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Keynote Presentations

Problem-Solving in Agricultural Production in the Developing Countries

Mohammad Babadoost

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Abstract:

First step for improving food security in the world is establishing sustainable crop production. Despite losing some of the productive agricultural lands to urban developments throughout the world, there are still considerable land areas with plenty of water for crop production. In spite of vast efforts on crop protection, however, more than 30% of food crops and products are lost to plant pests (diseases, insects, and weeds) and poorly handling yields and products. The losses are much higher in the developing countries than developed countries. To improve crop production and minimize the losses, establishing/strengthening national agricultural programs is vital. This requires strong teaching, research, and extension programs in every country. In most of the developing countries, none or limited connections exists among teaching, research, and extension programs. External helps are valuable. However, establishing sustainable agricultural production without understanding and respecting the local social cultures by outside helpers may not succeed. Thus, problem-solving in agricultural production in any area should be based on the credible teaching program and reliable local research complimented with timely information-delivery to the end users by local professionals.

Biography:

Mohammad Babadoost completed his Ph.D. in plant pathology at North Carolina State University. In 1999, he joined the faculty of the University of Illinois at Urbana-Champaign, where he is now a Professor of Plant Pathology and Extension Specialist. Mohammad conducts research and extension programs on the biology and management of vegetable and fruit crops diseases, and teaches "Plant Disease Diagnosis and Management." In the past 20 years, Dr. Babadoost has been involved in various teaching, research, and extension programs in 39 countries and has developed a profound commitment for establishing food security in the world.

Plant Absorption of Soil Microbes into Root Cells and its Consequences for Root Growth and Soil Nutrient Acquisition

James White*, Kathryn Kingsley, Xiaoqian Chang

Department of Plant Biology, Rutgers University, New Brunswick, New Jersey, USA

Abstract:

Plants secrete exudates from roots that attract bacteria to root tips where root cells absorb them into cells. These intracellular bacteria modulate root growth and differentiation. In addition, plants extract nutrients from bacteria. Root cells secrete superoxide onto bacteria, and this oxidizes cell walls off of bacteria leaving protoplasts, some of which are fully degraded by the superoxide while others leak nutrients. Intracellular microbes that survive the oxidative process secrete ethylene that triggers root hair elongation. As the root hairs elongate bacterial protoplasts are ejected back into the rhizosphere where they reform cell walls and may acquire additional soil nutrients. This soil microbe degradative process is termed rhizophagy cycle ('rhizo' = root; 'phagy' = eating). The rhizophagy cycle is a nutritional process whereby plants oxidatively extract nutrients

from microbes (primarily bacteria) in roots. In the rhizophagy cycle, microbes alternate between a free-living phase in soil and a plant-dependent naked protoplast phase inside plant root cells. Microbes acquire nutrients (e.g., nitrogen and other minerals) in the soil phase, and nutrients are extracted from microbes in plant root cells through exposure to reactive oxygen (i.e., superoxide) produced on the root cell plasma membrane. The dependence of plants on a healthy and diverse soil microbial community has practical consequences for plant cultivation and agricultural practice.

Biography:

James F. White is Professor of Plant Biology at Rutgers University in New Jersey where he and students conduct research on ecology of microbes that inhabit plants (endophytes). James White obtained the B.S. and M.S. degrees in Botany and Plant Pathology from Auburn University in Alabama, and the Ph.D. in Botany/Mycology from the University of Texas at Austin. James White is the author of more than 240 articles and book chapters, and author and editor of eight books on the biology of plant microbes.

Nanotechnology and Agriculture: Tuning Agrochemical Chemistry at the Nanoscale to Maximize Crop Production

Jason C. White*, Wade H. Elmer, Robert J. Hamers, Jaya Borgatta, D. Howard Fairbrother, Leslie Sigmon, Christy L. Haynes

**Connecticut Agricultural Experiment Station, USA; University of Wisconsin, USA, Johns Hopkins University, USA; University of Minnesota, USA*

Abstract:

Low use and delivery efficiency of conventional agrichemicals is a significant impediment to maintaining global food security, particularly given that a 60-70% increase in global food production is needed by 2050. Thus, novel and sustainable strategies for enhancing food production are needed all along the “farm-to-fork” continuum. We have focused on using nanotechnology to increase the delivery efficiency and efficacy of nutrients. For example, given the known role of micronutrients in plant growth and defense against both abiotic and biotic stresses, we began mechanistic investigations into the potential of nanoscale micronutrient platforms for disease management. In a number of studies, foliar amendment of nanoscale materials such as CuO, CuS, and SiO2 have been shown to significantly alleviate damage caused by the fungal pathogens, resulting in enhanced growth and yield. Importantly, disease suppression is largely a function of modulated plant nutrition and disease resistance and not direct toxicity against the pathogen. Separately, we are also looking at novel biopolymer-based nanocomposites as a means to enhance phosphorus delivery while minimizing run-off. Other studies are focused on the use of nanoscale metal oxides to enhance photosynthetic efficiency. Across all of these projects, it is clear that the ability to effectively tune nanoscale material structure and composition will be critical to maximizing positive impacts, including significantly reduced amounts of agrichemical use. Results will be presented from several studies where manipulation of nanoparticle synthesis resulted in tunable and sustainable materials that yielded greater plant health and crop yield by a range of agronomic endpoints.

Biography:

I have worked at the CT Agricultural Experiment Station (CAES) for 24 years and have been Director since April 2020. I received my B.S. from Juniata College in Ecology and my PhD from Cornell University in Environmental Toxicology. After a one-year CAES post-doc, I joined the scientific staff in 1998. I was Department Head of Analytical Chemistry from 2009-2020. My research focuses on nanotechnology and agriculture, as well as food safety. I hold secondary appointments at the Harvard T.H. Chan School of Public Health and at the University of Massachusetts. I am also a Commissioned Official of the US FDA.

Using Lasercapture Microdissection to Unravel Nodulation Signaling

Julia Frugoli* and Elise Schnabel, Jacklyn Thomas, Yueyau Gao, Rabia El Hawaz, Suchitra Chavan, F. Alex Feltus

Clemson University, USA

Abstract:

The legume-rhizobial symbiosis involves a complex signal exchange between the host plant and rhizobia bacteria to initiate the symbiosis, leading to the formation of root nodules in which the bacteria fix nitrogen for the plant. Signal transduction events occur between the host plant cell layers in tissues, organs, and across time. For example, bacterial infection threads pass through the epidermis and outer cortical cells towards the inner cortical cells, while the inner cortex and pericycle cells become mitotically active before the arrival of the infection thread. The vasculature is separated from inner cortical cells by the pericycle and endodermis; signaling passes across these tissues to the infection thread advancing across the cortex. Transcriptomic analyses have used whole roots to identify host genes involved in nodule development, but this approach does not capture unique transcription events in specific tissues. To address this, performed transcriptome profiling of specific root tissues during nodule development by using laser capture microdissection (LCM) to isolate the tissues for RNA extraction,followed by RNA-seq analysis of libraries made from epidermal, vascular, inner and outer cortical cells and developing nodules at 0, 12, 24, 48 and 72 hours post inoculation. The almost 100 libraries of over ~25,000 reads allows us a look at expression over time in individual tissues, and we will discuss our findings. This work is supported by NSF IOS ##14444.

Biography:

Julia Frugoli earned a BS in both Biology and Chemistry at Gordon College. As a research chemist at the US Army Natick Research Development and Engineering Center she explored biomimetic materials for several years before pursuing a PhD in Biological Science at Dartmouth College, working with C. Robertson McClung on the catalase gene family in Arabidopsis. Postdoctoral research at Texas A&M with Douglas Cook led to an interest in nodulation in Medicago truncatula. In 2000 she started as an assistant professor at Clemson University, rising to Alumni Distinguished Professor of Genetics. Her work has been continuously supported by the NSF.

Invited Talks

Role of Nanoscale Cu in Suppressing Plant Diseases

Wade Elmer1* R. D. L. Torre-Roche1, N. Zuverza-Mena1, I. Adisa1 , C. Dimkpa11, J. Gardea-Torresdey2, and J. C. White1

1The Connecticut Agricultural Experiment Station, New Haven, CT 06492

2The University of Texas at El Paso, Texas 79968 USA.

Abstract:

Engineered CuO nanoparticles have value in agriculture as a nano-fertilizers and/or as bactericides/fungicides since they can more effectively target specific tissues/pests at reduced rates. Several plant diseases have been managed with single applications of nanoscale Cu to young transplants. Many times, season long protection is observed resulting in increased yield. In three separate field trials with the Fusarium wilt disease, watermelon transplants exposed to 500 ppm nanoscale CuO had a 33%, 35%, and 36 % more marketable melons when compared to untreated controls. In one trial, nanoscale CuO was compared to nanoscale B, Mn2O3, or ZnO and

produced 24%, 20% or 14% more watermelons yield, respectively. Single foliar sprays of nanoscale CuO (500 ppm) to 4-6 week-old eggplants increased their marketable yields by 17% and 33%, and decreased the percent disease from Verticillium wilt by 28% and 22% in 2016 and 2017, respectively. In 2017, 2018, and 2020 the ornamental chrysanthemum was treated with nanoscale CuO, Mn2O3, ZnO (500 ppm) or a conventional fungicide at the transplant stage, then placed in pot filled with soil infested with the Fusarium wilt pathogen. Disease ratings were lowest for plant exposed to nanoscale CuO and were reduced 65%, 38%, and 38%, respectively, and were comparable to the conventional fungicide treatment. Although Cu is fungicidal, nanoscale CuO may have additional value in boosting host resistance in young plants by mechanisms that are common to many plant families.

