Scientific Tracks & Sessions
November 15, 2018

Plant Science 2018
Natural Medicine 2018





Joint Event
International Conference on
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Natural Products, Medicinal Plants and Traditional Medicines
November 15-16, 2018 | Paris, France

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Electrical stimulation of *Arabidopsis thaliana*

Diane Krill
Point Park University, USA

Plants respond to their environment in a multitude of ways. In our first report, we described a rapid movement response that occurred in plants without any physical contact with the seedlings based on electric charge. Experiments with genetically altered seedlings followed to isolate the pathway required for movement. Three varieties of seeds were planted in the laboratory under sterile conditions. After 5-10 days the seedlings were tested for their response to electric field stimuli, and video responses were recorded with the fluctuation in the electric field measured with an oscilloscope. Mutants of *A. thaliana* from ABRC tested included Jasmonate Resistant 1 (JAR1), which lack a functional synthetase in the jasmonate signalling pathway, and NHX7/SOS1, which contain homozygous mutagenized alleles for the Na+/H+ antiporter. Wild type (wt) (Col-1) from ABRC and mutant seeds were grown on low K+ media to support the growth of the hypersensitive NHX7/SOS1. Plant seedlings of wt *Thymus vulgaris*, *Arabidopsis thaliana* and *Mentha spicata*, starting at the 2-3 leaf stage, were capable of msec movement responses to objects that conveyed an electric charge. Movement responses were observed in 50% of wt Col-1 seedlings plated in low K+ media compared to 87% response of wt in regular salt media. The response rate was 18% for NHX7SOS1 and 24% for JAR1. Both types of genetically altered seedlings had a lower level of responsiveness compared to wt *A. thaliana*. Reduced responsiveness in JAR1 and SOS1 seedlings may be the result of seed genotype mixing, or crossover required between signalling pathways.

Speaker Biography

Diane Krill completed her Ph.D. in Developmental & Molecular Biology from Case Western Reserve University in Cleveland, Ohio. Her postdoctoral studies and an M.P.H. were completed at the University of Pittsburgh Graduate School of Public Health. She is currently a professor of biology at Point Park University in Pittsburgh, USA. The majority of her research publications involve the tumour microenvironment and angiogenesis as it relates to cancer. She successfully isolated a plant compound with therapeutic potential that prevents new blood vessel development in vivo in zebrafish, and in human stem cells. The plant assay system used to establish the effects of the plant compound on vascular tissue led to the study of electrical stimulation in the plant model, *Arabidopsis thaliana*. She is a member of the American Association for Cancer Research, the MS Society, and serves as a reviewer for the Journal of Cancer & Nutrition, Ethnopharmacology and other journals.

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Notes:

Assessment of Agro Biodiversity through the foldscope

Jayateertha Diwan, Kashappa Chikkanaragund, Suma TC, Mahadevaswamy Y S, Amaresh P R Badariprasad and **R Lokesh**
University of Agricultural Sciences, India

The study on Agrobiodiversity is important in the present context of Climate change as it helps to develop genotypes which are resilience to climate change. This helps to design climate smart plants. Agrobiodiversity includes the variability among living organisms contributing to food and Agriculture. This includes diversity within species, between species and of ecosystems. Foldscope is the low cost paper microscope which is durable, portable with magnification of 140X and 2 micron resolution. This is invented by Manu Prakash and Jim Cybulski from Stanford University, USA. The Foldscope can be used to study and understand biodiversity in crop plants, microbes and insects. This also helps in educating students and to design research strategies to meet desired goals.

In the present experiment we are trying to study the variability present in cereals, pulses, oilseeds and commercial crops for various parameters like Seed morphology, Seedling characters (root, shoot, pigmentation), Leaf characters (Leaf serration, Leaf sheath), Flower characters (Calyx, Corolla, Androecium, Gynoecium) and special features. The variability is an important part of genetic resources, which enables breeders to exploit it for interested trait and in desired direction for crop improvement all over the world. Presently, we are carrying out investigations on rice varieties for their root hair characteristics and quantified it using Foldscope. The observations were recorded for root hair length and density/mm2 for different rice varieties revealed existence of variability which can be utilised to study nutrient and water use efficiency. Similarly, other crop parameters will be studied. The variability is also being studied in microbes, disease causing pathogens and in insects for various parameters like insect morphology, anatomy, taxonomy, insect resistant and susceptible plants. It would be a significant contribution if we utilise the variability assessed through Foldscope in crop improvement, to study plant microbe interaction and to obtain insect resistant plants, which will help in better food and better Agriculture in the changing climate scenario.

