PROMOTING WORLD-WIDE PLANT HEALTH AND FOOD SECURITY

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

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The International Society for Plant Pathology promotes the world-wide development of plant pathology and the dissemination of knowledge about plant diseases and plant health management

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PORTABLE TECHNOLOGY SNIFFS OUT PLANT DISEASE IN THE FIELD

MATT SHIPMAN, NC STATE UNIVERSITY NEWS, 29 JULY 2019

Researchers at North Carolina State University have developed portable technology that allows farmers to identify plant diseases in the field. The handheld device, which is plugged into a smartphone, works by sampling the airborne volatile organic compounds (VOCs) that plants release through their leaves.

"All plants release VOCs as they 'breathe,' but the type and concentration of those VOCs changes when a plant is diseased," says Qingshan Wei, an assistant professor of chemical and biomolecular engineering and corresponding author of a paper on the work. "Each disease has its own signature profile of VOCs. So, by measuring the type and concentration of VOCs being released by the plant, you can determine whether a plant is diseased and – if it is diseased – which disease it has. Our contribution here is the creation of a device that can be plugged into a smartphone and used to make those VOC measurements quickly in the field," says Wei, who is also a faculty member in NC State's Emerging Plant Disease and Global Food Security cluster.

Photo credit: Zheng Li, NC State Uni.

Current disease identification techniques rely on molecular assays, which take hours to perform and – most importantly – have to be done in a lab. Getting a sample to the lab, where the sample may have to wait to be tested, can delay disease identification by days or weeks.

"Our technology will help farmers identify diseases more quickly, so they can limit the spread of the disease and related crop damage," says Jean Ristaino, William Neal Reynolds Distinguished Professor of Plant Pathology at NC State, co-author of the paper and director of the cluster. "We are now ready to scale up the technology."

Here's how the technology works. If a farmer suspects that a plant may be diseased, he or she can take a leaf from the relevant plant and place it in a test tube. The test tube is then capped for at least 15 minutes to allow the relevant VOCs to accumulate. After this incubation period, the cap is removed and the farmer uses a narrow, plastic tube to pump the VOC-laden air into a "reader" device connected to a smartphone. The air is pumped into a chamber in the reader that contains a paper strip. The paper is embedded with an array of chemical reagents that change color when they come into contact with a specific chemical group. By evaluating the resulting color pattern on the strip, users can determine the nature of any plant disease that may be affecting the plant.

In proof-of-concept testing, the researchers demonstrated the device's ability to detect and classify 10 plant VOCs down to the parts-per-million level. They were able to detect the late blight pathogen that caused the Irish famine two days after tomato plants were inoculated with the pathogen. Researchers could also distinguish tomato late blight from two other important fungal pathogens that produce similar symptoms on tomato leaves. In addition, the researchers showed they could detect the pathogen *Phytophthora infestans* in tomato leaves with greater than 95% accuracy.

The paper, "Noninvasive Plant Disease Diagnostics Enabled by Smartphone-Based Fingerprinting of Leaf Volatiles," is published in the journal Nature Plants.

ANNOUCEMENT OF 7TH INTERNATIONAL BACTERIAL WILT SYMPOSIUM, URGUGUAY

The 7th International Bacterial Wilt Symposium will be held during 29 March to 3 April, 2020, in Montevideo, Uruguay. A preliminary program is available on the website. Early registration closes 14 November 2019.

For updated information, visit the official conference website: www.7ibws2020.fq.edu.uy

LIGHT COULD BE KEY TO PROTECTING CROPS FROM COSTLY VIRUS

SCOTT WEYBRIGHT, WASHINGTON STATE UNIVERSITY NEWS, 2 AUGUST 2019

In a recent article in the journal *Frontiers in Plant Science*, Hanu Pappu, his WSU colleague Michael Neff, and their respective post-doctoral researchers Ying Zhai and Hao Peng report that tomato spotted wilt virus, part of a group called tospoviruses, may be able to sense light and respond to plant growth hormones. "I was very surprised," said Pappu, Samuel H. Smith Distinguished Professor and Chuey Endowed Chair in WSU's Department of Plant Pathology. "We had no idea any plant virus had this adaptation, even though it's been long accepted that viruses co-evolved with their hosts. And plants obviously respond to light, so this virus may have acquired the genetic sequences for light response from its hosts."

***Arabidopsis*, a model plant, showing that a tospovirus sequence can respond to light and growth hormones. Photo credit: Washington State University.**

Pappu has worked for nearly two decades to understand and manage diseases caused by tospoviruses. They are efficient killers of many food crops including peanut, pepper, potato, onion, soybean and many more vegetable and legume crops. These viruses contain only five genes, but they're known for snatching bits of genetic code from their plant hosts.