Biography:

Dr. Elmer serves as the Vice Director of the Connecticut Agricultural Experiment Station and Chief Scientist of the Department of Plant Pathology and Ecology. He received his Ph.D from Michigan State University in 1985 and began in Connecticut in 1987. Understanding the mechanisms of disease suppression through mineral nutrition has been his focus for the past 33 years. Since 2013, he has advanced the strategy of using nanoscale metal oxides to suppress plant disease. Dr. Elmer has edited four books, authored or co-authored over 120 peer-reviewed papers, 19 book chapters, and over 100 articles for trade magazines and symposia.

Towards Achieving a Resilient and Sustainable Food System While Facing the Challenges of Climate Change and COVID-19

Jock R. Anderson

Rutgers State University of New Jersey, Feed the Future Policy Consortium

Abstract:

The prevalence of excessive numbers of undernourished people around the planet indicates that the global food system is deficient. With a fragmented food system heavily reliant on small-scale producers, it struggles to keep up with growing demand and shifting consumer tastes. What research steps should be taken towards achieving a resilient and sustainable food system within the context of climate change and COVID-19? Clearly there are many such steps and some judged to be the most important in research and extension policy and in social protection policy are canvassed in this paper.

Biography:

Jock left his home farm to study agricultural science, at the University of Queensland, and worked first as a research agronomist in the private-sector fertilizer industry. He pursued a PhD at the University of New England, Armidale, NSW, Australia, where he became a Professor of Agricultural Economics. He worked with several CGIAR Centers over the years, and directed the Impact Study of the CGIAR 1984-6. He joined the World Bank (WB) in 1989 and was Adviser, Strategy and Policy in the Agriculture and Rural Development Department before he retired from WB in 2003.

Seed Transmitted Proteobacteria form the Core Microbiome of Juvenile Angiosperm Plants

David Johnston-Monje

Universidad del Valle, Cali, Colombia

Abstract:

Bioprospecting for beneficial bacteria within plant microbiomes offers much potential to develop inoculants for sustainably improving plant productivity, mitigating stress, and controlling diseases. With the goal of finding beneficial endophytes for maize agriculture, I discovered that seeds were a rich source of endophytes, especially belonging to the genus Pantoea, Enterobacter, and Burkholderia, and that some of these had the ability to systemically move through adult plants, exit through the roots and colonize the rhizosphere. Some examples of these beneficial seed bacteria were the strongly plant growth promoting Burkholderia phytofirmans isolated from seeds from a giant Mexican landrace, root growth enhancing Enterobacter asburiae isolated from seeds of a wild variety of Nicaraguan swamp grass and the fungal biocontrol strain Burkholderia gladioli isolated from seeds of a Mexican desert popcorn. We went on to find that seeds are more important than soil in the formation of young maize endospheres, and likewise the rhizospheres of young maize plants are dominated by seed transmitted Proteobacteria, primarily Burkholderia and Enterobacter. Expanding the study to include 16 other species of angiosperm plant including Arabidopsis, Brachypodium, wheat, tomato, rice and coffee, we found evidence that the seeds, spermospheres, shoots, roots and rhizospheres of angiosperms are all dominated by taxonomically similar strains of Pantoea, Enterobacter and Pseudomonas. Shared by dicots and monocots alike, this core microbiome perhaps hints at an important and ancient relationship between seed transmitted Proteobaceria and angiosperm plants.

Microbial Hotspots & Hot Moments in the Rhizosphere

Yakov Kuzyakov

Department of Soil Science, University of Göttingen, Germany

Abstract:

The rhizosphere is distinguished from root-free soil by very high microbial activities, converting it to a hotspot of various processes. These activities include microbial growth, a broad range of enzyme activities, oxygen consumption and CO2 production, turnover of all organic substances, mobilization of nutrients, etc. The main reason for these high activities is that microorganisms experience localized alleviation of C and energy deficiency, due to the release of easily available organic substances by the root. In this talk, the previously developed general concepts of microbial hotspots and hot moments will be elaborated for the rhizosphere.

A broad range of visualization approaches allowed quantification of rhizosphere properties and the assessment of their lifetimes. Based on 14C imaging, root exudates are localized at root tips and occupy not more than 10% of the soil volume. Despite their short lifetime of about 1-2 weeks, exudation hotspots trigger a cascade of microbial processes: microbial growth, flush of O2 consumption and CO2 release by fast decomposition of organics, and enzyme production and subsequent mineralization of N and P from SOM. All these processes structure the environment around the roots and make it more suitable for plant growth. Consequently, roots function as ecosystem engineers, building their living environment through close interactions with rhizosphere microorganisms. Generalized results from various non-destructive visualization approaches showed the rhizosphere extending 0.5-4 mm from the root surface, depending on the property. Based on changes of enzyme activities in the rhizosphere compared to the bulk soil, we concluded for the first time that the C and nutrient limitations are hotspot specific and will be modified during the hot moments.

Biography:

Prof. Yakov Kuzyakov has been working as a Head of Dept. of Soil Science of Temperate Ecosystems, and Dept. of Agricultural Soil Science, University of Göttingen, Germany. As a famous soil ecologist, his research focuses on soil - plant - microorganisms interactions, such as rhizosphere processes, priming effects, soil biogeochemistry cycling including C and N transformations. He has published 550+ papers, including 9 hot papers (top 0.1% citations) and 35+ highly cited papers (top 1% citations). Prof. Kuzyakov has acted as the member of the Editorial Boards of top ranking journals, such as Soil Biology & Biochemistry, Rhizosphere, European Journal of Soil Biology, Biogeosciences, Land Degradation and Development, etc.

Oral Presentations

Insights into the Molecular Mechanisms of a Three-Way Plant-Fungus-Virus Symbiosis Leading to Extreme Thermotolerance

Mustafa Morsy

University of West Alabama, United States

Abstract:

Plant response to biotic stresses is complicated and involves many pathways, i.e., signal transduction, transcriptional control, and physiological changes. To survive abiotic stress such as heat, freeze, drought, nutrient deficiency, UV radiation, ozone, high or low light intensity, or salinity, plants have developed different adaptive mechanisms. However, abiotic stress remains a significant contributor to reduced crop yield and quality. With climatic changes and increased global temperatures, there is a need to understand the molecular mechanism that governs thermotolerant plants to develop crops that can withstand higher temperatures and other abiotic stresses.

The fungus Curvularia protuberate carries a mycovirus named Curvularia thermal tolerance virus (CThTV). C. protuberate with CThTV develops a symbiotic relationship with a wide range of plants providing them with extreme tolerance to heat stress up to 65oC. However, the virus-free fungus cannot provide such heat tolerance; thus, this symbiotic relationship is a three-way (a plant, a fungus, and a virus). Our lab identified several pathways and potential mechanisms that control the three-way symbiosis leading to thermotolerance. These mechanisms involved the expression of high levels of the disaccharide trehalose and the enzyme catalase/peroxidase that function as an osmoprotectant and signaling molecule and as a scavenger of reactive oxygen species, respectively. Overexpression and knockout of trehalose and catalase/peroxidase genes in the virus-free and CThTV carrying C. protuberate, respectively, confirmed the role of these genes in the thermotolerance mechanism of this three-way symbiosis. The CThTV controls the production of trehalose and the expression level of the Catalase/peroxidase. In addition, CThTV affects many other fungal genes, including translationally controlled tumor protein (TCTP) and melanin pathway genes.

Endophytes in the Cannabaceae

April Micci*1, James White1

1Rutgers University, USA

Abstract:

The hemp industry is booming again in America, but the role of endophytic microbes in the Cannabis life cycle is relatively unknown. The aim of this research is to identify microbes that can be used to improve plant stress

tolerance, modulate disease resistance, regulate production of secondary metabolites, and enhance nutrient acquisition. A collection of endophytes and pathogens from Cannabis Sativa and Humulus lupulus have been evaluated for their interactions with each other and their influence on early seedling development. Root gravitropism, germination rate, and germination time were observed on tall fescue and kale seeds inoculated with strains of bacteria isolated from high CBD Hemp cultivars grown in a field trial at Rutgers Experimental Agriculture Station in Bridgeton NJ, commercial industrial hemp seed from Colorado and Humulus Lupulus land races from the USDA Corvallis research station. Several growth promotional strains were identified and will be employed in additional experiments.

Biography:

April Micci is a graduate student at Rutgers University in New Brunswick, NJ. She is studying plant microbe interactions as well as natural product discovery for use in sustainable agriculture. April's background is in horticulture, vegetable production crops and native plants. She teaches General Biology at the undergraduate level and is pursuing a career in academia to teach botany and plant pathology. When she is not pursuing academic interests, she enjoys gardening, cooking, and spending time with her English Bull Terrier.