Speaker Biography

Jayateertha R Diwan is currently working as Assistant Professor of Genetics and Plant Breeding at the University of Agricultural Sciences, Raichur, Karnataka, India. He has completed his Master's in Agriculture in Genetics and Plant Breeding from the University of Agricultural Sciences, Dharwad, INDIA. He worked as Scientist- Project Lead at the Barwale Foundation, Hyderabad and presently serving as Assistant Professor (Sr. Scale) at the University. He is awarded or honoured by National Merit Scholarship and Council of Scientific and Industrial Research (CSIR), Senior Research Fellowship. He is presently handling Department of Biotechnology (DBT), Govt. of India sponsored project and he also participated in International conferences.

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Management of post harvest microbial decay of banana

Raghavendra K Mesta
University of Horticultural Sciences, India

A study was conducted to check the efficacy of different post harvest treatments including sanitizers and bio agents on the quality and microbial load on banana fruits. Being a climacteric fruit crop, banana suffers with shorter shelf life with loss of appearance and microbial infections under ambient conditions. The fruits were subjected to washing treatments for 5 minutes using aqueous ozone, hydrogen peroxide, sodium hypochlorite, calcium hypochlorite, Trichoderma and Pseudomonas solutions and then stored under ambient condition for 6 days. Significantly minimum physiological loss in weight was recorded in sodium hypochlorite and aqueous ozone (14.23 and 14.28 per cent), minimum total soluble solids was in sodium hypochlorite and calcium hypochlorite (22.38 and 22.630 B), minimum respiration rate in sodium hypochlorite and calcium hypochlorite (62.23 and 60.40ml CO2/kg/hr) and minimum titratable acidity in sodium hypochlorite and calcium hypochlorite (0.63and 0.62 per cent) compared to untreated fruits. Significantly minimum microbial load for both fungi and bacteria are recorded in Pseudomonas and Trichoderma treated fruits. Highest sensory scores (7.00) were observed in the fruits treated with aqueous ozone.

Speaker Biography

Raghavendra K Mesta did his Ph.D. from University of Agricultural Sciences, Dharwad, India. He is presently serving as Professor and Head, Department of Plant Pathology, University of Horticultural Sciences, Bagalkot, India. He has published more than 50 papers in reputed journals.

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Phytochemical composition and biological properties of a hydroalcoholic extract obtained from the aerial parts of *Matthiola incana* (L.) R. Br. (*Brassicaceae*) growing in Sicily

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In continuation of our studies on species belonging to the Brassicaceae family growing in Sicily (Italy), this work aimed to characterize the phenolic profile and the volatile constituents and to evaluate some biological activities of a hydroalcoholic extract (80% methanol) obtained from the aerial parts (leaves and flower buds) of *Matthiola incana* (L.) R. Br. grown wild around Capo D'Orlando (Messina, Sicily) The HPLC-PDA/ESI-MS analysis led to the identification of twelve phenolic compounds, two phenolic acid derivatives (5.46 mg/g extract) and ten flavonoids (155.85 mg/g extract), being luteolin-glucoside the most abundant component (57.07 mg/g ± 0.87% RSD). By SPME/GC-MS fifty-one volatile constituents were fully characterized, and (Z)-9-Octadecen-1-ol turned out to be the most abundant one (24.35%). The antioxidant potential of *M. incana* extract was evaluated by in vitro methods based on different approaches and mechanisms: DPPH, reducing power, and ferrous ions chelating activity assays. The extract exhibited mild activity both in the DPPH and reducing power assays, whereas it was found to possess good chelating properties, reaching approximately 90% activity at the highest tested dose (2 mg/mL). In order to investigate the antioxidant efficacy of *M. incana* extract in a biological setting, the ability to protect bacterial growth and survival from the oxidative stress induced by hydrogen peroxide (H2O2) was evaluated on *Escherichia coli*. The extract displayed protective effect against H2O2-induced oxidative damage. The antimicrobial activity of *M. incana* extract against selected bacteria and yeasts were assayed by standard methods. The extract didn't show activity against the tested strains (MICs > 500 µg/mL). Finally, the potential toxicity was investigated using *Artemia salina* lethality bioassay. The median lethal concentration value indicated that the extract did not display any toxicity against brine shrimps (LC50 > 1000 µg/mL).