In addition to the five genes, the virus contains other genetic material that doesn't have a known function or use. After in-depth research, the team found the virus had some genetic signatures present in many plants and bacteria which were shown to respond to light and hormones. Zhai and Peng carried out a series of experiments to verify the activity of this viral sequence could be turned on or off by light or hormones.

Now Pappu and his colleagues will look to find what role this genetic element plays in the virus' life cycle. If they can find that, then it may be possible to disrupt that cycle and reduce the virus' reproduction and spread using light or growth hormones, he said.

CHOCOLATE UNDER THREAT FROM OLD AND NEW CACAO DISEASES

A review by Jean-Philippe Marelli *et al.* titled "Chocolate under threat from old and new cacao diseases" was published in 2019 by *Phytopathology* (vol. 109, pp 1331-1343). The abstract is as follows:-

Theobroma cacao, the source of chocolate, is affected by destructive diseases wherever it is grown. Some diseases are endemic; however, as cacao was disseminated from the Amazon rain forest to new cultivation sites it encountered new pathogens. Two well-established diseases cause the greatest losses: black pod rot, caused by several species of *Phytophthora*, and witches' broom of cacao, caused by *Moniliophthora perniciosa*. *Phytophthora megakarya* causes the severest damage in the main cacao producing countries in West Africa, while *P. palmivora* causes significant losses globally. *M. perniciosa* is related to a sister basidiomycete species, *M. roreri* which causes frosty pod rot. These *Moniliophthora* species only occur in South and Central America, where they have significantly limited production since the beginnings of cacao cultivation. The basidiomycete *Ceratobasidium theobromae* causing vascular-streak dieback occurs only in South-East Asia and remains poorly understood. Cacao swollen shoot disease caused by Cacao swollen shoot virus is rapidly spreading in West Africa. This review presents contemporary research on the biology, taxonomy and genomics of what are often new-encounter pathogens, as well as the management of the diseases they cause.

Read review.

DEVELOPING TARGETS FOR GENOME EDITING TO ENGINEER VIRAL DISEASE RESISTANT CROPS

A paper by Soo-Jung Han *et al.* titled "Recessive resistance: Developing targets for genome editing to engineer viral disease resistant crops" was published in 2019 by *Research in Plant Disease* (vol. 25, pp 49-61). The abstract is as follows:-

Plant viruses are among the important pathogens that cause severe crop losses. The most efficient method to control viral diseases is currently to use virus resistant crops. In order to develop the virus resistant crops, a detailed understanding of the molecular interactions between viral and host proteins is necessary. Recessive resistance to a pathogen can be conferred when plant genes essential in the life cycle of a pathogens are deficient, while dominant resistance is mediated by host resistance (R) genes specifically interacting with effector proteins of pathogens. Thus, recessive resistance usually works more stably and broadly than dominant resistance. While most of the recessive resistance genes have so far been identified by forward genetic approaches, recent advances in genome editing technologies including CRISPR/Cas9 have increased interest in using these technologies as reverse genetic tools to engineer plant genes to confer recessive resistance. This review summarizes currently identified recessive resistance genes and introduces reverse genetic approaches to identify host interacting partner proteins of viral proteins and to evaluate the identified genes as genetic resources of recessive resistance. We further discuss recent advances in various precise genome editing technologies and how to apply these technologies to engineer plant immunity.

Read paper.

OBITUARY OF ROBERT E. DAVIS, 1939-2019

WARWICK BEACON, 24 AUGUST 2019

Dr. Robert E. Davis, Research Leader, Molecular Plant Pathology Laboratory, at the USDA Beltsville Agricultural Research Center, member of the National Academy of Sciences, and discoverer of the spiroplasma genus of plant microbes, passed away on 18 July 2019. From the early 1970s up to and including the time of his passing, Dr. Davis was one of the leading researchers and innovators in the field of phytoplasmas and spiroplasmas, plant pathogenic cell wall-less bacteria that evolved from walled bacterial ancestors and which possess genomes that are among the smallest known in bacteria, approaching the minimal sets of genes required for cellular life and parasitism in plants and insects.

