PROMOTING WORLD-WIDE PLANT HEALTH AND FOOD SECURITY

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

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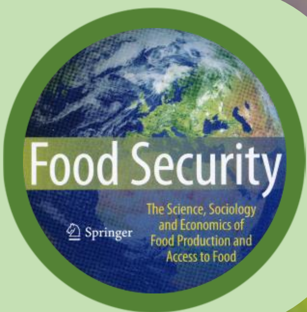

IN THIS ISSUE:

Associated Societies of ISPP are invited to present Call for bids to host the 14th International Congress of Plant Pathology, ICPP2032

ANDREA MASINO AND TERESA COUTINHO, 1 MARCH 2026

Associated Societies of ISPP are invited to present bids to host the 14th International Congress of Plant Pathology in 2032 (ICPP2032). Traditionally the ICPP is held in August. ISPP councillors are urged to consider and discuss this opportunity with their Society.

In calling for bids to host ICPP2032 the Executive recommends that bidding should be restricted to Societies that have been financial members of ISPP for at least three years. ISPP should also give consideration to giving priority in 2032 to a Society that has not previously hosted ICPP.

Attention to options for virtual attendance should also continue, both to broaden participation opportunities and strengthen the financial viability of Congresses and strengthen engagement with ISPP between Congresses.

The deadline for receipt of bids is 31 August, 2026. They should be sent to the Business Manager of ISPP, with c.c. to the Secretary ISPP, as e-mail attachments and/or Web addresses.

If a Society is considering a bid for the 14th International Congress of Plant Pathology, 2032, please read the bid and congress guidelines and requirements carefully. They can be accessed here.

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25 YEARS OF PLANT PATHOLOGY TEACHING — NOW SHARED GLOBALLY BY THE GLOBAL PLANT HEALTH ASSESSMENT PROJECT

GPHA WEBMASTERS - MANJARI SINGH, SONAM SAH (ICAR), AND FEDERICA BOVE (CORTEVA)

A complete Introduction to Plant Pathology course developed over 25 years at ETH Zürich Switzerland is now freely available to instructors and students worldwide. This Educational Material is intended for Professors and Instructors teaching an introductory course on Plant Pathology to undergraduate, graduate and post-graduate students.

This material is available on the website of the Global Plant Health Assessment (GPHA). The package includes lecture notes and PowerPoint slides designed for a 14-lecture introductory course, with each lecture lasting 45 minutes. Developed by Prof. Em. Bruce McDonald, the materials provide a scientifically accurate, adaptable foundation for teaching Plant Pathology. These files can be accessed here.

The lectures are organised as follows:

1. A short history of plant pathology and human affairs
2. Koch's Postulates. The concept of plant disease and some definitions
3. Abiotic diseases. Basic categories of infectious agents: parasitic plants, nematodes, viruses
4. Basic categories of infectious agents: bacteria and fungi and oomycetes
5. Pathogen life cycles and disease cycles. Pathogen infection processes
6. Disease development. Plant defence strategies and resistance mechanisms
7. Genetics of resistance in plants. Gene-for-gene hypothesis and receptor-elicitor models
8. Disease triangle and pathogen infection cycle. Epidemiology: the development of epidemics, dispersal patterns and gradients
9. Disease progress curves. Monocyclic and polycyclic diseases
10. Effects of environment and plant on epidemic development. Disease forecasting systems
11. Disease control strategies: exclusion and quarantines, sanitation
12. Crop rotation, biological control, genetic resistance. Resistance genes, boom and bust cycles, gene deployment strategies
13. Chemical control. Fungicides and risk assessment. Genetic engineering of plants for resistance to pathogens
14. Genetic engineering of plants for resistance to pathogens (continued). Integrated management strategies

We sincerely thank Prof. Em. Bruce McDonald for sharing his expertise with the international community.

These files are available on the website of the Global Plant Health Assessment at:

https://sites.google.com/view/global-plant-health-assessment/educational-materials/introduction-to-plant-pathology?authuser=0

OBITUARY OF DR. SALLY A. MILLER (1954–2026), AN INTERNATIONAL LEADER IN SUSTAINABLE PLANT PATHOGEN MANAGEMENT OF VEGETABLES

JONATHAN M. JACOBS, 27 APRIL 2026

The international plant pathology community mourns the loss of Sally Ann Miller, Ph.D., who passed away on 1 April 2026. Sally was a world-renowned scientist, dedicated mentor and past President of the American Phytopathological Society (2015-2016). Sally leaves behind a legacy defined by a commitment to plant pathology research and global food security.