Speaker Biography

Maria Fernanda Taviano obtained the following academic qualifications at the Faculty of Pharmacy of the University of Messina (Italy). Specialization degree in Pharmacognosy; PhD in Pharmacognosy; 1st level Master degree in Applied Biotechnology. She has been research grant holder for a period of four years. Currently, she is RTD-A Researcher (SSD BIO/15 - Pharmaceutical Biology) at the Department of Chemical, Biological, Pharmaceutical and Environmental Sciences of the University of Messina. She is Editorial Board Member of the scientific international journal "Pharmacognosy Magazine". Her scientific research activity is mainly focused on the phytochemical study and the evaluation of "in vitro" and "in vivo" biological properties of active products from plant sources, obtainable also by means of "in vitro" culture systems.

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Annual variation in the production of Boeravinone B in different plant parts of *Boerhaavia diffusa* L. - A medicinally important herb

Sharada Mallubhotla and **Savita Sharma**
Shri Mata Vaishno Devi University, India

Boerhavia diffusa (Nyctaginaceae) commonly known as Punarnava is a widely distributed herb that has been naturalized in many areas of the world. It is used for the treatment of various ailments by Indians, particularly tribal people as mentioned in Ayurveda, Charaka Samhita and Sushrita Samhita. Punarnava has many ethnobotanical uses (used as a green leafy vegetable, root juice is used to cure asthma, urinary disorders, leucorrhea, rheumatism, encephalitis, etc.) due to the presence of its valuable phytochemical constituents. Moreover, due to the presence of polyphenols and flavonoids, clinicians and scientists have examined it extensively to gain more insight into the biological and medicinal properties, amongst which Boeravinone B a potent flavonoid is responsible for its pharmacological activities. A study was performed for the identification and quantification of Boeravinone B throughout the year on a monthly basis using different parts of this useful species grown under field conditions by using HPTLC analysis. Variation in the content of Boeravinone B were observed throughout the year and maximum yield of metabolite was obtained in the month of July, which is also the ideal time for the growth and proliferation of this plant species. The study indicates a correlation of the availability of the metabolite with the various developmental stages of the plant. Among the different individual plant parts analyzed, the highest concentration was recorded in the roots followed by leaves and the least concentration was recorded in the defoliated stem parts of the plants species. These results signify the therapeutic potential of herb and the collection times for maximum availability of phytochemicals. The details shall be discussed and presented.

Speaker Biography

Sharada Mallubhotla from Punjab University, Chandigarh, India, is presently Academic Coordinator for School of Biotechnology at Shri Mata Vaishno Devi University, India. She has authored 26 publications, two books well cited over 175 times, and is serving as editorial board member of reputed Journals. Her research interests include production and manipulations of bioactive phytochemical metabolites from cell and organ cultures, micropropagation, medicinal plant conservation Biotechnology, Genetic engineering of medicinal plant species and Orchid Biotechnology. Currently she is working on application of bioreactor systems for production of plant bioactives, value additions through biotic and abiotic elicitation in plant cultures.

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Strategies and Priorities in Trees' Reproductive Allocation

Eliezer E Goldschmidt
The Hebrew University of Jerusalem, Israel

The survival of an individual tree does not depend upon sexual reproduction. Yet, the long term persistence of tree species requires an effective, asexual or sexual, means of reproduction. In the wild, most tree species reach reproductive maturity after a several decades of juvenility and even then, sexual reproduction appears sporadically, often in a mode of masting. Estimates of the reproductive allocation (= the percentage of annual photosynthate diverted towards sexual reproduction) in forest trees indicates a slow, gradual increase which may reach 50% in 'mast' years, but, on the average does not exceed 20%. The situation is different, however, in certain subtropical and tropical fruit trees(Citrus, Olive, Mango, Avocado), which invest a tremendous amount of resources in profuse flowering and fruiting. The reproductive allocation of a grapefruit tree has been evaluated as 79%. Some Citrus cultivars may collapse as a result of fruit overload and exhaustion of carbohydrate reserves. The rationale underlying this behavior might be that in their natural, original habitats these trees are exposed to environmental stresses, in particular drought, that threaten their survival. Thus, they divert all their resources towards sexual reproduction which is their highest priority. On the other hand, the survival of the aforementioned temperate and boreal forest trees is not endangered by environmental stresses; vegetative growth is their first priority and they maintain, on the average, a more moderate reproductive allocation.