Born in Brooklyn, N.Y. on 27 January 1939 to Robert S. and Cecelia Davis (neé Hall), Dr. Davis was raised in Warwick, where he attended Warwick High School and met his future wife of 58 years, Maryann Davis (neé Starr). He attended the University of Rhode Island, graduating with a Bachelor of Science in botany in 1961. He was awarded his Ph.D. in plant pathology from Cornell University, Ithaca, N.Y. in 1967. Following a National Research Council Postdoctoral Fellowship with the USDA-ARS in Beltsville, Maryland from 1966 to 1967, he accepted a position as a research scientist in the Plant Virology/Molecular Plant Pathology Laboratory, where he remained as a full-time government scientist until his passing, a career that spanned 52 years.

Dr. Davis developed several new scientific concepts and led the way toward discovery of an entirely new taxon of pathogens. In 1971, while looking for the causative agent in corn stunt disease, Dr. Davis was the first to discover a previously unidentified, extremely narrow helical and motile filament that was present in every diseased culture and in no healthy culture. In a 1972 paper in Science reporting his findings, Dr. Davis coined the term "spiroplasma" for the corn stunt and other yet-to-be-discovered wall-less bacteria having helical cell shape. Shortly thereafter, the citrus stubborn wall-less microbe, previously reported as a non-helical MLO, was recognised as a helical microbe, and the term "spiroplasma" was adopted as a new genus name. Dr. Davis's discovery of the spiroplasma class of organism is recognised as among the top ten milestones of the past century in plant pathology and opened an entirely new field in which diverse spiroplasma pathogens have subsequently been found. Today, following work in Dr. Davis's laboratory and others, diverse *Spiroplasma* species are known as insect-transmitted pathogens of plants, as symbionts in ticks and diverse insects, as lethal pathogens in crustaceans such as some shrimp and crab, and as possible inhabitants of jellyfish, a deep-sea chiton, and a hadopelagic zone sea cucumber; and some can present risk of human infection.

Most recently, Dr. Davis and his colleagues published the first completely sequenced genome of the corn stunt spiroplasma, *Spiroplasma kunkelii*, as well as the first completely sequenced genomes of the only other known plant pathogenic spiroplasmas, *S. citri* and *S. phoeniceum*. Important new insights into numerous plant diseases caused by poorly understood microbes were developed through national and international collaborative research teams led by Dr. Davis and his colleagues and whose contributions continue to impact basic science and provide solutions to economic problems in agriculture in the United States and elsewhere. During his career, Dr. Davis mentored many young scientists and students and helped establish molecular plant pathology laboratories worldwide, leaving an impressive legacy to the future of plant pathology.

DEVASTATING BANANA FUNGUS HAS SPREAD TO COLOMBIA

KAREN GRAHAM, DIGITAL JOURNAL, 13 AUGUST 2019

Colombia has declared a national state of emergency following confirmation that the dreaded Panama disease has appeared in the country's banana plantations - making this the first time the fungus has appeared in Latin America. Fusarium wilt Tropical Race 4 (TR4), is an insidious fungal disease that kills banana plants by disrupting their vascular systems, and it can persist in soil for decades. No known fungicide or biocontrol measure has proven effective against TR4.

With Latin America being the world's largest exporter of bananas, the finding in the La Guajira region of Colombia has put the whole region on alert. Wageningen University and the biotech company KeyGene, both in the Netherlands, used genome sequencing and molecular diagnostics to confirm the TR4 diagnosis in infected plant samples from Colombia.

After eradicating plants covering nearly 170 hectares (420 acres) of quarantined farmland, the Colombian Agricultural Institute (ICA) in Bogotá has now announced plans to expand biosecurity efforts that include increasing sanitary control measures at all ports, airports, and border points. Colombia's government is also considering providing funding to small and medium-size banana exporters to help them implement better biosecurity measures, such as disinfecting machinery, shipping containers, and footwear in quarantined areas. Additionally, agriculture ministers from across the region met in Quito in August to discuss plans to prevent further outbreaks.

First identified in Taiwanese soil samples in the early 1990s, TR4 remained confined to Southeast Asia and Australia, until its presence was confirmed in both the Middle East and Africa in 2013, according to National Geographic.

"Once you see it, it is too late, and it has likely already spread outside that zone without recognition," says Gert Kema, Professor of Tropical Phytopathology at Wageningen University in the Netherlands whose lab analysed soil samples to confirm TR4 in Colombia, as well as in earlier outbreaks.

Researchers at Wageningen University have also found out that strains of the fungal samples taken from soil and plants around the world are genetically identical. Gert Kema, a banana expert at Wageningen UR, says: "This research demonstrates that the quarantine measures and information provided around the globe apparently have not had the desired effect.

EFFECTS OF HUANGLONGBING ON ORANGE JUICE QUALITY REVIEWED

CABI PLANT SCIENCE NEWS, AUGUST 2019

Citrus greening, or Huanglongbing (HLB), is a devastating disease of citrus trees caused by Candidatus Liberibacter spp., generally transmitted by an insect vector, and with no easy means of control.