Sally was born in Canton, Ohio (1954). She began her academic journey at The Ohio State University where she earned a B.S. in Biology with Honors Distinction (1976). There she met her husband Chip Styer, and they both went on to study together at the University of Wisconsin–Madison. She finished graduate work at UW–Madison (M.S. 1979 and Ph.D. 1982) in Plant Pathology under the supervision of Dr. Douglas Maxwell. Her early research defined resistance responses in alfalfa to *Phytophthora* and set the stage for a career dedicated to creating solutions to agricultural challenges.

I recently chose to commemorate her memory in my Molecular Plant-Microbe Interactions course. In this class, we explore current and historical literature that defined the way we observe how microbes and plants engage during disease development or resistance. Sally's thesis research set the stage for future molecular biology research defining how plants resist pathogens using, at the time, leading microscopy imaging tools. My classroom students and I honored her by discussing her work, and it was moving to see a new generation of scientists who did not know Sally personally recognise her profound impact on our field.

She started her career in the biotechnology industry developing immunological diagnostic tools that set the stage for starting as faculty at Ohio State. In 1991, Dr. Miller joined the faculty at The Ohio State University at the Ohio Agricultural Research and Development Center (OARDC) in Wooster. She broke barriers as a Plant Pathologist and state Extension specialist in vegetable pathology as one of the first female faculty members in the Department of Plant Pathology at OSU. She was a fierce advocate for young researchers and a champion for women in science. I recall fellow Ohio State faculty like Dr. Francesca Hand mentioning how Sally emphasised that women scientists should project strength with their posture and voice, and Dr. Melanie Lewis Ivey, her former trainee, remembering Sally's constant encouragement to always lean into the discussion.

As an OSU College of Food, Agricultural and Environmental Sciences Distinguished Professor, her 32-year program focused on sustainable disease management and pathogen detection for vegetable crops. She led the field developing molecular diagnostics for pathogen detection meanwhile creating impactful solutions for growers around the world. Her work on food safety, specifically regarding human pathogen contamination of fresh-market vegetables, remains a cornerstone of the field.

Sally's career was defined by its international reach. A fierce advocate for smallholder farmers in the tropics, she led long-term agricultural development projects funded by USAID across South and Southeast Asia, Africa and Central America. She served in multiple impactful leadership roles including on the US National Academies of Science, Engineering, and Medicine Forum on Microbial Threats. She was awarded the APS International Service Award in 2002 and elected a Fellow of both the APS in 2010 and the International Society for Plant Pathology in 2023.

Sally cultivated an impactful generation of international scientists. Prof. Miller advised 33 graduate students. These trainees came from across the globe and now drive the field of Plant Pathology and plant health research worldwide. I fondly recall meeting Sally one summer at the APS Plant Health meeting in San Antonio. In the large, crowded social gathering, she spotted me from afar and sat next to me. Little did I know then that she was actively recruiting me to become her colleague at Ohio State. Like many others, I can point directly to her influence as a primary driver of my success. Her gift was making early-career scientists feel seen and supported.

She remained actively invested in her colleagues towards the end of her career. After I started, she immediately included me and our first co-advised student Taylor Klass (now Assistant Professor and Diagnostician at University of Arkansas) in her international research program where we defined bacterial wilt in Southeast Asia. She was a leader in plant disease diagnostics and a champion for my team's steps towards using microbiome science for diagnostics. Her impact was always forward facing to hopefully use the newest, leading tools for plant health improvement.

Beyond her professional successes, she was deeply committed to her family. Sally was one of seven siblings and was preceded in death by her parents, Eileen and Stanley Miller; and her brother Michael. She is survived by her husband, Chip Styer; her daughter Allison Styer (Eric) and grandsons Max and Milo; her daughter Carly Styer; and her son, Mike Styer (Shea). She is also survived by her siblings, Joan (Bob), Dave (Linda), Steve (Lucy), Terri (Thom), and Adam (Mary); and was a cherished aunt, great-aunt, and cousin to many. Sally's family, especially her husband, children and grandchildren brought her great joy, and her face would always light up speaking about Max and Milo.

Her legacy was clearly defined by profound interest in the international impact of science unique to our discipline. Her impact continues and lives on through the scientists she inspired who carry our discipline forward.

REPORT ON 5TH ISMPP INTERNATIONAL CONFERENCE, 8– 10 APRIL 2026

DR SHALINI SINGH VISEN, AMITY UNIVERSITY, LUCKNOW AND DR PRATIBHA SINGH, AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURAL RESEARCH, NEW DELHI

The 5th International Conference of the Indian Society of Mycology and Plant Pathology (ISMPP), held from 8–10 April 2026 at Amity University Uttar Pradesh, Lucknow Campus, successfully brought together leading scientists, policymakers, academics, industry experts, and young researchers under the central theme "Pathogens, Plant Health and Food Security: Recent Advances for Climate-Resilient Agriculture and Landscape Conservation."

