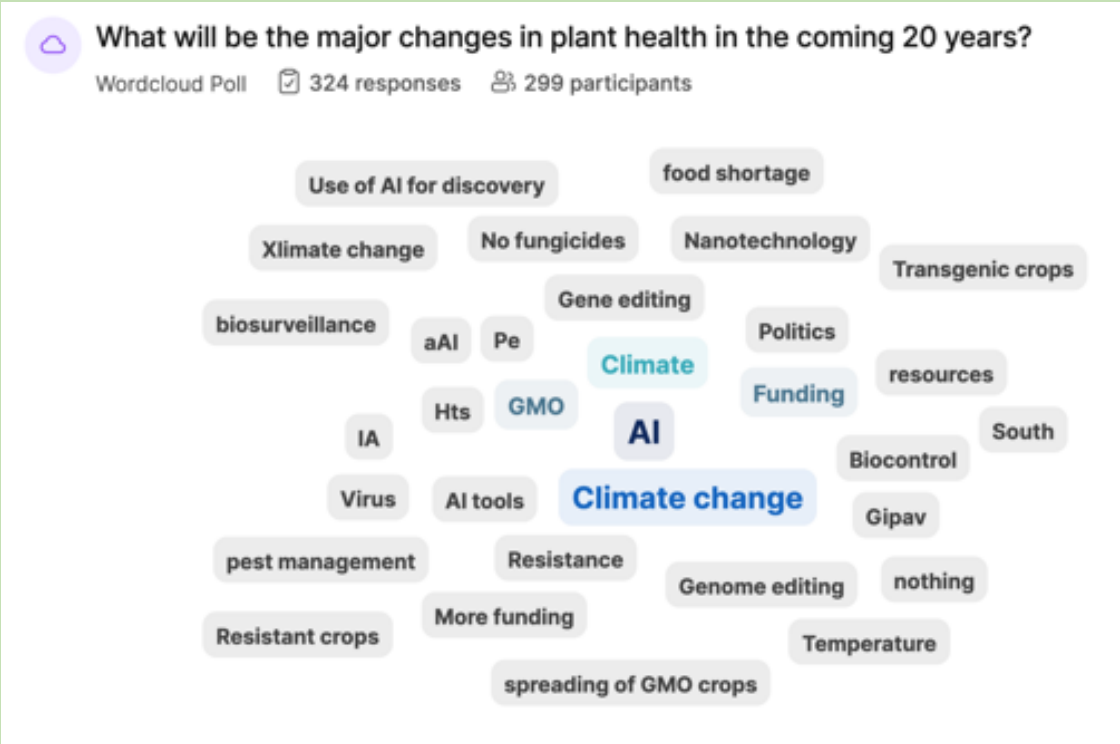
A transition from chemical to ecological crop protection is needed, alongside enhancing the effectiveness of biocontrol methods. Collaborative efforts must extend beyond major crops to encompass minor and subsistence crops, as well as urban and managed forests.