HLB infection affects tree development, yield and fruit quality. Fruits from infected trees can be symptomless (asymptomatic) or can show clear HLB symptoms (symptomatic). Key to the difference between healthy, asymptomatic and symptomatic fruits is the quality of juice produced by each. The juice from symptomatic fruits is of a lower quality than the juice from healthy or asymptomatic fruits and this has caused huge losses to the citrus industry.

In a paper published in a recent issue of *Frontiers in Plant Science*, researchers from Brazil, where HLB has been a long-standing problem, have reviewed the effects of HLB on orange juice quality and recommended sustainable measures which can be adopted by growers and citrus juice processors to mitigate the economic effects of this widespread disease.

Over time, fruit of HLB-infected trees begins to turn green and develop a bitter, metallic taste. Photo credit: Elizabeth Chin, University of California, Davis.

Juice made from symptomatic fruits from HLB-affected trees is generally described as bitter, sour, salty/umami, harsh, metallic, musty and lacking in sweetness and fruity/orange flavour. Chemical analyses have shown that symptomatic oranges have higher titratable acidity and lower soluble solids, solids/acids ratio, total sugars, and malic acid levels than asymptomatic fruits. Some flavour volatiles are lower but many monoterpenes are higher in symptomatic fruits than in healthy or asymptomatic fruits, and the disease also causes an increase in secondary metabolites such as limonin and hesperidin in orange peel and pulp. The juice quality of asymptomatic fruits, however, is similar to the juice quality of healthy fruits.

Despite the typically bitter taste of juice from symptomatic fruits, sensory panel tests have shown that adding small amounts of the lower quality juice from HLB-symptomatic fruits to juice from healthy or asymptomatic fruits does not compromise taste quality. Symptomatic fruits may be suitable for orange juice production as long as the proportion of juice from these fruits does not exceed a maximum percentage which ranges from 10% to 25% in different studies.

CURRENT VACANCIES

Assistant Professor of Teaching in Disease Biology, University of California, Davis, USA

The Department of Plant Pathology invites applications for a full-time Assistant Professor of Teaching in the field of disease biology, with a focus on epidemiology and disease ecology. Expertise in plant pathology or a related discipline is required. The successful applicant will play a key role in the Global Disease Biology major (http://gdb.ucdavis.edu/) through instruction in the core classes GDB 101, Epidemiology, and GDB/VME 158, Disease Ecology, as well as the elective course PLP 120, Introduction to Plant Pathology. The position will remain open until filled, but application materials should be received by 30 September 2019 to be assured full consideration. Further details about the position and how to apply are available in the PDF.

Assistant/Associate Professor (Plant Nematologist), Louisiana State University, USA

Department of Plant Pathology and Crop Physiology at the Louisiana State University, Baton Rouge, LA seeks to fill a position of Assistant/Associate Professor (Plant Nematologist). This position is a tenure-track 12-month appointment with 60% research, 30% extension (LSU AgCenter) and 10% teaching responsibilities (LSU College of Agriculture). The responsibilities for this position will be to address knowledge gaps in the epidemiology of plant-parasitic nematodes in agricultural systems, implementing contemporary diagnostic technologies and developing integrated management strategies for established and emerging plant parasitic nematodes in Louisiana while supervising the Nematode Advisory Service Laboratory. Application screening will begin 15 August 2019 and will remain open until filled. Further details about the position and how to apply are available at this link: https://lsu.wd1.myworkdayjobs.com/en-US/LSU/job/LSU---AG-Center/Assistant-Associate-Professor--Plant-Nematologist-_R00034627

ACKNOWLEDGEMENTS

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COMING EVENTS

BSPP Annual Meeting: Arms Race – evolution of plant pathogens and their hosts
2 September - 3 September, 2019
Bristol, UK
Website: www.bspp.org.uk/conferences/arms-race-evolution-of-plant-pathogens-and-their-hosts/

International Workshop on the Fruit Microbiome: A New Frontier
3 September - 6 September, 2019
National Conservation Training Center, Shepherdstown, West Virginia, USA
Website: www.bard-isus.com/fruitmicrobiome.html

Working Party Meeting of IUFRO WP 7.03.10 Methodology of forest insect and disease survey in Central Europe - "Recent Changes in Forest Insects and Pathogens Significance"
16 September - 20 September, 2019
Suceava, Romania
Website: www.silvic.usv.ro/iufroromania2019/