Jointly organised by the Amity Food and Agriculture Foundation, AUUP Lucknow, in collaboration with ISMPP, the conference served as a dynamic global platform addressing critical challenges in plant health and sustainable agriculture.

The inaugural session was graced by Hon'ble Deputy Chief Minister of Uttar Pradesh Shri Keshav Prasad Maurya, alongside eminent dignitaries including the Founder president Dr. Ashok K. Chauhan, from Amity Education Group and Dr. Aseem Chauhan, Chairman, Amity University, and Prof. (Dr.) Anil Vashisht (Pro VC). Keynote lectures and memorial award lectures were by eminent international speakers including Prof. Dr. SS Chahal, Prof. (Dr.) Chakravartula Manoharachary, Dr. A N Mukhopadhyay, Dr. Mary Lucy Oranje, Dr. Karen A Garrett , Prof Dr. Appa Rao Podile, Dr. CD Mayee, Prof Krishna Pratap Singh, Dr. Krishna Kumar, Dr. H B Singh, Prof Dr. Naresh Mehta, Dr. Shiv K. Agrawal, Dr. L. M. Suresh, and the conference abstract book was formally released, marking a significant academic milestone.

Several prestigious awards were conferred during the inaugural session, including the Prof. S. S. Chahal Lifetime Achievement Award, Y. L. Nene Outstanding Plant Pathology Teacher Award, Dr. B. B. L. Thakore Award, and the N. Prasad Awards for 2025 and 2026, recognising excellence and significant contributions in the field of plant pathology.

Parallel sessions for PP Singhal memorial PI Industries and Smt. Guman Devi and PR Verma Award, VP Bhide Award, R Prasada award 2025 and 2026 along with lead lectures were conducted at four different venues. The sessions were chaired and co-chaired by eminent scientists The presence of globally renowned scientists and experts, whose insights enriched the academic discourse was one of the greatest strengths of this conference.

Day 2 commenced with a high-level plenary invited lecture by Dr Pratibha Singh, Regional Manager, South Asia, Australian Centre for International Agricultural Research (ACIAR). Followed by five plenary and 10 lead lecture sessions, focusing on key areas such as molecular plant pathology and host–pathogen interactions, AI-based disease prediction and digital agriculture, biosecurity frameworks and global trade, as well as nutritional security and food safety, highlighting the interdisciplinary approaches needed to address emerging agricultural challenges.

Eight parallel thematic sessions were conducted, covering technological advancements such as AI, machine learning, nanotechnology, and genomics; integrated disease management with eco-friendly approaches like *Trichoderma* and microbial consortia; and food security issues including post-harvest losses, mycotoxins, and food safety.

The conference highlighted pressing global concerns, emphasising that 20-40% of crop losses are caused by plant diseases, with climate change accelerating pathogen evolution. Discussions strongly advocated integrating advanced technologies such as artificial intelligence, genomics, and nanotechnology with sustainable and eco-friendly disease management strategies.

Beyond academic deliberations, the event offered cultural and networking opportunities, including a vibrant Qawwali evening and gala dinner, enhancing collaborative engagement among participants.

Day 3 commenced under the esteemed presence of Hon'ble Minister of Horticulture, Dinesh Pratap Singh, Government of Uttar Pradesh Lucknow, and began with Prof Krishna Sahai Bilgrami best poster presentation award. 83 students were registered for poster presentation and 63 students presented and defended their presentations. Over 10 farmers were felicitated during the conference in recognition of their outstanding contributions to agricultural development and sustainable farming practices in UP.

A high-level panel discussion on Global Biosecurity Policy, Trade, and Entrepreneurship further strengthened interdisciplinary dialogue. The conference also fostered youth engagement through poster competitions and interactive sessions with leading scientists, inspiring the next generation of researchers.

Over three intellectually vibrant days, the conference featured keynote lectures, memorial award lectures, and thematic sessions led by internationally renowned experts, from ICARDA, ICAR, CSIR, CIMMYT, ICRISAT, CIAT, ACIAR including speakers from the Florida, Kenya, Ethiopia, Oklahoma, and Italy. Eight parallel technical sessions explored frontier areas such as AI-driven disease prediction, molecular plant pathology, integrated disease management, biosecurity frameworks, and food safety.

