



ISPP Newsletter 48 (3) March 2018

News and announcements on any aspect of Plant Pathology are invited for the Newsletter. Contributions from the ISPP Executive, Council and Subject Matter Committees, Associated Societies and Supporting Organisations are requested.

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Call for nominations for ISPP Fellows

At the 2018 International Congress of Plant Pathology (ICPP) in Boston, USA, the International Society for Plant Pathology (ISPP) intends to recognise the outstanding contributions of individuals to plant pathology, the aims of the ISPP, or both as Fellows of the ISPP.

A call for nominations is now open. Nominations will close on 31st May 2018.

Nominations should be sent with name and contact details of the nominee and the nominator. The nominator should state the rationale for the nomination by outlining in 500-700 words (Helvetica 9 point single-spaced

text) how the individual nominated has made an outstanding contribution to plant pathology, the aims of ISPP, or both. A more detailed CV may also be sent with the nomination. Individuals cannot nominate themselves.

Nominations (and enquiries) should be sent to the ISPP President, Dr Greg Johnson, gregh4d@gmail.com with the subject heading "ISPP Fellow Nomination". Nominations and deliberations of the Fellow's Selection panel will remain confidential.

ISPP Fellows:

- Elected by Council on 20 August 1988 in Kyoto:- Arthur Kelman dec.; RKS Wood dec.
- Elected by Council on 14 August 1998 in Edinburgh:- Johannes Dekker dec.; Chiu Wei Fan dec.
- Elected by Council on 26 August 2008 in Torino:- Chuji Hiruki; Wenhua Tang; Peter Scott; Brian Deverall dec.; James Cook; Charles Delp.
- Elected by Council on 27 August 2013 in Beijing:- Richard Falloon; Richard Strange; Yaacov Katan.

(Greg Johnson, ISPP President)

Editor in Chief Food Security: Expressions of interest will close on 31 March

At the end of 2018, Richard Strange, the foundation Editor in Chief of Food Security The Science, Sociology and Economics of Food Production and Access to Food, published jointly by Springer and the ISPP, will step down after ten years of service. The ISPP seeks expressions of interest from scientists interested in this honorary position. The appointee is expected to commence later in 2018 as Editor in Chief of Food Security commencing with Volume 11 Issue 1 which will be published early in 2019. The editor in Chief will be initially appointed for a three year term and provided with an honorarium, and modest travel and office support. Expressions of interest will close on 31 March 2018. For further information please contact the ISPP President, Greg Johnson (Email gregh4d@gmail.com).

(Greg Johnson, ISPP President)

ICPP 2018 Boston USA: Housing open and scientific program

Hotels for the International Congress of Plant Pathology are now available on the [ICPP2018 website](#).

The full scientific program for ICPP should be available soon.

Exhibits at ICPP2018 Boston USA

ICPP is an opportunity to discuss the latest in research, regulation, outreach, and education on the most important and relevant plant diseases - all in one place. Put your company in front of 2,000 plant pathologists from universities, government, and private industries from across the globe. [Trade displays](#) are available.

New board of the Mediterranean Phytopathological Union

The new board of the Mediterranean Phytopathological Union (MPU) for the 2018-2020 term was elected in January 2018. It now includes:

- President, Antonio F. Logrieco, National Research Council, Bari, Italy
- President Elect, Dimitrios Tsitsigiannis, Agricultural University of Athens, Athens, Greece
- Immediate Past President: Alan Phillips, University of Lisbon, Lisbon, Portugal
- Board Member, Blanca B. Landa, Institute for Sustainable Agriculture-CSIC, Córdoba, Spain
- Board Member, Anna Maria D' Onghia, CIHEAM/IAMB, Valenzano, Bari, Italy
- Board Member, Dimitris Tsaltas, Cyprus University of Technology, Lemesos, Cyprus
- Honorary President, Secretary-Treasurer, Giuseppe Surico, Università degli Studi di Firenze, Firenze, Italy
- Editor-in-Chief of Phytopathologia Mediterranea:
 - Laura Mugnai, Università degli Studi di Firenze, Firenze, Italy
 - Richard Falloon, New Zealand Institute for Plant & Food Research, Christchurch, New Zealand

Zealand

- MPU Membership executive delegate, Nicola Sante Iacobellis, Università degli Studi della Basilicata, Potenza, Italy

MPU SECRETARIAT and PM EDITORIAL OFFICE:

Mrs Angela Gaglier, administrative matters secretariat

Mrs Sonia Fantoni, Editorial office secretariat

c/o Università degli Studi di Firenze, Firenze, Italy

Contact details of the new board are on the [MPU website](#).