22nd Biennial Conference of the Australasian Plant Pathology Society
25 November - 28 November, 2019
Melbourne, Australia
Website: www.apps2019.org

International Symposium on Microbe-Assisted Crop Production – Opportunities, Challenges and Needs
2 December - 5 December, 2019
Vienna, Austria
Website: microp e.org/

Indian Phytopathological Society 7th International Conference on "Phytopathology in Achieving UN Sustainable Development Goals"
16 January - 20 January, 2020
New Delhi, India
Website: ipsdis.org

45th Annual Conference of the Nigerian Society for Plant Protection
15 March - 19 March, 2020
University of Uyo, Main campus, Akwa Ibom, Nigeria
Website: nsppnigeria.org

16th Congress of the Mediterranean Phytopathological Union
23 March - 27 March, 2020
Limassol, Cyprus
Website: cyprusconferences.org/mpu2020

7th International Bacterial Wilt Symposium
29 March - 3 April, 2020
Montevideo, Uruguay
Website: 7ibws2020.fq.edu.uy

14th International Conference on Plant Pathogenic Bacteria
7 June - 12 June, 2020
Assisi, Italy
Website: www.icppb2020.com

Joint 18th International *Botrytis* Symposium & 17th International *Sclerotinia* Workshop
8 June - 12 June, 2020
Avignon, France
Website: colloque.inra.fr/botrytis-sclerotinia-2020

4th International Conference on Global Food Security
16 June - 19 June, 2020
Montpellier, France
Website: www.globalfoodsecurityconference.com

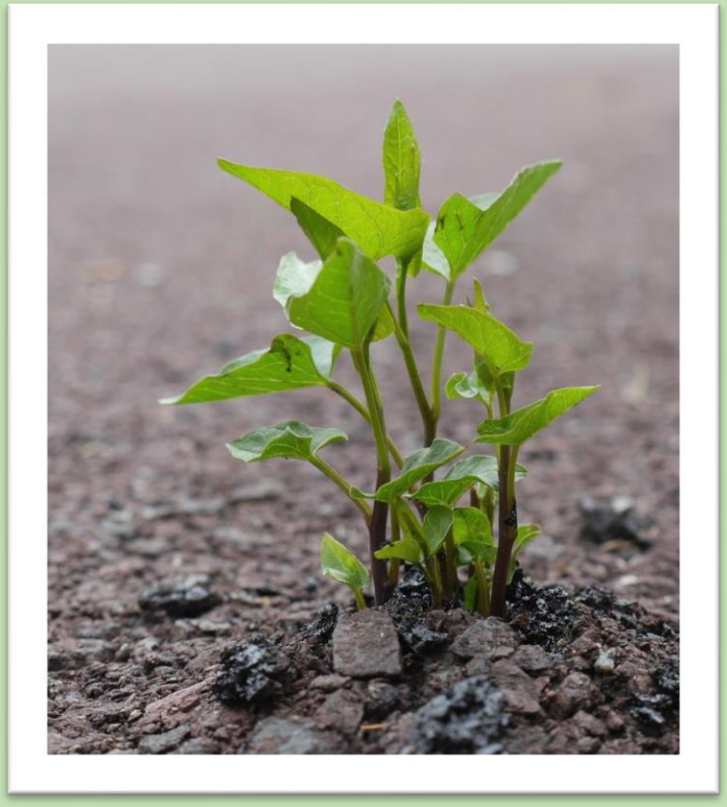
Asian Conference on Plant Pathology: Importance and Impact of Global Plant Health
15 September - 18 September, 2020
Tsukuba International Congress Center, Ibaraki, Japan
Website: iapps2010.me/2019/02/05/asian-conference-on-plant-pathology-2020/

13th Arab Congress of Plant Protection
1 November - 6 November, 2020
Le Royal Hotel, Hammamat, Tunisia
Contact: Dr. Asma Jajar, Chairperson of Organising Committee info@acpp-aspp.com
Website: acpp-aspp.com

IX International Postharvest Symposium
9 November - 13 November, 2020
Rotorua, New Zealand
Website: scienceevents.co.nz/postharvest2020

12th International Congress of Plant Pathology (ICPP2023)
20 August - 25 August, 2023
Lyon, France
Website: www.icpp2023.org

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY (ISPP)



WWW.ISPPWEB.ORG

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In accordance with the guidelines and recommendations established by the new EU General Data Protection Regulation 679/2016 (GDPR), the International Society for Plant Pathology has created a Privacy Information Notice containing all the information you need to know about how we collect, use and protect your personal data.

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Should you need further information please contact business.manager@issppweb.org

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