With participation from over 300 delegates, the conference successfully fulfilled its objectives of promoting climate-resilient agricultural strategies, strengthening global research networks, and encouraging technological innovation. It also laid the foundation for policy recommendations, knowledge exchange, and future collaborations aimed at ensuring sustainable agriculture and global food security.

Glimpse of event (Photo credit: International Conference of the Indian Society of Mycology and Plant Pathology, 2026).

Scientists Trace Crop Viruses Back to the Last Ice Age

AMERICAN PHYTOPATHOLOGICAL SOCIETY NEWSROOM, 9 MARCH 2026

Long before humans cultivated crops or sailed between continents, a group of plant viruses was already evolving among wild plants in Eurasia. According to a new international study published in *Plant Disease*, the ancestors of modern tymoviruses likely emerged before the last Ice Age, reshaping scientists' understanding of the vast evolutionary history of plant disease.

Tymoviruses infect dicot plants and are typically spread by leaf-eating beetles, although they can also be transmitted through seeds or direct plant contact. In parts of Eurasia and the Americas, these viruses infect both wild and crop plants, causing serious diseases in economically important crop plants, including several cultivated oilseed and vegetable brassica species and solanaceous crops such as potato, tomato, tobacco, and eggplant. They also infect legumes in Africa, Southeast Asia, and Australia. Because these viruses affect both cultivated plants and wild species, their spread has implications for both agriculture and natural ecosystems.

Led by Adrian J. Gibbs, Emeritus Faculty at the Australian National University, an international team of researchers conducted phylogenetic analysis and genomic sequencing of 109 tymoviruses and reconstructed their evolutionary relationships to estimate when and where this group of viruses first emerged. The newly sequenced tymovirus isolates mostly came from historical virus culture collections. The results suggest that the most recent common ancestor of all known tymoviruses existed before the last Ice Age, with some viral lineages likely reaching the Americas approximately 15,000 years ago. In contrast, the few tymoviruses that are now found on more than one continent appear to have spread globally much more recently—primarily during the past two centuries, coinciding with the expansion of international trade and agricultural exchange.

The analysis also revealed important clues about how these viruses adapt over time. Genes responsible for viral replication and protective structure showed strong evidence of stabilising evolutionary pressure, while the genes responsible for movement between plant cells appear to evolve more rapidly. This flexibility may help the viruses adapt to new plant hosts, including economically significant crops.

Beyond the scientific findings, the study represents an important collaboration across both geography and generations. The research team includes scientists from South America, Europe, the Middle East, and Australasia, combining expertise in modern genomic sequencing and virus population genetics with decades of historical research on plant viruses. The study's lead author, Adrian J. Gibbs, published one of the earliest studies describing an Andean tymovirus in 1966, while other contributors have worked on Andean potato viruses since the 1970s.

Understanding how these viruses originated and spread helps researchers anticipate future risks in a world in which plants, seeds, and agricultural products move between continents faster than ever before. The study shows that while the evolutionary roots of some crop viruses stretch back to a world shaped by glaciers and prehistoric ecosystems, human activity in recent centuries has played a major role in shaping their modern distribution. This broader perspective provides valuable information for scientists studying virus evolution and for plant health and biosecurity authorities responsible for protecting crops and ecosystems from emerging diseases.

THE FAST-TRACK TREE BREEDING METHOD THAT IS RESTORING ASH TO THE LANDSCAPE

JOHN INNES CENTRE PRESS RELEASE, 21 APRIL 2026

Researchers at the John Innes Centre, who have adapted the embryo extraction method, found that it rapidly speeds up the germination of European ash seeds. A process that can take up to six years in nature now takes around one week in the lab.

The rapid seed germination method has already produced more than 2,000 seedlings for trials and research. It has been welcomed by the international research community, and, with adaptations, could be adopted by landowners, conservation volunteers, and enthusiast gardeners.

The method, outlined in a recent study in *Scandinavian Journal of Forest Research*, offers hope for those trying to preserve the threatened species by establishing populations of ash families propagated from mother trees that show resistance to ash dieback.

The technique involves carefully extracting the embryo from the seed coat using a knife and tweezers and placing it on an agar nutrient jelly to give this slow starter a helping hand.

Dr Elizabeth Orton, a John Innes Centre researcher and first author of the study, said: "Ash seed usually takes two to three years to germinate in the wild, and we have reduced this to about a week in the lab. We have produced hundreds of seedlings rapidly for experimentation, for our seed orchard or for planting in the wild."

"We've had so much interest from both other researchers and from stakeholders keen to help restore ash populations. One of our next steps is to develop a kitchen method so that people can do this at home, using substances that you can purchase online such as household bleach and agar to treat the seed as part of the process."