Plant Growth Promoting Bacteria Identified for the Biocontrol of Botrytis cinerea in Floriculture Crops

Kaylee A. South* and Michelle L. Jones

The Ohio State University, USA

Abstract:

Application of plant growth promoting bacteria (PGPB) can improve plant resilience to biotic stresses. Botrytis cinerea is a fungal pathogen that reduces the quality of floriculture crops during production, shipping, and retailing. Botrytis infection can be difficult to control because it has become resistant to several fungicides. Therefore, alternative methods are needed for Botrytis control. From a collection of 60 PGPB, seven strains were identified for the biocontrol of Botrytis through an in-planta screen. The seven strains were evaluated in a validation greenhouse trial through biweekly drench applications to Petunia × hybrida 'Carpet Red Bright'. These plants were then inoculated with Botrytis and individual flowers were evaluated using a disease severity rating scale. All strains showed a reduction in disease severity index. Four of these top seven strains were also evaluated for the biocontrol of Botrytis in harvested cut flowers. The bacteria were sprayed onto Eustoma grandiflorum 'ABC 2 Blue' and then inoculated with Botrytis 24 h later. Flowers were placed into vases and covered with plastic sleeves. The sleeves were removed from the flowers 48 h later and evaluated with a daily disease severity rating. The daily ratings were used to calculate area under the disease progress curve (AUDPC). Pseudomonas chlororaphis 14B11 treated flowers had a reduced AUDPC compared to the negative control. In these studies, several PGPB were identified that have the potential to be formulated into products for the biocontrol of Botrytis in both bedding plants and cut flowers.

Biography:

Kaylee is from rural Georgia, USA. She became interested in greenhouse production through participating in the Floriculture Career Development Event and greenhouse plant sales through her school's National FFA Organization. She studied Horticulture at the University of Georgia, earning a B.S. in Agriculture (2015). During this time, Kaylee completed an American Floral Endowment Vic and Margaret Ball Internship at Sun Valley Floral Farms in Arcata, California (2014). She then completed her Ph.D. (2020) in the Floriculture Crop Improvement program at The Ohio State University (OSU). Kaylee is now continuing research with greenhouse crops as a postdoctoral researcher at OSU.

Novel Crop Protection Strategies to Prevent Losses to the Pest and Pathogens to Attain Sustained Productivity Under Uncertain Environmental Conditions

Sachin Rustgi*, Zachary Jones, Tariq Alam, Prasanna Shekar

Clemson University, Department of Plant and Environmental Sciences, Pee Dee Research and Education Center, Florence, SC, USA

Abstract:

In the U.S. the plant diseases cost ~$9.7 billion and insects ~$7.7 billion in annual losses. The yield losses to pests and pathogens are expected to aggravate by 10 to 25% per degree Celsius of warming, specifically in the world's temperate regions. The cultural management practices, genetic resistance, biopesticides, and primarily the topically applicable synthetic pesticides are used to manage plant diseases and invasive insect pests. An estimate of the global expense on pesticides could be made by looking at the value, $84.5 billion, of the pesticide industry in 2019, which is expected to grow further and reach $130.7 billion by 2023. The application of small-molecule synthetic pesticides on one end has helped sustain productivity but, on the other hand, has adversely impacted the eco-systems and human health and led to pesticide resistance development in pests and pathogens. These developments over the years have endorsed the need for eco-friendly solutions that could reduce pesticide application and promote sustainable agricultural practices. Nucleic acid-based biopesticides (NABs) are one such technology that can bring a paradigm shift and the focus of this talk. The NABs utilize the biological system's inherent processes such as RNA interference or RNase H mediated degradation of complementary RNA to silence the vital pest/pathogen genes to deter them and protect crops. Some examples of the use of NABs and the plant-incorporated protectants or PIPs, which are generally represented by genetically engineered crops that produce substances with pesticidal-properties to protect them from pest/pathogen, will be presented and their utilities discussed.

Biography:

Dr. Sachin Rustgi is affiliated as Assistant Professor of Molecular Breeding at the Department of Plant and Environmental Sciences, Clemson University, and Faculty Scholar at the Clemson University School of Health Research, as well as Adjunct Assistant Professor at the Department of Crop and Soil Sciences, Washington State University, Pullman. Dr. Rustgi's research primarily focuses on developing novel strategies to mitigate the major pests or pathogens of the primary South Carolina crops and dietary therapies for individuals with sensitivity to wheat or peanut. His research has resulted in several high-impact publications in recognized journals. He has additionally authored/edited three books.

A Novel Locus from Oryza latifolia Desv. Confers Qualitative Bacterial Blight (Xanthomonas oryzae Pv. oryzae) Resistance in Rice (Oryza sativa L.)

Rosalyn B. Angeles-Shim1*, Junghyun Shim1, Ricky B. Vinarao, Ruby S. Lapis, Joshua J. Singleton1

Plant Breeding Division, International Rice Research Institute, Manila, Philippines

1Current address: Department of Plant and Soil Science, College of Agricultural Sciences and Natural Resources, Texas Tech University, Lubbock, Texas, United States of America

Abstract:

Bacterial blight caused by Xanthomonas oryzae pv. oryzae (Xoo) is a destructive disease that negatively impacts rice productivity worldwide. Although chemical strategies are available to manage the pathogen, planting of varieties with innate Xoo resistance remains the most efficient and economical means of controlling the disease.

A novel locus conferring resistance to Philippine Xoo race 9A (PXO339) was identified in two introgression lines (i.e. WH12-2252 and WH12-2256) that segregated from Oryza latifolia monosomic alien addition lines (MAALs). Both MAAL-derived introgression lines (MDILs) are in the genetic background of the elite rice breeding line IR31917. Phenotyping for PXO339 resistance of the segregating populations derived from crosses between the MDILs and the recurrent parent indicate the recessive inheritance of the trait. Genotyping of a total of 216 F2, 1130 F3 and 288 F4 plants narrowed the candidate locus regulating the PXO339 resistance to a 1,817 kb region that extends from 10,425 to 12,266 kb in chromosome 12. Database mining identified 86 genes with open reading frames within the region of interest, 45 of which code for known protein products. Among these, nine have orthologues that have been reported to be involved in various defense responses. In silico and sequence analysis identified a wound-inducible basic protein as a candidate gene regulating the race-specific resistance of the MDILs to PXO339. To our knowledge, this is the first report of a genetic locus from the allotetraploid wild rice, O. latifolia conferring race-specific resistance to bacterial blight.

Granulated Polyhalite as Alternative Source of Nutrients for Coffee (Coffea Arabica L.) in Colombia

Hernan Gonzalez-Osorio1*, Siavosh Sadeghian1, Ruben Medina1, Lino Furia2

1Centro Nacional de Investigaciones de Café-Cenicafé, Colombia; 2Anglo American plc group, UK

Abstract:

Potassium (K), magnesium (Mg), calcium (Ca) and sulphur (S), are essential during the reproductive stage of coffee. To supply its requirements, around 50% of the coffee growers use bulk blends of fertilizers because it represents a low cost relative. However, the fertilizer sources available for their elaboration are minimal and usually non compatible with other granulated sources, causing low efficiency on fertilization. The objective of our research was to evaluate the effect of granulated polyhalite (GPoly), a multi mineral source of K, Mg, Ca and S, on coffee yield and coffee quality. The experiment was carried out in a Typic melanudand (K, Ca and Mg levels 0.4, 0.5 and 0.4 cmolc kg-1, respectivelly), belonging to the Colombian coffee zone. During three years, six treatments were evaluated: NPK-GPoly, NPK-CaNO3-CaSO4-MgO, NPK-MgSO4, NPK-CaNO3-MgSO4, NPK-CaNO3-MgO, and Control (NPK). NPK-GPoly and its nutritional equivalent, using simple sources of Ca and Mg, generated best coffee cherry yield during 2 years and the accumulate production at the end of reproductive cycle (3 years). Descriptively for all of the treatments evaluated, the variables to explain the coffee bean quality, such as coffee cherry/dry parchment coffee ratio and threshing performance factor, were associated to good coffee quality in Colombia. In respect to cup score, values above 80 in whole of the treatments were related to “special coffee”. According to the results, GPoly could be considered as an alternative source to supply K, Mg, Ca and S to coffee in Colombia.

Biography:

Researcher at Cenicafé (National Coffee Research Centre), since 2003. After receiving my BS in Agronomy at Caldas University, I won the National Prize in Soil Science, gave by Colombian Society of Soil Science. I studied MSc in Soils Science and PhD in Biotechnology at National University of Colombia. Upon completion my PhD emphasized in soil microbiology, I was awarded by International Plant Nutrition Scholar Award (IPNI). My research interests include coffee nutrition. Specifically, I am looking for new strategies, through use of new alternative fertilizers, and the management of soil fertility status, understanding the interactions coffee - microorganisms.

Colombian Coffee Area Vulnerable to Coffee Berry Borer Hypothenemus hampei (Curculionidae: Coleoptera) Under Different Climatic Scenarios

Marisol Giraldo-Jaramillo1*, Audberto Quiroga Mosquera2, Juan Carlos García López 3, Esther Cecilia Montoya Restrepo4, Ninibeth Sarmiento Herrera5, Juan Camilo Espinosa Osorio, 6, Hernando Duque Orrego7, Pablo Benavides Machado8

1,2,3,4,5,6,8 National Coffee Research Center – Cenicafé, Colombia 7 Technical manager, Federacion Nacional de Cafeteros de Colombia, Colombia.