(Laura Mugnai, Università degli Studi di Firenze)

UK project mapping global *Phytophthora* and a short questionnaire on the role of tourism

The Phytothreats project is led by Great Britain's principal organisation for forestry and tree related research, Forest Research, under the Tree Health and Plant Biosecurity Initiative (THAPBI) and under the auspices of the Living With Environmental Change (LWEC) partnership. The project aims to understand, predict and mitigate future threats from *Phytophthora* species to UK forest and woodland ecosystems. Further details on the objectives of the project can be found at <https://www.forestry.gov.uk/fr/phytothreats>.

The project is also scoping knowledge gaps surrounding the global movement of *Phytophthora* species. Mike Dunn and Mariella Marzano, social scientists at Forest Research UK, are exploring evidence for the role of tourism and recreation in the spread of *Phytophthora* within and between regions.

Plant pathologists with experience in forest health who would be willing to complete a very short questionnaire about the importance of tourism as a potential pathway for introducing *Phytophthora* to new regions can do so by completing the questionnaire at the link at the end of the article and returning it by email to Louise Barwell at loubar@ceh.ac.uk before 16th March 2018. The questionnaire will take less than five minutes. The results will be presented alongside a review of existing literature on the tourism pathway and analyses of relationships between visitor pressure and *Phytophthora* disease reports.

The project will also collate global database of *Phytophthora* records, which will be used to model the transport of *Phytophthora* through global trade networks and to model the global environmental niches of different *Phytophthora* species by matching patterns in their known occurrence with environmental risk factors. We hope to improve horizon scanning by relating arrival, establishment and spread to the ecological traits of *Phytophthora* species, so that we can predict the behaviour of newly arising pathogens with similar traits. So far our database comprises data from forests, nurseries, agricultural settings, gardens and the wider environment, but there are still many gaps. If you are willing to contribute any *Phytophthora* records from surveys or studies you have carried out, please contact Louise Barwell (loubar@ceh.ac.uk). Please see the link at the end of the article for further details.

<https://drive.google.com/open?id=1bDLGMGHjkski1Gsd3rPCmy9Wss1H8MEa>

Louise Barwell, on behalf of the Phytothreats project team
NERC Centre for Ecology and Hydrology, Oxfordshire, UK

Report on the 5th International Workshop for Capacity Building in Nematology, Karachi, Pakistan

The 5th International Workshop for Capacity Building in Nematology was jointly organised by the National Nematological Research Centre (NNRC) of the University of Karachi (UoK), Pakistan Society of Nematologists (PSN) and ECO Science Foundation (ECOSF) from 12-22 February 2018 at the University of Karachi, Karachi, Pakistan. The workshop was supported by Higher Education Commission of Pakistan (HEC) and Pakistan Science Foundation (PSF).

A total of 42 participants which included resource persons and trainees from six ECO countries, i.e. Afghanistan (2), Azerbaijan (1), Iran (3), Kyrgyzstan (2), Pakistan (32) and Tajikistan (2), attended the workshop. The senior

scientists presented country reports in one day seminar with reference to status of nematology and its development in their countries.



The workshop was opened by the Vice Chancellor of UoK, Prof. Dr. Muhammad Ajmal Khan and the Member of Higher Education Commission of Pakistan Prof. Dr. G. Raza Bhatti. In his opening speech, Professor Khan welcomed the distinguished national and international guests to the University and thanked ECOSF for partnering with the University to organise the workshop. He pledged his support for the workshop and NNRC for future ventures. He briefly gave an introduction of UoK to the participants mentioning its establishment and various programmes/departments. He also shared



that some institutes of the University such as the Institute of Chemical and Biological Sciences and Institute of Business Administration are world class institutes. He was an admirer of the activities of ECOSF for promotion of Science, Technology & Innovation (STI) in the region. He hoped that ECOSF would continue supporting the University and he would personally look at the options of how the University can benefit more from the Foundation.