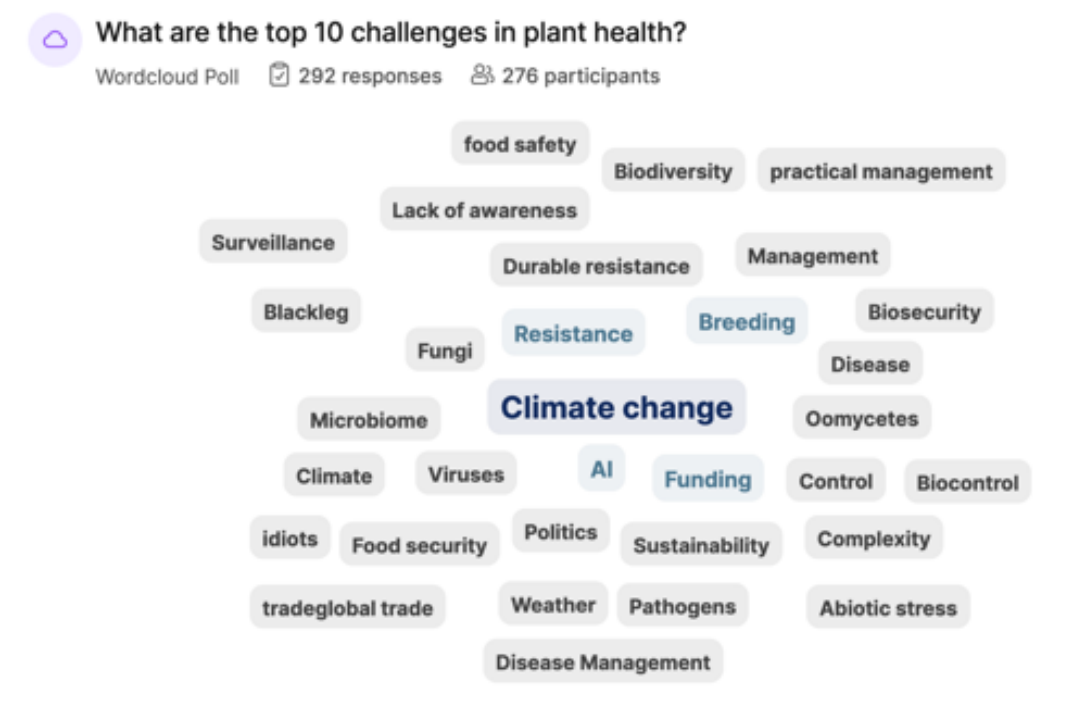
Equally important is the training and education of the next generation of plant pathologists. They will need skills in a large number of disciplines to deal with the complex challenges that lie ahead.

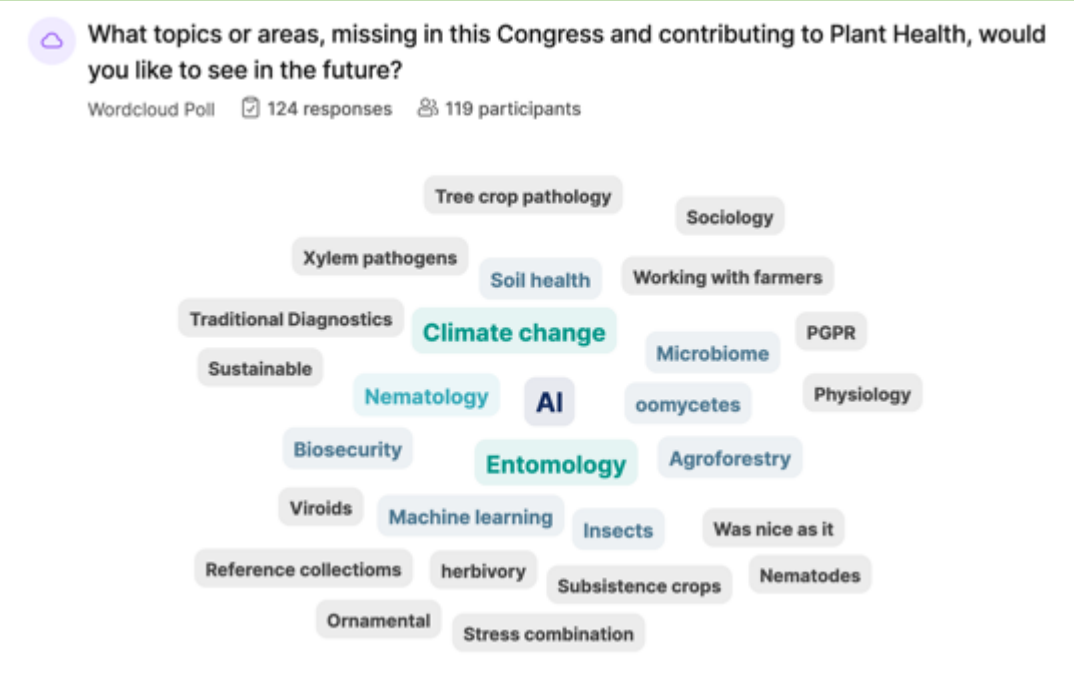
In conclusion, plant pathologists and field practitioners are more needed than ever. Their expertise and collaborative endeavours will be essential to safeguarding our crops and ecosystems.