Abstract:

Temperature is the abiotic factor that most impacts the physiology and behavior of the coffee berry borer (CBB). Colombian coffee growing area has annual average temperatures that vary from 17 to 24 ° C, which may be favorable for the development of CBB at certain elevation and climates, particularly when El Niño Southern Oscillation (ENSO) events occur. The present work aims to identify the areas in Colombia that are vulnerable to CBB populations causing damage during ENSO climatic events.

Vulnerability maps were prepared for Colombia using a geographical information systems ArcGIS 10.3.1) and climate data from the Coffee Information System, SICA. The shape of the country was represented by 67.246 pixels (1 pixel = 1.0 km2), and for each pixel the average daily temperature was obtained for the three ENSO scenarios, (1)1990 as a Neutral scenario, (2) between May 1997 and April 1998 as an El Niño scenario, and (3) 1999 as a La Niña scenario. The average daily temperature for each pixel was estimated by applying the interpolation model proposed by Hutchinson (2006), using the Anusplin software (version 4.4).

For each pixel and each ENSO scenario, the number of CBB generations was estimated as a function of temperature using the linear model reported by Giraldo-Jaramillo (2016) and pixels were categorized into four categories of vulnerability to CBB damage: very low (<= 4), low (> 4 and <= 7), moderate (> 7 and <= 11) and high (> 11). Depending on the degree of vulnerability, actions are established to control CBB under an integrated management program (IPM).

Biography:

I am Agronomy Engineer, with Msc and Phd in Entomology,I am from Colombian and I currently work at the Entomology Department, Cenicafe - Colombia. My specific research focus in the biological and integrated pest control of coffee pests. The goal of my researches is to provide the basis for the development of sustainable pest management systems. I also work in the climate-arthropod interactions, for determining the climate zones for coffee Berry borer and coffee leaf miner in Brazil and Colombia, some of the another coffee pests. I also work on systematics, biology and ecology of Tephritidae at the neotropical region.

Calcium Nutrition in Coffee and its Influence on Growth, Stress Tolerance, Cations uptake, and Productivity

Victor Hugo Ramírez-Builes, Jürgen Küsters, Thais Regina de Souza, Christine Simmes

Center for Plant Nutrition and Environmental Research Hanninghof, Yara International, Hanninghof 35 D-48249, Dülmen, Germany.

Abstract:

Calcium (Ca^{2+}) is an important macronutrient in coffee and is involved in several physiological processes that influence crop growth, development, productivity, and stress response. This paper presents results from five experiments conducted on coffee under greenhouse and field conditions for over five years (2014–2018). The main objective of this study was to evaluate the influence of Ca+2 application on coffee growth, development, abiotic stress response, cation uptake, leaf cell structure, and productivity. The results show that Ca+2 directly influences the growth and development of plants and has a strong effect on root growth. Drought stress and low Ca+2 rates of 8 mg.L-1 showed no differences in photosynthetic rates (PN) and biomass accumulation; high Ca+2 rates between 75 to 150 mg.L-1 increased PN and biomass accumulation in plants under drought stress, with a positive correlation between Ca+2 content in the leaves and PN with and without drought stress. High air temperature (>30°C) reduced PN rates, and the treatment with proper Ca+2 application showed better PN compared to the treatments with low Ca+2. Ca+2 application showed a synergistic effect with potassium (K+) uptake and no influence on the magnesium (Mg+2) uptake but a reduction in the leaf concentration with the increase in Ca+2 application. Additionally, coffee plants with proper Ca+2 application showed thicker leaves, denser epidermis, and larger, more compact, and better-structured palisade parenchyma compared with the plants treated with Ca+2 at lower rates. After five years, the mean coffee yield showed a polynomial response with respect to the doses of Ca+2 applied, with optimum rate of 120 kg CaO ha-1year-1 and a peak of Ca+2 uptake by the coffee cherries during 110 to 220 days after flowering.

Biography:

Victor Hugo Ramirez-Builes is a Senior Scientific and coffee crop expert working in the Center for plant nutrition and environment of Yara International. With 21 years of professional experience, conducting research in soil, plant and atmosphere relationships mainly in abiotic stress and nutrition. Last 12 years 100% I was dedicated to conduct research in coffee in several coffee research areas as follow: during 5 years in the National Coffee Research Center-Cenicafé in Colombia in topics related with the coffee crop production and climate stress management with special emphasis in climate variability and last 7 years in Yara in topic related with coffee crop nutrition and coffee productivity, profitability, quality and abiotic stress resistance.

Sustainable Management of Calcareous Saline-Sodic Soil in Arid Environments: the Leaching Process in the Jordan Valley

Mufeed Batarseh

Abu Dhabi Polytechnic, PO Box 111499 Abu Dhabi, UAE

Abstract:

Soil salinity is a major problem facing sustainable development in the agricultural sector in the Jordan Valley and significantly affect its productivity. Removing salts from the root zone can be done by using various methods. Soil leaching is well known to be the most effective procedure, but this requires a large amount of water which is not recommended for a country with scarce water resources like Jordan. Biological methods, such as salt tolerant plants (halophytes) and certain bacterial strains, were reported to be effective in removing salts from the root zone.

A leaching experiment of calcareous saline-sodic soil was conducted in Jordan Valley and aimed to reduce the soil salinity ≤ 4.0 dS m-1. The quantification of salt removal from the effective root zone was done using three treatment scenarios. Treatment A contained soil amended with gypsum leaching with fresh water. Treatments B and C contained non-amended soil, but B was leached with fresh water only while treatment C's soil was washed with saline agricultural drainage water at the start of the experiment and continued with fresh water to reach the desired soil salinity. All treatments were able to reduce the soil salinity to the desired level at the end of the experiment; however, there were clear differences in the salt removal efficiencies among the treatments which attributed to the presence of direct source of calcium ion. The soil amended with gypsum caused a substantial decline in soil salinity and drainage water's electrical conductivity and drained the water twice as fast as the non-amended soil. It was found that utilizing agricultural drainage water and gypsum as a soil amendment

for calcareous saline-sodic soil reclamation can beneficially contribute to sustainable agricultural management Jordan.

Identification, Association of Natural Variation and Expression Analysis of Zm NAC9 Gene Response to Low Phosphorus in Maize Seedling Stage

Javed Hussain Sahito 1*, Xiao Zhang 1, Haixu Zhong 1, Xuan He 1, Chen Zhen 1, Peng Ma 1, Bowen Luo 1,Dan Liu 1, Ling Wu 1, Muhammad Hayder Bin Khalid 2, Hakim Ali Sahito 3, Zeeshan Ghulam Nabi Gishkori 4 , Asif Ali 4 and Shibin Gao 1,

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2 Maize Research Institute, Sichuan Agriculture University, Chengdu 611130, China

3 Faculty of Natural Sciences, Shah Abdul Latif University, Khairpur 66020, Sindh, Pakistan;

4 Rice Research Institute, Sichuan Agricultural University, Chengdu 611130, China

Abstract:

Low phosphorus P stress is a limiting factor in maize production. Improving maize plant tolerance to low P through molecular breeding is an effective alternative to increase crop productivity. This experiment was conducted to identify the favorable alleles and nucleotide diversity of ZmNAC9 in 111 maize inbred lines, which plays an important role in response to low P stress. A significant difference was found under low- and sufficient-P conditions for each of the 22 seedling traits, and a total of 41 polymorphic sites including 32 (SNPs) and 9 (InDels) were detected in ZmNAC9. Among the 41 polymorphic studied sites, a total of 6 sites were highly significantly associated with a diverse number of low-P tolerant root trait index values at $-\log 10$ P = 3.61. In addition, five polymorphic sites (S327, S513, S514, S520, and S827) were strongly significantly associated with multiple seedling traits under low-P and normal-P conditions, most of the sites were associated with root traits. LD was strong at ($r2 > 1.0$). Furthermore, the effect of five significant sites was verified for haplotypes and favorable allele S520 showed a positive effect on the dry weight of roots under the low-P condition. Furthermore, ZmNAC9 was highly induced by low P in the roots of the P-tolerant 178 inbred line and validated by qRT PCR. Moreover, the subcellular localization of ZmNAC9 was located in the cytoplasm and nucleus. Together, the finding of this study might lead to further functions of ZmNAC9 and might be involved in responses to low-P stress in maize.

Keywords: maize; identification; ZmNAC9; association; expression analysis; phosphorus deficiency

Biography:

Dr. Javed Hussain Sahito (Ph.D) Crop Genetics and Breeding, Sichuan Agricultural University, China. Dr. Sahito secured BSc and MSc degree in plant Breeding and Genetics, Sindh Agriculture University, Pakistan. He has awarded a scholarship for higher studies form Sichuan Government China. He has published several research articles in international journals and attended conferences and workshops in China. He actively take a part in various curriculum activities. Having such outstanding academic accomplishments he offers himself as potential candidate for PhD degree. Dr. Sahito is interested in the research field of Molecular biology, Genetics of Crop Plants, and relevant his field.