Member (Operations & Planning) of Higher Education Commission of Pakistan (HEC) Prof. Dr. Ghulam Raza Bhatti speaking during the opening ceremony said that journey of HEC of Pakistan started 15 years ago. The success of the commission was the result of an enormous uphill struggle. He said that HEC was focusing on human development and does funding for collaborative and joint research projects and programs. He appreciated the efforts of ECOSF in promoting STI and interaction of S&T community of the 10 ECO member countries and assured of HEC cooperation wherever common goals are being pursued. Professor Bhatti also appreciated the NNRC and the PSN for continuing the efforts in the field of nematology as well as for publishing in Pakistan Journal of Nematology since 1983 which is an HEC recognised journal.

President ECOSF Prof. Manzoor H. Soomro in his remarks briefly introduced ECOSF and its programmes. He said that the promotion of improved methods in the teaching of science was one of the prime initiatives of ECOSF. The Foundation focuses on the evaluation of the existing training facilities in the region and formulation of training programmes for building highly skilled scientific and technical human resource. Later, a detailed presentation was made by the President ECOSF during one of the technical sessions of the workshop, in which he highlighted the inception and achievements of the Foundation. While describing the main programmes of the Foundation, Prof. Soomro said that critical thinking plays a pivotal role in research and decision making which can be achieved through Inquiry Based Science Education (IBSE) teaching methodology. Realising its significant potential and impact on the future generation of IBSE methodology, ECOSF in collaboration with La main à la pâte Foundation under the auspices of Academy of Sciences of France, the International Science, Technology and Innovation Center for South–South Cooperation under the auspices of UNESCO (ISTIC) Kuala Lumpur and the Inter-Academy Partnership Science Education Program (IAP SEP) and the Islamic Development Bank, is implementing its capacity building program to promote and implement IBSE at schools in the ECO Region. Prof. Soomro also shared with the participants that since its establishment, the ECOSF had established strong working collaborations with international and regional organisations .

Earlier, Prof. Dr. Shahina Fayyaz, Director of NNRC formally welcomed all the participants from ECO countries including Pakistan and attendees of the ceremony. While describing the NNRC, Dr Shahina Fayyaz informed that the centre was founded in 1973 in the old barracks of KU while the publication of an internationally reputed Pakistan Journal of Nematology was initiated in 1983 by Dr M.A. Maqbool (Late) and Prof Dr Abdul Ghaffar (Late). So far, more than 1,000 research papers have been published in national and international reputed journals by the centre. The centre has produced 18 PhDs and four MPhils, and has close linkages with 50 national and international universities and institutes for joint collaborative research work.

She highlighted the aims of the workshop which were:

- To develop capacity in the field of nematological research and management.
- To identify deficiencies in present methods of dissemination of crop protection information, and opportunities arising from new communication technologies.
- To develop collaboration among ECO member countries in the field of Nematology with focus on crop production.
- To emphasize the importance of phytonematodes problem in the context of current and future global challenges.

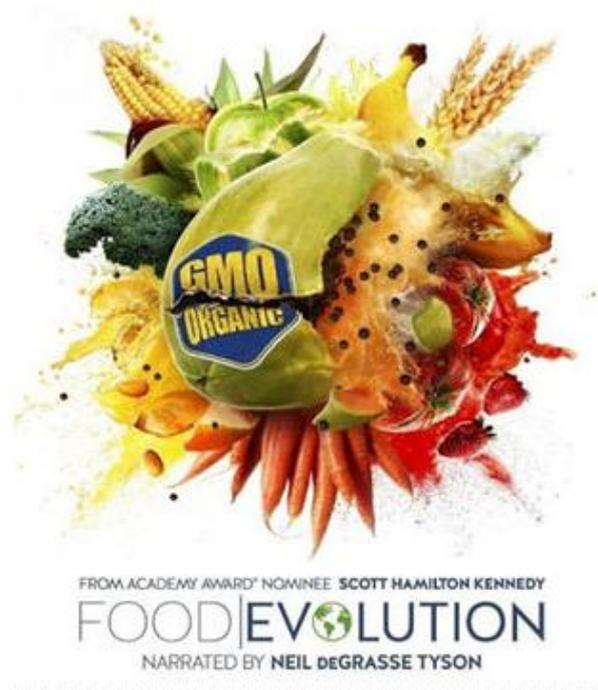
The participants were engaged for ten days in different activities covered through presentations and hands-on activities including the importance of nematodes as quarantine pests in growing trade (national perspective), symptoms and disease caused by plant parasitic nematodes, morphology and major groups of plant parasitic nematodes, and biological control, and many more topics. On the final day, a concluding ceremony was arranged and the shields and certificates were distributed among the resource persons, trainees and supporting staff by the President of ECOSF, Professor Manzoor Soomro, who is also the President of Pakistan Society of Nematologists.