Finally, below are the results of the poll that was held among the participants.




What are the top 10 challenges in plant health?
Wordcloud Poll
292 responses
276 participants
food safety
Biodiversity
practical management
Lack of awareness
Surveillance
Durable resistance
Management
Blackleg
Resistance
Breeding
Biosecurity
Fungi
Disease
Climate change
Microbiome
Oomycetes
Climate
Viruses
AI
Funding
Control
Biocontrol
idiots
Food security
Politics
Sustainability
Complexity
tradeglobal trade
Weather
Pathogens
Abiotic stress
Disease Management


What topics or areas, missing in this Congress and contributing to Plant Health, would you like to see in the future?
Wordcloud Poll
124 responses
119 participants
Tree crop pathology
Sociology
Xylem pathogens
Soil health
Working with farmers
Traditional Diagnostics
Climate change
PGPR
Microbiome
Sustainable
Nematology
AI
oomycetes
Physiology
Biosecurity
Entomology
Agroforestry
Viroids
Machine learning
Insects
Was nice as it
Reference collectioms
herbivory
Subsistence crops
Nematodes
Ornamental
Stress combination

# ICPP 2023 BY BIKE

CINDY MORRIS, 22 NOVEMBER 2023

As most of the attendees of the International Congress of Plant Pathology (ICPP) 2023 in Lyon learned, some twenty scientists travelled to the conference on bicycle taking the Via Rhôna bicycle route (https://en.viarhona.com/) from Avignon. Coming from several towns in the south of France, as well as Italy, the UK and the USA, they pedaled for three days from 18 to 20 August, covering 270 kilometers under a blazing sun to reach Lyon. Beyond the physical performance, the main aim of this great human adventure was to raise awareness among all of us about the carbon footprint of our personal and professional travels. However, this adventure also highlighted the concept that our professional activities can be coherent with our personal beliefs about planetary sustainability.

The initiative was the brainchild of Cindy Morris, a researcher at INRAE's Plant Pathology unit in Avignon: "As soon as it was announced in 2018 that the ICPP 2023 would be held in Lyon, I immediately had the idea of valorising the safe Via Rhona bicycle path as a means to get there. Each time I presented this idea to colleagues, I received positive and enthusiastic responses. What's more, I had the impression that such a move was fully in line with our institute's policy on environmentally-sustainable research practices."

Building the trip started actively in April 2022 with technical discussions between Cindy and one of her classmates from graduate school at the University of Wisconsin - a UK cyclist with decades of experience in long distance bike traveling. A call for participants was started by contacting a range of people who had initially expressed interest in the project from hearsay. This group helped to define the length of the trip (number of days) and the numerous technical questions for which we needed responses (baggage, water, food, fatigue, bike preparation, housing, etc...). By November 2022, the steps of the trip and the housing plans were set. In February 2023, a general call for participants was launched via the mailing list of the French Society for Plant Pathology and via a few tweets on Twitter (as it was called at the time), and an organisation team consisting of two of Cindy's colleagues at INRAE in Avignon and herself was ready for action.

Team building was an important goal for the bike trip. Most of the participants were going to surpass their usual biking achievements in terms of duration and weather conditions, and this was going to require a large dose of solidarity. Five on-line meetings of the bikers were held from April to August 2023 (about 1 per month). These meetings were very important for resolving and communicating all of the logistic details so that everyone knew what to expect, where to meet and at what time each day, how long we would ride, how to stay hydrated, where to reserve housing, how to maintain communication with the group and solicit help during the ride, etc. However, these meetings were also the means by which the group solidarity and cohesion were created. A part of the first team building meeting was dedicated to each participant explaining their motivations for joining the trip and what they hoped to achieve. Nearly unanimously, the participants evoked a desire to be in a team with common values to achieve a goal together. Having identified this common motivation and respecting it in the decisions that were made throughout the organisation and realisation of the trip was the main key to its success.