High Throughout Multi-Omic Characterization of a Solanum Introgression Population Unravels Novel Determinants of the Ripening Process

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5 Department of Plant and Environmental Sciences, University of Copenhagen, Copenhagen, Denmark.
6 Institute for Wine Biotechnology, Faculty of AgriSciences, Stellenbosch University, Stellenbosch, South Africa.
7 Department of Botany, Savitribai Phule Pune University, Pune, India.
8 Department of Plant Breeding, Wageningen Plant Research, Wageningen, the Netherlands.
9 BU Bioscience, Wageningen Plant Research, Wageningen, the Netherlands.
10 Institute of Food Science, Technology and Nutrition, Madrid, Spain.
11 Faculty of Agriculture, The Hebrew University of Jerusalem, Rehovot, Israel.

Abstract:

Wild tomato species represent a rich gene pool for numerous desirable traits lost during domestication. Here, we took advantage of an introgression population representing wild desert-adapted species and a domesticated cultivar to establish the genetic basis of gene expression and chemical variation accompanying the transfer of wild-species-associated fruit traits. Transcriptome and metabolome analysis of 580 lines resulted in the identification of genomic loci associated with levels of hundreds of transcripts and metabolites. These associations occurred in hotspots representing coordinated perturbation of metabolic pathways and ripening-related processes. This study reveals complex interactions between genome, transcriptome and metabolome during tomato fruit ripening, and facilitates the use of wild species for next-generation crop breeding.

Phytochemical and Genetic Characterization of 10 Selected Wild Hop (Humulus lupulus L.) from Italy

Margherita Rodolfi1*, Deborah Beghè1*, Tommaso Ganino1*

1Parma University, Italy

Abstract:

Hop (Humulus lupulus L.), is a dioecious climbing perennial plant grown widely across the Northern Hemisphere (Neve, 1991). Hop is an essential raw material for brewing industry: it impart bittering, enhance beer flavour, and is a preservative and foam stabilizer. The presence of numerous bioactive compounds and antioxidants in hop strobiles, provide pharmacological properties. In particular, xanthohumol, is a strong antioxidant specific of the hop plants (Zanoli and Zavatti, 2008).

The aim of the study is the analysis of the genetic variability of wild Italian germplasm, to find out hop accessions characterized by disease resistances, high level of resins, and essential oils, as well as other traits important for modern hop breeding.

Hop samples were collected from the experimental field. For molecular analyses, the DNA was extracted from leaves according to Belaj et al. (2001). Nine microsatellite primer were used for DNA analyses. For the chemical analysis, HPLC-UV and GC-MS were used to determine bitter acids, xanthohumol and aromatic profile. The

collected data were also analysed using analysis of variance (ANOVA) and principal component analysis (PCA).

The statistical analysis on the genetic results, shown a rich biodiversity in the studied population: every genotype, is genetically different from each other. The chemical analysis, revealed interesting findings: differences in bitter acids compositions, in oil contents and in aromatic profiles, with the presence in some genotypes of bergamotene and trans-β-farnesene, thus characterizing the ecotypes with fresh citrusy and spicy notes. Moreover one accession show significantly high level of Xanthohumol.

Biography:

Belaj, A., Trujillo, I., De la Rosa, R., Rallo, L., & Gimenez, M. J. (2001). Polymorphism and discrimination capacity of randomly amplified polymorphic markers in an olive germplasm bank. *Journal of the American Society for Horticultural Science*, 126(1), 64-71.

Neve R.A. (1991) Hops. Chapman & Hall, London, UK

Zanoli P., Zavatti M., Rivasi M., Brusiani F., Losi G., Puia G., Avallone R., Baraldi M. (2007) Evidence that the β-acids fraction of hops reduces central GABAergic neurotransmission. *Journal of Ethnopharmacology*, 109:87–92.

Isolation of Triterpenes from Boswellia pirottae Resin, Ethiopia

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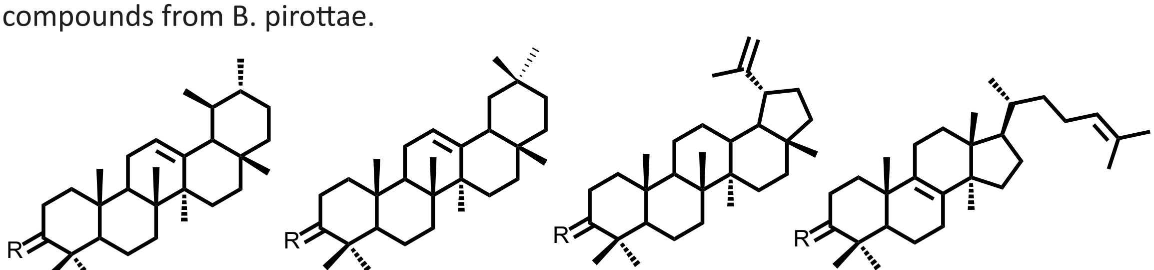
1Wollo University, Ethiopia; 2Addis Ababa University, Ethiopia

Abstract:

This article focused on isolation of compounds from Boswellia pirottae which is endemic to Ethiopia. The isolation and identification of the EtOH soluble constituents of the resin afforded a total of 19 compounds, -amyrone (1), -amyrone (2), lupenone (3) and tirucall-8,24-dienone (4), epi--amyrin (5), epi--amyrin (6) and 3-OH-tirucall-8, 24-diene (7), -amyrin (8), -amyrin (9), 3-OH-tirucall-8, 24-diene (10) and lupeol (11), and eight fatty acid esters (12-19). The structure of isolated compounds was elucidated using spectroscopic techniques. To the best of our knowledge, this is the first report on the isolation and identification of the aforementioned compounds from B. pirottae.



R = O, **1**
R = α-OH, 5
R = β-OH, **8**

R = O, **2**
R = α-OH, 6
R = β-OH, **9**

R = O, **3**
R = β-OH, **10**

R = O, **4**
R = α-OH, **7**
R = β-OH, **11**

Key words: *Boswellia, pirottae, resin, Ethiopia, Abay, Valley, Gibe, river*

Biography:

My name is Sisay Awoke Endalew from Ethiopia, assistant professor of organic chemistry in the Department of Chemistry, Wollo University, Ethiopia. I have been teaching Organic chemistry, Biochemistry, Natural product chemistry, Textile chemistry for both BSc and MSc students learning in different Universities and Colleges of the Ethiopia. All BSc, MSc and PhD specializations were done at Addis Ababa University, Ethiopia, with Excellent

Thesis evaluation. My focus research Thematic are Isolation of biological active compounds from natural sources against human pathogens ; Investigation of natural sources applicable in leather and textile industries ; Formulation of substantial natural flavor from plant materials for food and beverage industries ; Identification of potential resources (limestone, opal, coal, petroleum, Iron ore) in Ethiopia; Characterization of environmental pollutants regarding to water quality. I do have nine publication on different issues regarding my focus area.

E-Poster Presentations

Predicting Wheat Phenology Based on Vrn-1, Ppd-1 and Eps Genes

Mariana Jardón 1*, Santiago Alvarez-Prado 1, 3, Roman Serrago 1,3, Leonardo Vanzetti 2,3, Dionisio Gómez 2, Daniel Helguera 2, Alan Severini 2, Fernanda Gonzalez 2,3, Thomas Perez-Gianmarco 2, Jorge Dubcovsky 4 and Daniel Miralles 1,3.

1 Universidad de Buenos Aires, Facultad de Agronomía, Argentina
2 INTA Instituto Nacional de Tecnología Agropecuaria, Argentina
3 CONICET, Argentina
4 University of California, Davis, CA, United States of America

Abstract:

Major developmental genes Vrn-1 and Ppd-1 are determinants of wheat adaptation to different environments. Such genes play an important role in the crop ability to escape from seasonal abiotic stresses like frosts and extreme temperatures, which are expected to be more frequent in the short term future due to climate change. Therefore, it would be important to develop allelic-based phenological models as a potential tool to design lower costs breeding programs and accelerate the breeding process in a constantly changing climate scenario. With the objective to characterize and associate the phenotypic responses of different combinations of Ppd, Vrn and Eps alleles with the environmental variables that affect phenology in wheat, field trials were performed using a wide range of genetic ideotypes along multiple locations and sowing dates during 2018 and 2019 growing seasons. Based on trial results, we calibrated a marker-based mixed model that predicts heading date using genotypes with different winter, photoperiod and Eps alleles at the Vrn-1 and Ppd-1 loci, and the Eps-1 locus. ANOVA analysis showed that four genes had a statistically significant relationship to predicting wheat phenology: VRN-A1, PPD-B1, PPD-D1 and Eps-1. The gene-based model had a prediction accuracy of 7.5 d using 10-year validation datasets that cover a high latitude and environmental range, thus providing a wide range in temperature and day length gradients. This marker-based model will allow breeders to target gene combinations to current and future environmental scenarios, using simple parameters that are independent of current commercial genotypes.

Biography:

Mariana Jardón studied agricultural engineering at the University of Buenos Aires and is currently completing her PhD in Agricultural Sciences. Also, she works as an Assistant Professor in the Agronomy School of the University of Buenos Aires. Her research work includes understanding how crop development-related genes interact with physiology and designing phenology prediction models for winter cereals, especially wheat and barley.