(Erum Iqbal, Shahina Fayyaz and Manzoor Hussain Soomro)

Film “Food Evolution” - Genetically modified food for thought

The debate about public opinion on GMOs and the scientific consensus is the driving force behind the film “Food Evolution,” which features University of California (UC), Davis, USA researchers as well as other scientists across the world. Part of the film focuses on farmers in Africa, who struggle to survive due to disease-riddled crops and the repercussions of activist groups in developed countries affecting developing countries.

Though the film focuses on GMOs, it’s used as an extended metaphor to highlight the broader issue of the public’s distrust of scientific literature and expert opinions. “Yes, the issue is about GMOs, but it’s really about how do we make decisions, and the importance of objective evidence guiding our decisions, and how easy it is for fear and emotion to overwhelm science and people get the wrong idea about agriculture in particular,” Van Eenennaam said, a cooperative extension specialist in animal biotechnology and genomics in the UC Davis Department of Animal Science. “I think that was what the movie tried to address - that fight between what your gut tells you and what’s actually true.”



https://www.youtube.com/watch?time_continue=1&v=IVuN19Id_2c

[Read more.](#)

For more information on the film, go <https://www.foodevolutionmovie.com/>.

(Jack Carillo Concordia, The California Aggie, 19 February 2018)

Genomics: The evolution of citrus fruits

The origins of today’s citrus fruits were reported online in Nature in February 2018, providing a new evolutionary framework for this common group of plants that challenges current taxonomical thinking.

Citrus trees are the most widely cultivated fruit trees in the world, but the origins and history of Citrus have been unclear. In this study, Guohong Albert Wu and colleagues analysed the genomes of 60 different citrus varieties, including 30 that are newly sequenced, from the Australian finger lime to the Cleopatra mandarin. Today’s citrus trees are descended from at least ten natural citrus species, they report. Citrus diversified during the late Miocene epoch, 6 to 8 million years ago, and spread rapidly through southeast Asia - a transition that correlates with the weakening of the Asian summer monsoons. Australian citrus fruits diversified more recently, around 4 million years ago, when they crossed the Wallace Line, a transitional zone between Asia and Australia.

The authors also studied the domestication of commercial citrus fruits from their wild ancestors, and they show that genes from the pummelo, a natural citrus fruit that resembles a large grapefruit, may have contributed to the mandarins.

[Read paper.](#)

Celebrate Chinese New Year of the Dog with Springer

Read highly cited papers by Chinese authors for free until 15 March from Springer journals. Showcasing papers published in 2015-2017 on biotechnology, microbiology, botany, etc. These papers had received enough citations as of July/August 2017 to place them in the top 1% of their academic fields based on a highly cited threshold for the field and publication year.

[Download papers.](#)

CONNECTED network begins with UK Launch Conference

Scientists from 11 African countries joined scores from the UK and elsewhere for the inaugural conference of a ground-breaking project that brings together world-leading researchers to tackle vector-borne plant disease that devastates crops in Sub-Saharan Africa. Over 70 delegates attended the CONNECTED Network Launch conference, in Bristol, UK, from 29-31 January 2018. The network is led by Professor Gary Foster from the University of Bristol's School of Biological Sciences jointly with Professor Neil Boonham from Newcastle University and Fera Science Ltd. The network is funded by a £2 million grant from the UK government's Global Challenges Research Fund, which supports research on global issues that affect developing countries.

The conference's opening day began with a meeting of the project's Management Board, led by the UK's Chief Plant Health Officer, Professor Nicola Spence. Delegates were then welcomed to Bristol's iconic MShed by the city's Deputy Mayor Cllr Asher Craig and the Vice-Chancellor and President of Bristol University, Professor Hugh Brady. Scene-setting presentations were made by Professor Foster, Professor Spence and project co-director Professor Neil Boonham (Newcastle University), and Question and Answer sessions focused on the pump-prime research funding opportunities the project will be enabling in the coming months.