The ash dieback epidemic spreading across Europe has created an urgent need to propagate new populations from ash trees with resistance to the disease.

This is needed to restore ash in the landscape and to advance research methods which probe the genetics and mechanisms by which trees can resist pests and pathogens.

Research efforts have so far looked at finding trees which show visible resistance to the fungal pathogen that causes dieback. Approaches include cloning resistant trees, grafting healthy cuttings on rootstock or using air layering, a method used to clone desirable traits in difficult to root species.

But propagation from seed remains the most effective way to preserve the high genetic diversity of ash. This offers best protection against a range of pests and pathogens and allows populations to adapt to new climate conditions.

A problem has been that the distinctive winged seeds of ash have a long dormant period in nature. Seeds are protected in a hard case and require a stratification period (a warm summer period followed by a chilly winter, sometimes repeated) before they germinate, usually in the second spring after formation.

This rapid seed germination protocol developed by the John Innes Centre team is based on earlier research It involves carefully removing the embryo, and therefore bypassing seed dormancy. Embryos, after being cultured on agar media, are ready to transplant as seedlings into compost within 14 days in the lab. The process is likely to take a little longer (two to three weeks) in non-specialist settings.

After a period of 10 months in a glasshouse, the ash seedlings are ready for planting outside.

Using this accelerated method, researchers now have a way of germinating ash seeds which can be reliably used to produce orchards of thousands of trees. It has been used to create a seed orchard at the Wendling Beck, nature recovery project, near Dereham, Norfolk. These trees selected because they show resistance to ash dieback, will breed, set seed and, hopefully, produce a new generation of resistant trees.

This study and its next steps offer a cause for hope, says Dr Orton: "This propagation method is a big step forward and the interest I have had has been very positive. People from all over the international research community are working on restoring ash populations together and our contribution has added to the atmosphere of hope that we can speed up natural selection and transform the fortunes of ash trees."

"With the modifications we are making the technique could be adopted by conservation volunteers and other non-specialists to support local efforts in growing diverse ash populations for restoration projects."

Ash dieback, caused by the fungal pathogen (Hymenoscyphus fraxineus) was first detected in the wild in the UK by John Innes Centre researcher Dr Anne Edwards in 2012, in Ashwellthorpe Woods, Norfolk. It is believed to have been in the UK much longer via a combination of wind-blown spores from the continent, plus movement of horticultural stock carrying the fungus.

Between 5-10% of ash show good resistance to the fungus, and conservation volunteers and researchers have been scouring woodlands for examples of healthier trees from which to propagate new populations. Even so, many hundreds of thousands of ash have succumbed to the disease, and more will follow, a threat not only to the keystone species but also to the many species that associate with it.

The Emerald Ash Borer, a beetle which has already devastated ash populations in the United States, is a further threat to this beloved and versatile species. Research by the John Innes Centre and partners is looking into the possibility that trees that show resistance to ash dieback fungus also show resistance to the beetle.

Dr Orton said: "Climate change means that pests and pathogens can become established in previously unfavourable locations and the movement of infected timber and horticultural material means that we are in a race to protect keystone species such as ash. With this model we can restore natural resistance much quicker, not only in species such as ash but others such as elm."

A BACTERIAL NUTRITION STRATEGY FOR PLANT DISEASE CONTROL

A paper by Shanzhi Wang *et al.* titled "A bacterial nutrition strategy for plant disease control" was published on 18 December 2025 by *Science* (Vol. 390, Issue 6779, pp. 1299-1304). The abstract is as follows:-

Xanthomonas spp. cause serious diseases in more than 400 plant species. The conserved AvrBs2 family effectors are among the most important virulence factors in xanthomonads, but how AvrBs2 promotes infection remains elusive. We found that AvrBs2 is a glycerophosphodiesterase-derived synthetase that catalyzes uridine 5'-diphosphate-α-d-galactose into a sugar phosphodiester, bis-(1,6)-cyclic dimeric α-d-galactose-phosphate, which is referred to as xanthosan. Xanthosan is synthesized by AvrBs2 in host cells and released into apoplastic spaces. *Xanthomonas* bacteria uptake xanthosan through the XanT transporter and hydrolyze it through the XanP phosphodiesterase for nutrition. AvrBs2, XanT, and XanP form a xanthosan "generation-uptake-utilization" system to provide a dedicated nutritional strategy to feed xanthomonads. Furthermore, elucidation of the AvrBs2-XanT-XanP virulence mechanism inspired us to develop an "anti-nutrition" strategy that should be applicable to control a wide variety of *Xanthomonas* diseases.

Read paper.