Effects of Endophytic Pseudomonas spp. from Agave on Crop Growth and Pathogen Resistance

Qiuwei Zhang1*, Kathryn L. Kingsley1, and James F. White1

1Rutgers University, USA

Abstract:

Pseudomonas spp. are common soilborne and endophytic bacteria which have garnered much attention for their ability to colonize root tissues and act as biocontrol agents against pathogenic fungi.

Several fluorescent and non-fluorescent Pseudomonas strains isolated from the seeds of Agave palmeri display remarkable antifungal properties that affect a wide range of fungi, including plant pathogenic fungi such as Fusarium oxysporum and Cercospora spp. Metabolites and volatile organic compounds produced by Pseudomonas spp. were able to inhibit the growth and sporulation of fungi, and some strains were able to colonize and degrade hyphae. Inoculation with an artificial Pseudomonas microbiome was able to eliminate seedling death caused by F. oxysporum in carrots and coriander.

Endophytic Pseudomonas spp. appear to have a broad host range, as they have not caused disease symptoms in any of the crop plants tested so far, including lettuce, celery, maize, and Kentucky bluegrass. Seeds inoculated with the artificial microbiome had faster germination times, but decreased germination rates. Inoculated seedlings grew longer roots that produced greater amounts of root exudates compared to sterile seedlings. This effect persisted even when the seedlings were subjected to pathogen stress and drought stress.

These results indicate that endophytic Pseudomonas spp. from A. palmeri have the potential to be used as fungal biocontrol agents and plant growth enhancers in a non-host-specific manner.

Biography:

Qiuwei is a graduate student in the Department of Plant Biology at Rutgers University. Their research interests focus on desert plant endophytes and how they can be used as plant growth promoters and pathogen inhibitors.

Development of a Protocol for the in Vitro Propagation of Microsorum scolopendria from Spores

Claudia Fassio1*, Maria Jose Marchant 1,2, Paula Molina 1, Miriam Montecinos1, Leda Guzmán 2, Cristobal Balada 2 and Monica Castro 1

1Laboratorio de Propagación, Escuela de Agronomía, Facultad de Ciencias Agronómicas y de los Alimentos, Pontificia Universidad Católica de Valparaíso, Quillota, Chile.
2Laboratorio de Biomedicina y Biocatálisis, Instituto de Química, Facultad de Ciencias,

Abstract:

Microsorum scolopendria better known as "Matu'a pua'a" is an important medicinal fern on Rapa Nui Island and other islands in Polynesia. The presence of high amounts of ecdysteroid (active compound) generate pharmacological effects in mammals/humans, e.g. anabolic, hypoglycemic, hypocholesterolemic, tonic, hepatoprotective, antidepressant, and purgative effects. Propagation of Microsorum is possible by spores and by rhizome cuttings, but both methods show very relatively slow growth. Present study attempts to find an efficient propagation method for this specie based in spore germination and gametophyte development an in vitro condition. Spores of three different colors were harvested: 10YR 7/10, 10YR 6/8 y 5YR 6/12. A proliferation medium composed of mineral salts of Murashige & Skoog medium (MS) + 20 g L-1 sugar + 7 g L-1 agar and pH 5.7 was used. 14 flasks were established for each spore color, making a total of 42 culture flasks. They were

incubated for 90 days at 23ºC and a photoperiod of 16 hours light day-1. Differences in germination were observed according to color. Spores of 5YR 6/12 color germinated 100%. However, the spores of the color 10YR 7/10 did not germinate. When analyzing a germinated 5YR 6/12 colored spore under the microscope, the presence of small leaves and microrhizomes was observed. In addition, it was possible to witness the capsule of the spore that remains after germination. The germination of spores and their maturation to sporophytes were successful. From them, it will be possible to generate mature fern of M. scolopendria.

Biography:

Phd Researcher and Extension Specialist:

-Plant propagation

-Plant Physiology and Tree Fruit production.

-Subtropical crops and native medicinal plant.

Temporary Immersion System to Suitable in Vitro Production of Curcuma longa from Rapa Nui Island

Monica Castro 1*, Maria Jose Marchant 1,2, Paula Molina 1, Miriam Montecinos1, Leda Guzmán 2, Cristobal Balada 2 and Claudia Fassio1

1Laboratorio de Propagación, Escuela de Agronomía, Facultad de Ciencias Agronómicas y de los Alimentos, Pontificia Universidad Católica de Valparaíso, Quillota, Chile.
2Laboratorio de Biomedicina y Biocatálisis, Instituto de Química, Facultad de Ciencias,

Abstract:

Curcuma longa (C. longa) is a tropical plant belonging to the Zingiberaceae family. The rhizomes of C. longa (fresh or processed) are widely used for their therapeutic and protective properties. Actually "Pua" is a species classified as vulnerable to extinction in this fragile ecosystem. The micropropagation method by a temporary immersion system (TIS) was established to improve the in vitro production of C. longa from Rapa Nui island. As culture medium, Murashige & Skoog medium (MS) + BAP was used for multiplication for 60 days and MS + ANA for rooting for 15 days. The treatments used consisted of evaluating the number of explants (20, 30 or 40) per flask. Cultures were maintained at 23 °C with 16 hours photoperiod light / day, and 6 dives 4 minutes each were performed daily. After the growth and rooting period, the fresh biomass of explants, consumption of culture medium and proliferation rate were determined. The results show that with 30 explants per flask, a greater number of plants and higher fresh biomass are produced compared to those with 20 and 40 explants per flask. The proliferation rate decreases as the number of explants increases. Our results suggest that the ideal quantity is 30 explants per flask since an average consumption of 6 mL of culture medium per explant is obtained and a higher average plant biomass.

Biography:

Professor and Specialist:

-Plant propagation

-Tissue culture.

-Subtropical crops and native medicinal plant.

Anitichilamydial Activity of Hydrocotyle bonariensis LAM

Alejandra Catalano1*, Andrea Entrocassi2 , Adriana Ouviña1 , Marcelo Rodriguez Fermepin2 , Paula López1

1Cátedra de Farmacognosia, Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires, Argentina, 2Cátedra de Microbiología Clínica, Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires, Argentina.

Abstract:

Leaves of Hydrocotyle bonariensis Lam. (Araliaceae) are used in ethnomedicine to heal wounds, as inflammatory and to treat skin eruptions. The infusions of the aerial parts are used as diuretic, stimulant, emmenagogue and antiseptic. Chlamydia trachomatis causes one of the most prevalent sexually transmitted infections in the world, and treatment failures have been observed. Objective: Evaluate the in vitro antichlamydial activity of the methylene chloride extract (CH2Cl2) of H. bonariensis. Experimental: Extract and Fractions tested: CH2Cl2 maceration of aerial parts of H. bonariensis and fractions obtained by chromatography; FE: Silicagel, FM: hexane, CH2Cl2, ethyl acetate and methanol. Cell viability: reduction of 3- (4,5-dimethylthiazol-2-yl) -2,5-diphenyltetrazolium bromide. Antichlamydial activity: C. trachomatis L2/434/Bu strain was used on LLC-MK2 cell culture under five different conditions: pre-incubation of the cell culture with the extract or fractions before Chlamydia infection; preincubation and inoculation with the extract or fractions; inoculation with the extract or fractions; inoculation and 48 hours after incubation with the extract or fractions, 48 hours after incubation with the extract or fractions. Results and Discussion: CH2Cl2 extract showed inhibitory effect (90%-100%) when added after inoculation, during the inclusion growth stage. This could be due to its interference with cellular metabolic pathways related to the development of chlamydial inclusion. The 1HNMR of the extract showed signals of lipid or cerebroside fatty acids, aromatic phenolic compounds, phytosterols, methyl triterpenes and cerebrosides. After bioguided fractionation by activity a bactericidal fraction (100 µg/mL) was obtained. Conclusion: CH2Cl2 extract of H. bonariensis has bactericidal activity against C. trachomatis. Biography -Gallo Vaulet, M.L.; Entrocassi, A.C.; Corominas, A.I.; Rodríguez Fermepin, M. 2010. Distribution study of Chlamydia trachomatis genotypes in symptomatic patients in Buenos Aires, Argentina: association between genotype E and neonatal conjunctivitis BMC. Research Notes, 3: 34. -Toursarkissian, M. 1980. Plantas Medicinales de la Argentina. Ed. Hemisferio Sur, Buenos aires, 131pp.