Since returning to their laboratories and offices, participants have written short summaries of their experience, and, in particular, how the trip was related to addressing the grand challenges that society faces. Many of the participants indicated that the trip has made it easier for them to consider biking as an option for more varied trips than simply going to and from work. It was a means to test the limits of intercity travel by bike – especially the step of putting a bike on a train when necessary. The adventure was also perceived as an extraordinary collective experience that reflects the challenges we must face and the difficulties in overcoming them together. Even if we do not all move at the same speed, everyone's skills are needed for us to advance. Finally, one participant expressed in detail the link between the bike challenge and the challenges faced by researchers:

"Physical activity is essential to physical and mental health, yet the professional environment is generating ever-increasing levels of stress, particularly with the accelerating flow of information. In recent years, the research profession has evolved considerably, with a multiplicity of demands to be met, tasks to be accomplished, deadlines to be met... These drastic changes are at odds with the reflection and exchange that form the basis of research activities. By commuting by bike, we reduce the carbon footprint of our professional activities, while at the same time regaining time for reflective and forward-looking activities, either directly during the exchanges that take place during the long-distance journey, or indirectly, whatever the distance, by contributing to greater serenity and therefore efficiency at work."


The team of bikers have maintained their network of exchange about biking and other modes of "soft" transportation. They have met again for a weekend in October, via bike, halfway between Montpellier and Avignon to re-live the joy of being together and are planning future trips together in the spring of 2024 and to celebrate their 1 year anniversary. They are adding new members to the group and would love to test the other modes of "soft" transportation that can be paired with biking.

# CHLOROPLASTS DO MORE THAN PHOTOSYNTHESIS: THEY'RE ALSO A KEY PLAYER IN PLANT IMMUNITY

LIANA WAIT, UC DAVIS NEWS, 25 OCTOBER 2023

Scientists have long known that chloroplasts help plants turn the sun's energy into food, but a new study published in *Science Advances*, led by plant biologists at the University of California, Davis, shows that they are also essential for plant immunity to viral and bacterial pathogens.

Chloroplasts are generally spherical, but a small percentage of them change their shape and send out tube-like projections called "stromules." First observed over a century ago, the biological function of stromules has remained enigmatic.

Previous studies have shown that chloroplasts produce more stromules when a plant detects an infection. Stromules aid in clustering chloroplasts around the nucleus and function as conduits to transport pro-defense signals from chloroplasts to the nucleus. Despite these findings, researchers have not been able to determine the role of stromules in immunity, as no genes involved with the formation of stromules have been identified.

**Experimental seedlings in the laboratory. UC Davis plant biologists have discovered how chloroplasts, responsible for photosynthesis in green plants, also play a key role in plant immunity to infections (Photo credit: Sasha Bakhter, UC Davis College of Biological Sciences).**

In the new study, Savithramma Dinesh-Kumar, professor and chair in the Department of Plant Biology, graduate student Nathan Meier and colleagues have identified a key protein involved in stromule biogenesis during immunity. Their findings are published Oct. 25 in Science Advances.

## A HIDDEN PLAYER IN IMMUNE DEFENSE

In order to test the stromules' role in immunity, researchers need to switch them off and then observe how stromule-less plant cells fare when faced with a pathogen. However, without knowing which genes are involved with the creation of stromules, researchers have had no way to know which genes to switch off.

To overcome this roadblock, Dinesh-Kumar and his colleagues turned to kinesins, proteins that function as tiny motors that allow molecules and organelles to move around a cell. This intracellular movement usually involves the cell's cytoskeleton, which is made up of two different types of fiber: large microtubules and smaller actin filaments.

The researchers wanted to investigate a type of kinesin that is unique to plants and capable of binding both microtubules and actin filaments. The researchers found that overexpression of one of these kinesins, KIS1, induced stromule formation in the absence of pathogen infection. When the researchers manipulated tobacco and Arabidopsis plants so that they could not produce the KIS1 kinesin, they found that neither plant was able to form stromules, and their chloroplasts did not migrate toward the nucleus. This left the plants unable to defend themselves from introduced pathogens.