HISTORY OF PLANT PATHOLOGY IN SOUTH AFRICA

History of Plant Pathology in South Africa by Teresa A. Coutinho and Michael J. Wingfield, first published in 2022, is a comprehensive and well-structured account of the development of plant pathology as a scientific discipline within South Africa. The book combines historical narrative with institutional and scientific insights, tracing the field from early observations of plant diseases in the 17th century through to modern, highly specialised research systems. It highlights how plant pathology evolved alongside agricultural expansion, with early records of crop diseases such as wheat rust and vineyard mildews illustrating the long-standing challenges faced by growers.

A key strength of the book is its integration of scientific, institutional, and personal histories. It documents the establishment of important organisations such as government plant health services, universities, and the Agricultural Research Council, while also acknowledging the contributions of influential scientists who shaped the discipline. The inclusion of sub-disciplines—such as mycology, virology, and molecular plant pathology—demonstrates the increasing complexity and sophistication of the field over time.

The book also provides valuable context on the economic and agricultural importance of plant pathology, noting the significant impact of plant diseases on crop productivity and food security. Additionally, the detailed account of the Southern African Society for Plant Pathology underscores the importance of collaboration, professional networks, and knowledge exchange in advancing research and practice.

Overall, this work serves as both a historical record and a reference text. While it is particularly relevant to South African readers, its themes—such as the co-evolution of science and agriculture, and the importance of plant health—have broader international significance.

Read book.

Fungal alliances: New research reveals co-infection dynamics in wheat diseases

GRDC MEDIA RELEASE, 14 ARPIL 2026

Australian researchers have revealed the intricate relationship between two major fungal wheat diseases – septoria nodorum blotch and yellow leaf spot – and how the order of infection can dramatically influence disease severity and plant resistance.

The breakthrough study was led by scientists from the Centre for Crop Disease Management (CCDM) in collaboration with the Western Australian Department of Primary Industries and Regional Development (DPIRD) and Australian Grain Technologies (AGT).

CCDM is a national co-investment of the Grains Research and Development Corporation (GRDC) and Curtin University.

The CCDM, DPIRD and AGT team, (right to left) CCDM Research Assistant Leon Lenzo, DPIRD Research Officer Jason Bradley, AGT Wheat Grower Dion Bennett, DPIRD's plant pathologist Geoff Thomas, CCDM Associate Professor Kar-Chun Tan, next to a digital PCR machine in the lab (Photo credit: Lisa Smith, CCDM).

Following development of a digital Polymerase Chain Reaction (PCR) method to quantify the pathogen presence in samples, researchers have discovered that when the yellow leaf spot pathogen infects wheat first, it primes the plant for septoria nodorum blotch, breaking down host resistance.

Conversely, when the septoria nodorum blotch pathogen strikes first, it suppresses yellow leaf spot and outcompetes the pathogen.

This study builds on an earlier PhD to investigate the finer details of interactions that occur during co-infection, providing intriguing insights into the cooperation and competition between pathogens.

CCDM Research Assistant Leon Lenzo using the digital PCR machine.CCDM Research Assistant Leon Lenzo using the digital PCR machine. Photo: Lisa Smith, CCDM.

CCDM researcher Leon Lenzo said the new digital PCR method, which allows the analysis of pathogen DNA, was an essential development for this study.

"Studying disease symptoms such as lesion sizes works well to estimate the pathogen presence when you have controlled conditions and only a single disease infection," Mr Lenzo said.

However, using digital PCR, we could reliably distinguish between these two common diseases, and get accurate quantifications on their relative presence within the crop.

Researchers collected leaf samples from WA field sites in the 2022 growing season, including a long-term AGT disease nursery in Northam and DPIRD trial plots in South Perth.

These trials tested how infection order influences disease severity using cultivars with varying resistance levels. The study found co-infection was common, with most symptomatic wheat leaf samples infected by both pathogens.

"Plants infected first by the yellow spot pathogen had a significantly higher disease load compared to single disease infections, particularly the elite cultivar Scepter," Mr Lenzo said.

The opposite occurred when septoria nodorum blotch was introduced first, suggesting both a co-operative and competitive relationship depending on which disease gets the upper hand.

"We don't know the exact mechanisms that drive this yet, but the reality is that the yellow leaf spot pathogen often strikes first in nature, as its spores release earlier in the season than septoria nodorum blotch, and are generally better at surviving harsh conditions.

"Now that we know this can drive co-infection with the septoria nodorum blotch pathogen, it should be a consideration for growers when looking at crop resistance to these diseases," he said.