Root Architecture and Functional Traits of Spring Wheat Under Contrasting Water Regimes

Abdelhalim

Talca university, Chile

Abstract:

Three-year trials (2015, 2016, and 2017) were conducted in 160 cm length tubes on a set of 15 spring wheat (Triticum aestivum L.) genotypes under contrasting water regimes. The main study objectives were: (1) to assess genotypic variability in root weight density (RWD) distribution in the soil profile, biomass partitioning, and total water used; and (2) to determine the oxygen and hydrogen isotopic signatures of plant and soil water in order to evaluate the contribution of shallow and deep soil water to plant water uptake and the use of these isotopes as a surrogate for plant transpiration. In the 2015 trial under well-watered (WW) conditions, the total root biomass and the RWD distribution in the soil profile were significantly different among 15 wheat genotypes. In 2016 and 2017 trials, a subset of five genotypes from the 2015 trial was grown under WW and WL regimes. The water deficit significantly reduced AB only in 2016. The water regimes did not significantly affect the root biomass and root biomass distribution in the soil depths for both the 2016 and 2017 trials. The study results highlighted that under a WL regime, the production of thinner roots with low biomass is more beneficial for increasing the water uptake than the production of large thick roots. The models applied to estimate the relative contribution

of the plant's primary water sources were not efficient. On the other side, the combined information of root architecture and the leaf stable isotope signatures could explain plant water status.

Acclimatization Ex Vitro of Avocado´s Rootstock (Persea americana Mill.) in Comercials Planting

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1Corporación para investigaciones biologicas -CIB, Colombia
2University of Antioquia, Colombia
3University of Antioquia, Colombia

Abstract:

One of the most significant limitations in the production chain of avocado (Persea americana Mill.) in Colombia is the selected rootstock material deficiency and its clonal propagation at scale to supply cultivators. Field establishment of cloned rootstocks in vitro is a valuable strategy to improve productivity and efficiency in harvests. The final phase of micropropagation (acclimatization or hardening) is crucial to moving from the laboratory to the field. To increase the survival and strength of the seedlings at this stage, it is proposed in this research, to determine the effect of different substrates and microorganisms that promote plant growth and development. The sterile substrates used were: coconut fiber, coconut fiber: sand (2: 1 p / p) and coconut fiber: chicken manure (1: 0.005 p / p). Additionally, the effect of a consortium of Mycorrhizae (250 spores/g), Serratia marcescens (1x104 CFU/mL), and Trichoderma harzianum (1x104 spores/mL) was assessed. The variables evaluated three months after transplantation were: plant length, number of leaves, number and length of roots. An entirely randomized experimental design with two factors was used. The results obtained indicate that the coconut substrate with a survival percentage of 74.1% facilitates the development of the plant without requiring the addition or mixing of the assessed microorganisms ($p < 0.05$). No significant statistical differences were found between the substrates and the microorganisms assessed. To conclude, the method used allowed the ex vitro adaptation of a selected "criollo" rootstock.

Biography:

Lina María Arbelaez is a colombian reseacher at the Corporación para Investigaciones Biologicas -CIB. Studied at the colegio mayor de Antioquia, Universidad Nacional de Colombia, and Universidad de Antioquia. She belongs to the group of phytosanitary and biological control of CIB. She has expertise in microbiology and micropropagation of differents crops. she works a research project in various institutions. His present research interest includes phytopathology and biotechnology plant.

Response of Wheat Towards Abiotic (Salinity) & Biotic (Bipolaris Sorokinia) Stresses Solely and Simultaneously at Physiological, Biochemical and Molecular Levels

Mohammed Obied Alshaharni

Newcastle University, United Kingdom

Abstract:

Abiotic stress such as drought, heat, cold and salinity are major factors in reducing crop productivity. Salinity stress is one of the major hurdles in the agricultural sector, significantly decreasing crop yield. Wheat is an important cereal crop and a staple food source globally. Increasing salt tolerance in wheat is crucial for food production and security. The study of the effect of salinity on the physiology and biochemistry of wheat helps us to understand

how wheat responds in salty conditions. More importantly, one of the components involved in wheat's response to salinity is the transcription factors, which are DNA-binding proteins, which play an important role in the regulation of gene expression. WRKY genes have been studied in the regulation of abiotic and biotic stresses. The aim of the current study is to investigate wheat's response to salt stress at physiological parameters, with its biochemical changes, along with the regulation of transcription factors genes, which are affected by high levels of salt stress

Biography:

I am Mohammed Obeid Alshaharni and I'm originally from Saudi Arabia. I'm working in King Khalid University (Department of Biology) in Saudi Arabia. I had my bachelor's degree in general biology at King Khalid University, I conducted my Master's Degree in Science College at Missouri State University in U.S. Currently, I am a full time Ph.D. student at Newcastle University

Nano-Silver Particles Reduce Contaminations in Tissue Culture but Decrease Regeneration of Aldrovanda Vesiculosa Explants

Marzena Parzymies*, Magdalena Pogorzelec, Barbara Banach-Albińska, Barbara Marcinek

University of Life Sciences in Lublin, Poland

Abstract:

Aldrovanda vesiculosa is a carnivorous water plant endangered by extinction worldwide. The number of natural stands and populations constantly decreases; therefore, there is a need for active protection. Due to the low availability of plant material, it seems that the best method would be a tissue culture propagation. It would allow to obtain a lot of plants in a relatively short time, but initiation of in vitro cultures of aldrovanda is difficult and the main problem is disinfection of explants. Therefore, it was decided that we should treat the explants with nano-silver particles, which is recognized as a very promising disinfectant. The explants were shoot fragments which were treated with sodium hypochlorite and then placed in a liquid 1/5 MS medium, supplemented with silver nanoparticles (AgNPs) at a concentration of 5 mg·dm−3 or without the addition of the AgNPs. It was observed that AgNPs reduced the number of contaminations but also led to necrosis of the shoots. The shoots, which undertook regeneration in presence of AgNPs, were smaller and did not form traps; however, after being moved to fresh media twice, they started to develop normal leaves. Taking into consideration both disinfection and regeneration rates, it might be advisable to disinfect aldrovanda shoots in sodium hypochlorite only, without AgNPs. The results of the research might indicate a toxic activity of AgNPs towards water plants, which seems a big problem, as nanoparticles are commonly used in all the fields of life.

Biography:

Marzena Parzymies,PhD, scientific interests: tissue culture of ornamental plants and endangered species, ornamental plants, horticulture, floristry.

This research was funded in part by the European Union through the Infrastructure and Environment Operational Programme, project title: Ochrona czynna aldrowandy pęcherzykowatej (Aldrovanda vesiculosa na terenie Lubelszczyzny (Active conservation of Aldrovanda vesiculosa in Lubelszczyzna region), no. POIS.02.04.00-00-0034/18.-

Heat Stress at the Time of Meiosis Triggers Cytoskeletal Alterations and Severely Reduces Fertility and Grain Yield in Wheat

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Department of Biological Resources, Agricultural Institute, Centre for Agricultural Research, ELKH, Martonvásár, Hungary

Abstract:

Extreme weather events, such as heat waves occur more and more frequently in the world, exerting increasingly negative impact on agriculture. Reproductive processes, such as meiosis and the following micro- and macrogametogenesis are especially vulnerable to high temperature stress. Disturbances during these phenophases frequently lead to decreased seed number, which takes the most significant negative impact on the yield. Effects of heat stress on the fertility, grain yield and cytoskeletal organization during meiosis were studied in our experiments. Heat stress (constant 35 ˚C for 24 hours at the time of meiosis) was applied on plants of Mv 17-09, a Hungarian winter wheat genotype. Microtubules were labelled using indirect immunofluorescence, while actin filaments were visualized by fluorescently labelled phalloidin. Microscopic analysis of male meiocytes revealed that heat stress induced various alterations in the cytoskeletal structure. Dissociation of microtubules and defective spindle formation occurred after heat stress. Actin filament disintegration and the appearance of actin rings were common after treatment. These changes triggered various defects during the meiotic process, such as generation of micronuclei, displacement of meiotic plane and uneven movement of chromosomes. Stress treatment significantly decreased the fertility of main spikes by 40%. We found a strong positive correlation between fertility and grain yield per spike. Our results confirm that the sensitivity of meiotic processes to heat stress may be a significant yield limiting factor in wheat, and suggest the critical importance of cytoskeletal network in gamete formation.

Our studies were financed by the grant NKFIH-OTKA FK 134992.

A Comparative Study of Soil and Foliar Nickel Application on Growth, Yield and Nutritional Quality of Barley (Hordeum vulgare L.) Grown in Inceptisol

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Abstract:

Nickel (Ni) deficiency was progressively increases under intensively cultivated agricultural lands. As Ni was a costly input for crop production, therefore the judicious application of it needed to address the Ni deficiency most economically and effectively. Thus, the present field experiment was undertaken to evaluate the crop responses on soil (SA), foliar (FA) and combinations of these two methods of Ni application on growth, yield, nutritional quality and bio-chemical properties of soil using barley as a test crop. Foliar application of 0.2% NiSO4 significantly enhanced growth, yield and nutrients concentration in grain as compared to SA. The highest grain and straw yield was in 5.0 kg SA Ni ha-1 + 0.2% FA of NiSO4 but it was statically at par with 0.2 % FA of NiSO4. The maximum bacterial population was observed with 5 kg SA Ni ha-1, whereas actinomycetes population in 7.5 kg SA Ni ha-1. Moreover, a higher dose of Ni had a synergistic effect on the fungal population and urease activity. It was therefore recommended that 0.2% FA of NiSO4 has been applied to resolve the challenge of Ni deficiency in crop production relative to its soil application.