## SECRETS OF CHLOROPLAST MOVEMENT

To disentangle the roles of microtubules and actin, the researchers engineered one set of KIS1 variants that could only bind to microtubules, and another that could only bind to actin. Expression of these variants in tobacco showed that KIS1 needs to bind to microtubules in order for chloroplasts to form stromules, but in order for chloroplasts to move toward the nucleus, it must also bind to actin.

The team also wanted to know how stromules fit into the bigger picture of plant immunity. By using genetic manipulation to switch different immune signals off, they found that stromule formation is triggered by molecular signaling and that an intact immune signaling system is needed in order for stromules to form.

"If we remove any of the known immune signaling genes, the chloroplasts lose the ability to make stromules, which suggests that these structures are an integral part of the immune signaling pathways that activate defense," said Dinesh-Kumar.

## NEW LIGHT ON PLANT IMMUNITY

This study is the first evidence of a plant kinesin directly involved in plant immunity. It's also the first time that scientists have identified a gene — KIS1 — involved in chloroplast stromule biogenesis, which opens the door to understanding the role of chloroplast stromules and why chloroplasts cluster around the nucleus during plant immune defense.

"If we can better understand at the cellular level how organelles like chloroplasts help cells to defend themselves, we could help to engineer resistance to the pathogen." Dinesh-Kumar said.

# INOCULATION AGAINST DISEASED FIELDS

UNIVERSITY OF ZURICH NEWS, 30 NOVEMBER 2023

Farmland often harbors a multitude of pathogens which attack plants and reduce yields. A Swiss research team has now shown that inoculating the soil with mycorrhizal fungi can help maintain or even improve yields without the use of additional fertilizers or pesticides. In a large-scale field trial, plant yield increased by up to 40 percent.

Intensive use of fertilisers and pesticides on fields reduces biodiversity and pollutes the environment. There is therefore great interest in finding sustainable ways to protect yields without the use of agricultural chemicals. One example of alternative biologicals is mycorrhizal fungi, which are beneficial organisms that help plants acquire nutrients.

## YIELDS IMPROVED BY UP TO 40 PERCENT

A team of researchers from the universities of Zurich and Basel, Agroscope and the Research Institute of Organic Agriculture (FiBL) has now shown for the first time on a large scale that the application of mycorrhizal fungi in the field works. The fungi were mixed into the soil before sowing crops on 800 trial plots at 54 maize farms in northern and eastern Switzerland. "On a quarter of the plots, the mycorrhizal fungi enabled up to 40 percent better yields. That's huge," says the study's co-lead Marcel van der Heijden, a soil ecologist at the University of Zurich and at Asgroscope. But there's a catch: on a third of the plots, the yield did not increase and in some cases even decreased. The research team was initially unable to explain why this happened.

## PATHOGENS IN THE SOIL

In their search for the cause, the researchers analysed a variety of chemical, physical and biological soil properties, including the biodiversity of soil microbes. "We discovered that the inoculation functioned best when there were lots of fungal pathogens already in the soil," says co-first author Stefanie Lutz from Agroscope, the federal center of competence for agricultural research. "The mycorrhizal fungi act as a kind of protective shield against pathogens in the soil that would weaken the plants." As a result, the normal yield can be maintained in fields where without mycorrhizal fungi there would have been

**The fungi were mixed into the soil before sowing crops on 800 trial plots at 54 maize farms in northern and eastern Switzerland (Photo credit: UZH).**

losses. In contrast, mycorrhizal fungi had only a minor effect on fields that are not contaminated with pathogens. "The plants there are strong anyway and grow excellently. The use of mycorrhizal fungi in such cases brings no additional benefits," says the other first author Natacha Bodenhausen from the Research Institute of Organic Agriculture.

## VACCINATION SUCCESS CAN BE PREDICTED

The aim of the study, funded by the Gebert Rüf Foundation, was to be able to predict the conditions under which mycorrhizal inoculation works. "With just a few soil indicators – mainly soil fungi – we were able to predict the success of inoculation in nine out of 10 fields, and thus could also predict the harvest yield even before the field season," says the study's co-lead Klaus Schläppi of the University of Basel. "This predictability makes it possible to target the use of the fungi in fields where they will work. That's a crucial element for developing these technologies into a reliable agricultural method," says Schläppi.