The second day was led by input from African delegates, with presentations from four of the project Management Board's African-based researchers:

- Prof Lava Kumar, International Institute of Tropical Agriculture (IITA), Nigeria Integrated approaches for severing the virus-vector connection in Sub-Saharan Africa
- Dr Anne Wangai, Kenya Agricultural & Livestock Research Organisation (KALRO), Kenya Management of maize lethal necrosis disease outbreak through multi-institutional co-operation
- Dr Titus Alicai, National Crops Resources Research Institute. Uganda CONNECTED: an opportunity for sustainable management of plant virus diseases in Africa
- Prof Emmanuel Okogbenin, African Agricultural Technology Foundation (AATF), Kenya Safeguarding Africa's food security against crop viral diseases

These were followed by over 40 two-minute flash presentations from delegates, outlining their roles, and their current work, enabling the identification of avenues for researcher collaboration and interdisciplinary working.

A series of workshops followed for the remainder of the conference, led by the University of Bristol's Cabot Institute, which is providing input and expertise to the CONNECTED project. The workshops gathered thoughts, ideas and views from delegates, helping to shape the next steps in the project, setting priorities for pump-prime funding and guiding future network action planning.

Conference presentations were filmed and will shortly be made available for network members.

As the project progresses, CONNECTED will run further meetings, training courses, seminars and networking events in both the UK and Africa with the aim of promoting interdisciplinary working and strengthening research capacity and capability.

Anyone with an interest in African plant virus vector-borne disease can apply to become a network member using this link <https://www.connectedvirus.net/join/>



Participants at the CONNECTED Network Launch conference, in Bristol, UK.

(Richard Wyatt, CONNECTED Communications Officer)

Viruses prefer agricultural areas to natural areas

Agriculture has a considerable influence on the distribution and prevalence of plant viruses in the environment. In agricultural areas, viral infections are significantly more frequent than in natural areas. This is the conclusion of a study conducted by a team of international scientists in the Camargue (France) and in the Western Cape regions (South Africa), the results of which were published in January 2018 in the [International Society for Microbial Ecology \(ISME\) Journal](#).

Although 50 percent of emerging plant diseases are viral, knowledge of the diversity of plant viruses is still dramatically lacking. Officially, to date, around 1,400 species of plant viruses have been characterised and taxonomically assigned. This figure is probably well below the true diversity of plant viruses, as shown by recent explorations of terrestrial and marine ecosystems. Moreover, this count is undoubtedly distorted on two levels. First, the description of viruses has been conducted almost exclusively based on a very small number of agricultural plant species and, second, most of the viruses were only characterised after the appearance of symptoms in their hosts. "Our knowledge of the world of plant viruses therefore remains extremely partial in terms of diversity, but also in terms of distribution at the agroecosystem level," says Denis Filloux, a researcher in plant virology at CIRAD. "This lack of knowledge is an obstacle to our understanding of the global functioning of agroecosystems, and to the definition and quantification of risk factors in the emergence of new plant viral diseases or the design of strategies to tackle these diseases." The majority of the viruses remaining to be identified are found in areas with little human activity.

To achieve this result, the scientists adopted a new viral metagenomics approach. "Metagenomics is a method that conducts high-throughput sequencing on all genomes of the microbes populating a given environment," explains Philippe Roumagnac. "It enables us, for example, to access the virome, in other words, all of the viral sequences contained in a host organism or in a sample containing several potential hosts."