DPIRD plant pathologist Geoff Thomas emphasised the importance of these findings for industry, suggesting they could help improve resistance rankings for wheat varieties.

"This work explains how these pathogens interact and how infection order influences disease expression and resistance response. This impacts our thinking on how to best rate varieties for their resistance, so growers in regions where both diseases are prevalent can have a better idea on how crops will respond to this co-infection complex," he said.

CCDM Director, Professor Mark Gibberd, praised the team's achievement, highlighting its significance for future breeding and management strategies.

"This study is a significant first step in working towards the development of management strategies to simultaneously control multiple pathogens through genetic resistance and cultural practices," said Prof. Gibberd.

The research showcases CCDM's focus on addressing problems that regularly occur in field for Australian growers, and the centre's ability to work deeply and collaboratively with other experts in the state.

"Work such as this ensures Australian agriculture remains a global leader in grain production research and innovation."

INTEGRATION OF TWO GENES: A VALUABLE STRATEGY FOR DEVELOPING VIRUS-RESISTANT TOMATOES

EUREKAALERT NEWS RELEASE, 14 APRIL 2026

Tomato yellow leaf curl disease (TYLCD), caused by begomoviruses, is a global problem in tomato production, affecting yield. While introduction of resistance genes is one of the strategies to control TYLCD, introduction of a single Ty-gene is inadequate in providing full protection against begomoviruses. Now, researchers have determined that a combination of Ty-1/Ty-3 and Ty-6 can fully protect tomato plants from begomoviruses, providing a promising strategy to improve tomato varieties and ensure their stable production.

Tomatoes are one of the most important vegetables worldwide and are consumed every day. However, they often develop tomato yellow leaf curl disease (TYLCD), a devastating disease caused by many viruses of the genus Begomovirus, which severely affects tomato yield and production. One of the primary strategies for the management of TYLCD is the introduction of Ty virus resistance genes. Till now, six Ty genes have been identified, and one or more of these genes have been incorporated into commercial varieties of tomato.

While including only one type of Ty gene provides resistance to some less aggressive begomoviruses, highly virulent viruses can still impair the growth of these slightly resistant plants. Incorporation of multiple Ty genes can help improve resistance. However, the introduction of all types of Ty genes can sometimes bring linked wild genomic regions that negatively affect cultivated tomato traits, a phenomenon known as linkage drag.

To address this, a research team led by Professor Sota Koeda, along with MS student Moeno Shimoide, both from the Graduate School of Agriculture, Kindai University, Japan, have investigated the combinations of Ty genes that can provide resistance against highly virulent begomoviruses common in tropical Southeast Asia. The study was published in *Euphytica*.

"To control aggressive begomoviruses distributed in Southeast Asia, which are one of the most virulent species globally, relying on a single resistance gene common in Europe and Japan is insufficient. Thus, determining which combinations of resistance genes are necessary and sufficient for effective control is important for breeding tomatoes with enhanced viral resistance," says Prof. Koeda.

The researchers first tested the resistance of tomato plants against three begomoviruses that differed in virulence. They used common Japanese varieties with tomato yellow leaf curl virus (TYLCV) resistance, including Momotaro Sakura (MS) and Momotaro Peace (MP), and without TYLCV resistance, including Momotaro (M). They also tested some AVTO lines from the World Vegetable Center, which were specifically bred to be highly resistant to TYLCD.

MS and MP exhibited symptoms caused by infection of highly virulent begomovirus species. Notably, some AVTO lines fared better against all three viruses, with strains 1919, 1920, and 1701 showing the greatest resistance and no symptoms of infection.

Genetic analysis showed that AVTO1919 carried two copies (homozygous) of the Ty-1 and Ty-6 genes, while AVTO1920 carried two copies of the Ty-3 and Ty-6 genes. AVTO1701 had four Ty genes, including Ty-2, Ty-3, Ty-5, and Ty-6 but did not have significantly better virus resistance than 1919 or 1920. MP had only one copy (heterozygous) of the Ty-1 gene, which resulted in limited resistance to viruses.

"Our study suggests that the introduction of fewer resistance genes than expected can substantially enhance resistance. It offers a promising approach for improving tomato varieties while balancing resistance, productivity, and fruit quality," says Prof. Koeda.

Crossbreeding AVTO1919 or AVTO1920 with susceptible Moneymaker (MM) produced offspring with lower resistance to the viruses than the parent AVTO types, though they were far superior to MM. These findings indicate that resistance conferred by Ty-1 or Ty-3 and Ty-6 is incomplete dominance. Thus, the integration of Ty-1/Ty-3 and Ty-6 genes in homozygous states in tomatoes may confer highly robust resistance to begomoviruses.