Further research is still required to find out the easiest way to spread the fungi over large areas. Nevertheless, "the results of this field trial represent a big step toward a more sustainable agriculture," concludes Marcel van der Heijden.

Read the *Nature Microbiology* paper.

# MYCORRHIZAL FEEDBACKS INFLUENCE GLOBAL FOREST STRUCTURE AND DIVERSITY

A paper by Camille S. Delavaux *et al.* titled "Mycorrhizal feedbacks influence global forest structure and diversity" was published on 19 October 2023 by *Communications Biology* (vol. 6, 1066). The abstract is as follows:-

One mechanism proposed to explain high species diversity in tropical systems is strong negative conspecific density dependence (CDD), which reduces recruitment of juveniles in proximity to conspecific adult plants. Although evidence shows that plant-specific soil pathogens can drive negative CDD, trees also form key mutualisms with mycorrhizal fungi, which may counteract these effects. Across 43 large-scale forest plots worldwide, we tested whether ectomycorrhizal tree species exhibit weaker negative CDD than arbuscular mycorrhizal tree species. We further tested for conmycorrhizal density dependence (CMDD) to test for benefit from shared mutualists. We found that the strength of CDD varies systematically with mycorrhizal type, with ectomycorrhizal tree species exhibiting higher sapling densities with increasing adult densities than arbuscular mycorrhizal tree species. Moreover, we found evidence of positive CMDD for tree species of both mycorrhizal types. Collectively, these findings indicate that mycorrhizal interactions likely play a foundational role in global forest diversity patterns and structure.

Read paper.

# AN EMERGENT PLANT-PARASITIC NEMATODE IN BRAZIL: APHELENCHOIDES BESSEYI. CURRENT STATUS AND RESEARCH PERSPECTIVES

A review by Victor Hugo Moura de Souza *et al.* titled "An emergent plant-parasitic nematode in Brazil: *Aphelenchoides besseyi*. Current status and research perspectives" was published on 21 November 2023 by *Plant Pathology* (early view). The abstract is as follows:-

*Aphelenchoides besseyi* is an emerging and yet overlooked plant parasite of many economically important crops, including cotton, soybean and common bean. It presents an economic risk to these crops in several countries, notably in Brazil. Although first reported infecting strawberries in the United States as early as 1942, it was only identified to be the causal agent of green stem and foliar retention (GSFR) disease in Brazil in 2017. Currently, there are no chemical nematicides registered in Brazil against *A. besseyi*, and no known sources of genetic resistance. Here, we review the biology of *A. besseyi*, its spread across Brazil, its relevance to the country's current and future agriculture and the limited control measures. We describe control measures that have been successfully used to manage infestations of other plant-parasitic nematodes and could potentially be extended to use in the control of *A. besseyi*. We also review and discuss potential future control measures, such as RNA interference and genome editing, for the development of crops with enhanced resistance to *A. besseyi*.

Read paper.

# RECENT CO-EVOLUTION OF TWO PANDEMIC PLANT DISEASES IN A MULTI-HYBRID SWARM

A paper by Mostafa Rahnama *et al.* titled "Recent co-evolution of two pandemic plant diseases in a multi-hybrid swarm" was published on 9 November 2023 by *Nature Ecology and Evolution* (online). The abstract is as follows:-