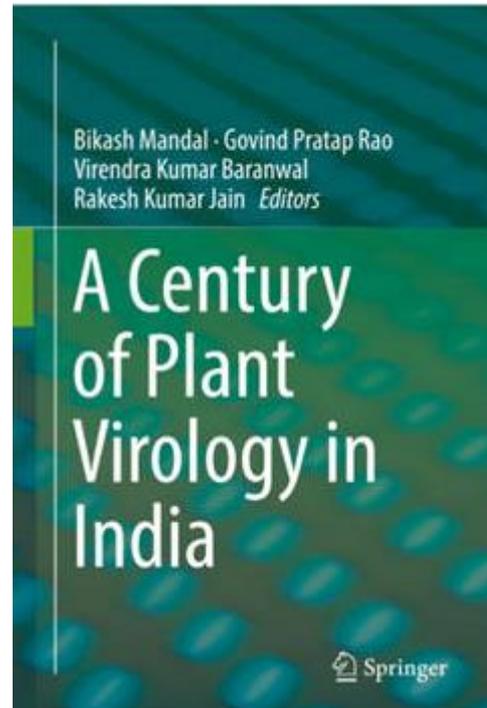
Since 2009, a new generation of metagenomics research has emerged in plant pathology, making it possible not only to analyse the overall genome of an ecosystem or organism, but also to directly link sequences of pathogenic agents to their host and/or to a geographical position. This original research in spatial metagenomics has revolutionised the view of plant virus distribution by revealing that many of the plants analysed were virus-infected.

(CIRAD, [Phys.org](https://phys.org), 31 January 2018)

A Century of Plant Virology in India – new book

A Century of Plant Virology in India. 2017. Mandal, B., Rao, G.P., Baranwal, V., and Jain, R. (Eds.). Springer Singapore, 805 p.

The book is a compilation of research work carried out on plant viruses during past 100 years in India. Plant viruses are important constraints in Indian agriculture. Tropical and sub-tropical environments and intensive crop cultivation practices ideally favours perpetuation of numerous plant viruses and their vectors in India, which often cause wide spread crop losses. Of all the plant pathogens, studies of plant viruses have received a special attention as they are difficult to manage. A large body of literature has been published on the plant virus research from India during past 100 years; however the information is so far not available in one place. This book provides comprehensive information on the biology, molecular biology, epidemics, crop losses, diagnosis and management of viruses and viroids occurring in India. Description of properties of the viruses are provided in the chapters comprising of different genera such as *Allexivirus*, *Begomovirus*, *Babuvirus*, *Badnavirus*, *Carlavirus*, *Carmovirus*, *Cucumovirus*, *Closterovirus*, *Ilavirus*, *Mandrivirus*, *Potyvirus*, *Tospovirus*, *Tungrovirus* and *Sobemovirus*. Virus-vector research related to aphid, thrips and whitefly is discussed. The work on the management aspects of plant viral diseases has been described with reference to the conventional, antiviral and transgenic approaches. Further, the quarantine mechanism developed in India for the exclusion of viruses and vectors has also been included. The book also provides useful information about the capacity building on the research and education on Plant Virology in India. The book will be a resourceful reference to the students, scientists, agricultural professionals and policy makers.



Visit [Springer](https://www.springer.com) to learn more about this book.

Managing grapevine trunk diseases: Current strategies and future prospects

A paper by David Gramaje et al. titled "Managing grapevine trunk diseases with respect to etiology and epidemiology: Current strategies and future prospects" was published in January 2018 by Plant Disease (vol. 102 pp. 12-39). The abstract is as follows:-

Fungal trunk diseases are some of the most destructive diseases of grapevine in all grape growing areas of the world. Management of GTDs has been intensively studied for decades with some great advances made in our understanding of the causal pathogens, their epidemiology, impact, and control. However, due to the breadth and complexity of the problem, no single effective control measure has been developed. Management of GTD must be holistic and integrated, with an interdisciplinary approach conducted in both nurseries and vineyards that integrates plant pathology, agronomy, viticulture, microbiology, epidemiology, biochemistry, physiology, and genetics. In this review, we identify a number of areas of future prospect for effective management of GTDs worldwide, which, if addressed, will provide a positive outlook on the longevity of vineyards in the future.

[Read paper.](#)

How manipulating the plant microbiome could improve agriculture

Recent surveys of the plant microbiome have begun to document which species are present—including not just bacteria, but fungi and microscopic eukaryotes as well—and how they affect the plant's health and

functioning.

Characterising the plant microbiome and its function could be applied in an agricultural setting, better equipping our crops to grow in resource-poor environments and to fight off plant pathogens. Indeed, the private sector has begun to invest in this approach. One strategy many companies are pursuing is a form of plant probiotic, which consists of preparations of beneficial microbes to be mixed with seeds at sowing and again once the seedlings germinate. Another approach is to use plant breeding to select for varieties that have enhanced symbiosis with the microbiota.