"Overall, our findings may provide valuable guidance for enhancing begomovirus resistance in other crops and represent a discovery that could contribute to the long-term stable production of food," says Prof. Koeda.

INTRACELLULAR ACCOMMODATION OF BACTERIA, FUNGI, AND OOMYCETES BY PLANTS ANALYZED USING TRANSMISSION ELECTRON MICROSCOPY

A paper by Isabella Gantner *et al.* titled "Intracellular accommodation of bacteria, fungi, and oomycetes by plants analyzed using transmission electron microscopy" was published on 22 December 2025 by *PLOS Pathogens* (Vol. 21 (12), e1013780). The scientific background is as follows:-

The advent of high-resolution imaging using transmission electron microscopy (TEM) was instrumental to reveal previously undetectable details of sub-cellular interfaces between host cells and intracellular microorganisms. While the resolution of light microscopy is restricted to 200 nm due to the diffraction limit of light, electron microscopy has the potential to reach a resolution of 1 nm or even belo]. This imaging capability enabled detailed exploration of the cellular ultrastructure, and revealed subcellular features like membrane invaginations, the structure of organelles, and new organelle-like cell compartments. Based on the comparative analysis of TEM images originating from different laboratories working on different plant-microbe interactions, it has been postulated more than 25 years ago, that all intracellular symbioses, featuring living microorganisms in living plant cells, share a series of common structural features:

(1) Entire microorganisms, in case of bacteria or their hyphal extensions in case of fungi or oomycetes, are hosted inside a living plant cell. (2) A plant-derived membrane separates the accommodated microorganism from the cytoplasm of the host plant cell. Depending on the interaction, this membrane is called peribacteroid membrane (PBM) in the nitrogen-fixing root nodule symbiosis (RNS), periarbuscular membrane (PAM) in arbuscular mycorrhiza (AM), and perihaustorial or extrahaustorial membrane (PHM/EHM) around the haustorium formed by pathogenic fungi or oomycetes inside living plant cells. (3) The presence of a space between perimicrobial membrane and the outermost layer of the microorganism (the outer membrane in case of rhizobial bacteria and the cell wall in case of oomycetes or fungi). Depending on the interaction, this space is called peribacterial space (PBS), periarbuscular space (PAS), and peri- or extrahaustorial space (PHS/EHS).

In this paper, we present, explain, and compare the structural interfaces of three such intracellular interactions, documented by the same lab using the same equipment, microscope settings, and sample preparation methods, all carried out by the same scientist.

Read paper

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There are no current vacancies.

ACKNOWLEDGEMENTS

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COMING EVENTS

VIII International Symposium on Postharvest Pathology
18 May – 22 May, 2026
Ullensvang, Norway
Website:
https://nibio.pameldingssystem.no/isphpp2026#/contact-2228

36th Symposium of the European Society of Nematologists
1 June – 5 June, 2026
Egmond aan Zee, The Netherlands
Website: www.esn2026.nl/home

25th Annual Fusarium Laboratory Workshop
21 June – 26 June, 2026
Manhattan, Kansas, USA
Contact: John Leslie jfl@ksu.edu

Plant Health 2026
1 August – 4 August, 2026
Providence, Rhode Island, USA
Website:
www.apsnet.org/meetings/annual/PH2026/Pages/default.aspx

Plant Pathology 2026
8 September – 10 September, 2026
John Innes Centre Conference Centre, Norwich, UK
Website: Not yet available

13th Australasian Soilborne Diseases Symposium
14 September – 18 September, 2026
Melbourne, Australia
Website: www.asds-apps.com

20th IOBC – WPRS Working Group meeting on: "Integrated Control in Oilseed Crops"
29 September – 1 October, 2026
Swedish University of Agricultural Sciences (SLU), Campus Alnarp, Lomma, Sweden
Website: www.slu.se/ICOC20

7th International Symposium on Fusarium Head Blight
5 October – 8 October, 2026
Department of Agricultural, Food and Environmental Sciences, University of Perugia
Perugia, Italy
Website: www.7isfhb.org

International Phytobiomes Conference 2026
3 November – 5 November, 2026
Niagara-on-the-Lake, Ontario, Canada
Website: https://phytobiomesconference.org/

XXI International Plant Protection Congress (IPPC) 2027 in conjunction with 26th Australasian Plant Pathology Conference (APPC)
1 November – 5 November, 2027
Te Pae Christchurch Convention Centre, Christchurch, New Zealand
Website: www.ippc2027.com

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


ICPP2028
13th
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19-25 August, Gold Coast Convention & Exhibition Centre, Queensland, Australia

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