Most plant pathogens exhibit host specificity but when former barriers to infection break down, new diseases can rapidly emerge. For a number of fungal diseases, there is increasing evidence that hybridization plays a major role in driving host jumps. However, the relative contributions of existing variation versus new mutations in adapting to new host(s) is unclear. Here we reconstruct the evolutionary history of two recently emerged populations of the fungus Pyricularia oryzae that are responsible for two new plant diseases: wheat blast and grey leaf spot of ryegrasses. We provide evidence that wheat blast/grey leaf spot evolved through two distinct mating episodes: the first occurred ~60 years ago, when a fungal individual adapted to Eleusine mated with another individual from Urochloa. Then, about 10 years later, a single progeny from this cross underwent a series of matings with a small number of individuals from three additional host-specialized populations. These matings introduced non-functional alleles of two key host-specificity factors, whose recombination in a multi-hybrid swarm probably facilitated the host jump. We show that very few mutations have arisen since the founding event and a majority are private to individual isolates. Thus, adaptation to the wheat or Lolium hosts appears to have been instantaneous, and driven entirely by selection on repartitioned standing variation, with no obvious role for newly formed mutations.

Read paper.

# ADVANCES IN UNDERSTANDING GRAPEVINE DOWNY MILDEW: FROM PATHOGEN INFECTION TO DISEASE MANAGEMENT

A review by Junbo Peng *et al.* titled "Advances in understanding grapevine downy mildew: From pathogen infection to disease management" was published on 22 November 2023 by *Molecular Plant Pathology* (early view). The abstract is as follows:-

*Plasmopara viticola* is geographically widespread in grapevine-growing regions. Grapevine downy mildew disease, caused by this biotrophic pathogen, leads to considerable yield losses in viticulture annually. Because of the great significance of grapevine production and wine quality, research on this disease has been widely performed since its emergence in the 19th century. Here, we review and discuss recent understanding of this pathogen from multiple aspects, including its infection cycle, disease symptoms, genome decoding, effector biology, and management and control strategies. We highlight the identification and characterization of effector proteins with their biological roles in host–pathogen interaction, with a focus on sustainable control methods against *P. viticola*, especially the use of biocontrol agents and environmentally friendly compounds..

Read paper.

# UNEXPECTED DISCOVERY OPENS BIOENGINEERING OPPORTUNITIES FOR HUMAN AND PLANT HEALTH

JOHN INNES CENTRE NEWS, 14 NOVEMBER 2023

Researchers in the Osbourn group at the John Innes Centre have been investigating biosynthetic gene clusters in wheat – groups of genes that are co-localised on the genome and work together to produce specific molecules.

In a study which appears in *Nature Communications*, they identified a gene cluster activated by pathogen infection, which was found to produce a compound they named triticein.

Experiments to determine the structure of triticein surprisingly identified this compound as an isoflavone rather than a flavone, as the team had expected.

Isoflavones are a class of phytoestrogen compounds well studied for their benefits to human health, which include prevention of cardiovascular disease and some cancers. They are mostly found in the legume family of which soybeans are the main source in the human diet.

The discovery of an alternative route to isoflavonoid biosynthesis, this time in wheat, and the elucidation of the triticein biosynthetic pathway in this study, provides exciting opportunities for future research and paves the way for metabolic engineering efforts. Increasing triticein production in wheat, for example, may aid in developing cultivars with higher disease tolerance.

Another possibility is that wheat triticein-forming genes can be expressed in other plants or microbes, from which the molecule can be produced, and its antimicrobial properties further investigated. And because triticein is an isoflavone there is a possibility that it may have health benefits like others in this class, although there is much further research to be done on this prospect.

Dr. Rajesh Chandra Misra, a post-doctoral scientist at the John Innes Centre and one of the lead authors explained: "We do not know anything specifically about potential health benefits of triticein, only about other isoflavones. Also, the concentrations of triticein (and other isoflavones) that we found in wheat grains were very low, so wheat cannot be currently considered as a source of dietary isoflavones."

Joint lead author Dr Guy Polturak previously at the John Innes Centre and now at The Hebrew University of Jerusalem reflected: "This study is a nice example of how scientific research sometimes takes scientists down unintended paths, eventually leading to unexpected discoveries. The main aim of this research was to learn about wheat chemical defence mechanisms, but it led to interesting new findings on plant biochemistry, in this case the discovery of a unique isoflavone synthase."

# 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 Monica Höfte, Grahame Jackson, Greg Johnson, and Cindy Morris for contributions.

# COMING EVENTS

**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

**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

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

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### WWW.ISPPWEB.ORG

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