Many questions remain about the plant microbiome, however—not least of which is how thousands of years of cultivation have changed crops' relationships with the soil biota. Using a cultivation-independent approach, Davide Bulgarelli from the University of Dundee, UK and colleagues recently demonstrated that [wild ancestors and modern varieties of barley \(*Hordeum vulgare*\) host distinct microbiotas](#). Likewise, Jos Raaijmakers of the Netherlands Institute of Ecology and colleagues last year [identified a shift in the structure of the microbiome of modern and ancestral varieties of common bean \(*Phaseolus vulgaris*\)](#); Bacteroidetes were more abundant in wild relatives, and their contribution to the community was progressively replaced by Actinobacteria and Alphaproteobacteria in the more domesticated plants.

How do these differences translate to altered functionality of the microbiome? Thanks to the experience gained by Arabidopsis scientists, we are now in a position to address this question, and developing SynComs from crops will be an important step in the process. Luckily, the field is motivated to do just that, as well as to define a road map to achieve the translational potential of the plant microbiome. In a few years, the plant microbiome manipulations may have moved from the lab to the field.

[Read more.](#)

(Davide Bulgarelli, The Scientist, 1 February 2018)

Molecular weapons of the plant microbiome

Researchers at McMaster University in Canada have pinpointed the identity of a toxin used by a soil-dwelling bacterium that protects plants from disease. The work is published in the February 2018 issue of the [Journal of Biological Chemistry](#).

The bacterium *Pseudomonas protegens* can kill soil-dwelling plant pathogens, including fungi and bacteria that attack the roots of important crops such as cotton. *P. protegens* releases diverse antimicrobial compounds into the soil, but John Whitney was curious specifically about the compounds that it was injecting directly into other bacteria through the type VI secretion system, or T6SS.

Jenny Tang and Nathan Bullen, undergraduate students from the University of Waterloo working with Whitney on a co-op work-study assignment, spearheaded the discovery that the toxic protein used by *P. protegens* against other bacteria acts on a molecule found in nearly all living cells: nicotinamide adenine dinucleotide, or NAD⁺.

NAD⁺ is a cofactor, or "helper" molecule, in many biochemical reactions. By injecting a protein that destroys NAD⁺, *P. protegens* is able to kill other bacteria.

The team then investigated the genome sequences of many other bacteria to see how widespread the strategy of targeting NAD⁺ is in microbial warfare. They found that many bacteria with secretion systems carry genes similar to the one encoding the NAD-targeting toxin.

The abundance of these toxins in nature raises many questions: How do different bacteria in different environments evolve to resist this toxin? Are NAD-targeting toxins more effective against some bacterial species than others? Understanding the diversity of bacterial weapons is an active area of study among agricultural researchers who would like to develop better ways to fight plant diseases.

"The identification and characterisation of antibacterial toxins produced by plant-protective bacteria may one

day allow us to engineer these bacteria to have enhanced ability to suppress pathogens," Whitney said.

(American Society for Biochemistry and Molecular Biology, [ScienceDaily](#), 5 February 2018)

How fungi make nutrients available to the world

For millions of years, nothing could break down lignin. When a tree died, it just sank into the swamp where it grew. When the fossil record started showing trees breaking down around 300 million years ago, most scientists assumed it was because the ubiquitous swamps of the time were drying up. But biologist David Hibbett at Clark University, Worcester, Massachusetts, USA suspected that wasn't the whole story. An alternative theory from researcher Jennifer Robinson intrigued him. She theorised that instead of ecosystem change alone, something evolved with the ability to break down lignin. Through evolutionary biology research supported by the Department of Energy's (DOE) Office of Science, USA, Hibbett and his team confirmed her theory. They found that, just as she predicted, a group of fungi known as "white rot fungi" evolved the ability to break down lignin approximately the same time that coal formation drastically decreased. His research illustrated just how essential white rot fungi were to Earth's evolution.

Fungi are still indispensable. The short-order cooks of the natural world, they have an unheralded job making nutrients accessible to all. Some fungi can break down plant cell walls, including lignin, that makes it easier for other organisms to use the carbon that is in those cell walls.

To understand fungi's role in the ecosystem and support biofuels research, scientists supported by DOE's Office of Science are studying how fungi have evolved to decompose wood and other plants.

[Read more.](#)

(US Department of Energy, [Phys.org](#), 1 February 2018)

Acknowledgements

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