Keywords: Growth attributes; micronutrient concentration; microbial population; urease activity; yield

Green Extraction Processes for High-Value Bioactive Compounds from Plants: Theory and Practice

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Abstract:

Nowadays, medicinal plants are still the first reservoir of new drugs. Considered as an important source of essential raw material for the discovery of new bioactive compounds, plants contain a large variety of biomolecules (peptides, polyphenols, alkaloids ...). Over the last few years, natural substances have become gradually more and more important in many areas. Indeed, the awareness of the consumers and their reticence to consume manufactured products containing synthetic molecules led a number of industrial sectors (cosmetics, pharmaceuticals) to gradually incorporate these natural molecules in their drugs formulation. In order to be valorized, bioactive compounds must first be separated from their original plant matrix. Obtaining these biomolecules often requires many lengthy and expensive steps, such as extraction. One of the major challenges of process engineering consists in technological innovation involving the development of “green” methodologies of extraction, with rapid separation, miniaturization, and coupling with other steps. In this context, the purpose of this work is to update the technical information on extraction mechanisms, their advantages and disadvantages, and efficiency factors. It also compares the applications of modern green extraction techniques: supercritical fluid extraction (SFE), deep eutectic solvent extraction (DES), ultrasonic assisted extraction (UAE), microwaves (MAE), alternatives to conventional extraction methods as soxhlet, and maceration. These techniques are promising for the extraction of bioactive molecules thanks to their advantages compared to the conventional methods: reduction of solvent volumes used, time and energy consumption in addition to their higher recovery rates with lower operational costs. To explore their extensive applications on an industrial scale by overcoming technical barriers in emerging global markets, future researches are required for improving both the understanding and the design of modern extraction operations.

Keywords: deep eutectic solvent (DES), microwave-assisted extraction (MAE), supercritical fluid extraction (SFE), ultrasound-assisted extraction (UAE), maceration, Medicinal plants.

Phenotyping and Genotyping of Tomato Thermotolerant Lines to Get Heterotic Hybrids for Yield-Related and Fruit Quality Traits

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Abstract:

High-temperatures and climate change strongly affect tomato cultivation in terms of fruit quality and yield performances. Facing this issue, the present work aimed at characterizing parental lines to get F1 hybrids that could display heterotic effects in yield-related traits under high-temperatures. Fifteen genotypes previously selected for heat-tolerance and/or good quality traits were evaluated for yield-stability in five different locations of South-Italy, usually characterized by high-temperatures during the growing season. Various yield-related traits were evaluated, such as fruit set, number of fruits per plant and fruit weight. The statistical analysis performed on data collected from five experimental fields allowed to establish five genotypes showing high and stable

yield performances under high-temperatures, whereas other five exhibited good stability but combined with lower yield values. Three of the best performing genotypes in terms of yield-stability also showed good fruit quality traits, such as total soluble solids and titratable acidity. Using datasets retrieved from SolCAP SNP array and Genome-by-sequence genotyping analyses, an Identity-by-State score (IBS) was calculated to estimate the genetic distance among the genotypes. For most comparisons, the IBS values were higher than 90% in both the datasets, and they were lower than 76% when involving three genotypes, and deeply decreased to 54% when including two other genotypes, indicating that they were the most genetically distant respect to each other. The phenotypic and genotypic analyses carried out allowed selecting the best suitable parental genotypes to obtain thirteen heterotic F1 hybrids that are being evaluated for yield-related and fruit quality traits under hightemperatures.

Biography:

Salvatore Graci is a Ph.D Student at University of Naples “Federico II” in Sustainable Agricultural and Forestry Systems and Food Security, under the supervision of Prof.ssa Amalia Barone. The work of the Ph.D course is focus around using high throughput genotyping platforms to assist the selection of the best parental lines and heterotic hybrids in tomato.

Encapsulation of cv. “Columbus” Microcuttings: A Valid Technology for hop Propagation

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Abstract:

The spreading of hop cultivation all over the Italian territory, mainly due to the increasing interest in craft beers, led hop growers to face a big problem: the nursery material supplying; indeed, in Italy, very few are the nurseries specialized in hop plant commercialization. Traditionally, hop is propagated by cuttings, suckers, rhizomes; in vitro tissue culture, among the most recent biotechnological methods, could be both a valid alternative to traditional propagation and an efficient support for nurserymen, in order to increase hop supplying. Actually, in vitro propagation allows mass and clonal production of true-to-type plants, aseptically, in a small space and regardless of seasonality. Among tissue culture techniques, synthetic seed technology has proven to be an innovative strategy to propagate and preserve several plant species. In this study, a valid protocol for hop, cv. “Columbus”, encapsulation has been set up. As previously reported for another hop genotype, also cv. “Columbus” well responded to the encapsulation procedure, with encapsulated microcuttings maintaining their viability during the culture time; moreover, a strong influence on regrowth and conversion of 6-benzyl aminopurine concentration in the culture medium was observed. Results reported in this study represent a step forward in the application of encapsulation technology to the hop propagation, giving new insights about potentials and limitations of this technique. For these reasons, it will be necessary to carry out further studies, in order to acquire better outcomes in terms of vitality and recovery for future uses in nurseries.

Biography:

Prof. Benedetta Chiancone, Ph.D. in Horticulture at the University of Palermo, is Associate Professor at the Department of Food and Drug (University of Parma, Italy). Prof. Chiancone developed her expertise in breeding and propagation of several horticultural crops (Citrus spp, olive, cherry, loquat, apricot, hop and hazelnut), through traditional and biotechnological methods. Moreover, Prof. Chiancone is interested on studying the influence of in vitro culture conditions on secondary metabolite synthesis, to exploit vitro-derived plant material as bioactive compound source, with applications in pharmaceutic

An Endangered Species of Drypetes (Putranjivaceae) Discovered by J. Léonard in the Democratic Republic of the Congo

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Abstract:

During his stay in Yangambi in the 1940s, the Belgian botanist J. Léonard collected a species of the genus Drypetes endemic to the Democratic Republic of the Congo. He named it D. morocarpa on herbarium labels, but never published it. The present study is based on the revision of 26 collections of D. morocarpa. Morphometric measurements on herbarium specimens belonging to the new species and its closest relatives in Drypetes were carried out in order to describe this new species. We describe here D. morocarpa J.Léonard ex D.J.Harris & Quintanar. It is easily recognisable by its blackish twigs and young branchlets, orbicular stipules, leaf blades usually entire, and hard fruits, covered with irregular protuberances. It has been collected in two areas along the course of the Congo river or its tributaries. A differential diagnosis, a detailed morphological description, a key to distinguish it from the most similar species, an illustration and all the available information about its habitat, distribution and conservation status are provided. This work was published in the scientific journal Plant Ecology and Evolution 153 (2): 312–320 (2020).

Biography:

I investigate the biology of the genus of tropical trees Drypetes (Putranjivaceae) in Africa and the systematics within the grass subfamily Pooideae. I use plant morphology and phylogenetics to perform reviews of the aforementioned groups, solve their taxonomic problems and describe their diversity. I am particularly interested in the African flora and its conservation.

Metabolites and Mineral Nutrient Profiles of Maize Roots Upon Soil Exposure to Zerovalent Iron Nanoparticles

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Abstract:

Nanoscale zero-valent iron (nZVI) has been widely applied in the environmental field to degrade organic pollutants. The potential risk posed from nZVI on crop species is not well understood and is critical for sustainable application in the future. In this study, maize (Zea mays L.) plants were cultivated in field soils mixed with nZVI at 0, 50, and 500 mg/kg soil for four weeks. Upon exposure to 500 mg/kg nZVI, ICP-MS results showed that Fe accumulated by roots and translocated to leaves was increased. At 50 mg/kg, root elongation was enhanced by treatment; at 500 mg/kg, pigments, lipid peroxidation, and polyphenolic levels in leaves were also increased, whereas the accumulation of Al, Ca, and P were decreased. A GC-MS based metabolomics analysis of maize roots revealed that antioxidants and stress signaling associated metabolites were downregulated at 50 mg/kg, but were upregulated at 500 mg/kg. At 50 mg/kg, the content of glutamate was increased by 11-fold, whereas glutamine was decreased by 99% with respect to controls. Interestingly, eight metabolic pathways were disturbed at 50 mg/kg, but none at 500 mg/kg. This metabolic reprogramming at the lower dose represented potential risks

to the health of exposed plants, which could be particularly important although no phenotypic impacts were noted. Overall, metabolites analysis provides a deeper understanding at the molecular level of plant response to nZVI and is a powerful tool for full characterizing risk posed to crop species as part of food safety assessment.

Biography:

Dr. Yi Wang obtained her Ph.D, in Chemistry from the University of Texas at El Paso in 2020. She then joined the Connecticut Agricultural Experiment Station, Analytical Chemistry Department as a Post-doc under the supervision of Dr. Jason C. White and Dr. Wade Elmer. Her research experiences include the application as well as impact of nanotechnology in agricultural field, especially with the plants of their elemental accumulations, yields, fruit nutritional qualities and enzyme activities; the effects of engineered nanoparticles on the suppressing of plant disease; the analysis of plants and other environmental samples on the molecular level, using spectroscopy and microscopy techniques, such as ICP-OES, UV-VIS, SEM, LC-MS, GC-MS and RT-qPCR; statistical analysis for genomic and metabolic data.