Speaker Biography

Eliezer E Goldschmidt was born in Jerusalem, Israel, in 1938. He received a Ph.D. degree in 1968 from the Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem. Since 1983, he has been a Professor of Horticulture in the Institute of Plant Sciences and Genetics in Agriculture, The Hebrew University of Jerusalem. His primary areas of research include growth regulators, tree productivity, alternate bearing, carbohydrate management, fruit ripening and senescence in citrus, and citron physiology. Over 200 publications in Scientific Journals. With Prof. Pinhas Spiegel-Roy, he has co-authored 'The Biology of Citrus', Cambridge University Press, 1996.

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Molecular evaluation of telomerase activity in sunflower under various salt stress conditions

Maryam Parvini and **Mehdi Teymouri**
Islamic Azad University, Iran

Telomerase activity is highly regulated, abundant in animal rapidly dividing cells and reproductive organs, but undetectable in most other differentiated tissues. Little is known about the activity of telomerase in plants, whose development differs in fundamental ways from that of animals, especially through stressed conditions. Telomerase synthesizes the plant telomere repeat sequence TTTAGGG. To examine the possible involvement of telomerase activity in plants under stress, we used Molecular assay to screen telomerase activity. Experimental samples were taken from the leaves of Helianthus annus under various salt stress conditions, include 2, 5 and 8 ds.m at 6, 12 and 24 hours of growth. Using Real time RT-PCR showed decreased expression of the gene coding telomerase, TERT in all plants under salinity stresses. Telomerasewithdecreasedlevelsfromsalinetreatedtissuesmight sheds light a correlation between telomerase activity and salt stresses as one of a probable mechanism, affected by this stress.

Speaker Biography

Maryam Parvini has completed her PhD at the age of 31 years from Islamic azad University, science and research branch, Tehran, Iran. After 3 years research in Royan institute (for my Ph.D thesis), whose ranking is the first for stem cells and Developmental biology researches in Iran, She achieved a thorough understanding of every aspect of these areas, especially neural patterning and achieving the different neural progenies from human embryonic stem cells. Her most recent position as scientific staff in Islamic Azad University,Urmia, Iran, has provided me with 1 year supervisory experience as leader of M.Sc students. She is also keen to express my deep interest to Plant science, especially for molecular aspects. It was extreem and enough cause to bigen my cooperation with Prof. Dr Reza Darvishzadeh, who is plant biotechnologist. Since this field obviously take a great leap forward, she need to go on with learning and experiencing as to assist me in this feild more and more. She is a reviewer of some Iranian journals.

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Vegetal nutrition in tropical crops

Gloria E Arevalo de Gauggel
Zamorano University, Honduras

Within the tropics, there are marked differences in climate (temperature and rainfall) related to altitude and the influence of the temperature patterns of the Atlantic and Pacific Oceans and usually, within regions, a strong orographic effect. Strong differences in soil parent materials, besides the other four soil forming factors present challenges in plant nutrition of the great range of tropical crops. Each of these crops with very different nutrient demands. Among the most cultivated tropical crops are oil palm, bananas, plantains, coffee, sugarcane, cocoa, pineapples, potatoes, cassava, coconuts, corn, beans, rice, ornamental crops and forestry (indigenous and exogenous species). Most tropical countries base their agricultural goals in two very different aims: self-feeding and exporting agricultural produce to obtain most wanted income from wealthy markets. In such variety of soils, climates, crops and at the face of global warming and climate change, plant nutrition poses a great challenge to secure high yields and sustainable natural resources. Usually, small-farmers base plant nutrition programs on nitrogen, phosphorous and potassium applications without any soil or leaf analyses using traditional nutrient application rates. However, very significant yields have being obtained in the crops indicated previously by using soil and tissue analyses and applying the entire range of essential plant nutrients, irrigation, drainage and improving soil physical conditions that constrain nutrient up take. Large-scale plantations apply nutrients to the leaf based on soil, leaf and soil solution analyses. Plant nutrition technology is rapidly improving and expanding with higher yields.

Speaker Biography

Gloria Arévalo has completed her Ph.D. in 2015 from Almería University, Spain. She obtained her Master Degree in the National University of Colombia. She is Associate Professor of Soil Science and Plant Nutrition at Zamorano University in Honduras. She has over 200 publications and has been serving as an editorial board member of reputed Journals.

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In vitro propagation of native plant species from Kuwait desert

Suad Almazrooei
Kuwait University, Kuwait

Clonal propagation by tissue culture of selected plant species, Native to Kuwait desert, was studied. Micropropagation of *Haplophyllum tuberculatum, Farsetia aegyptica, Heliotropium bacciferum, Ochradenus baccatus, Rumex vesicarius, Salvia spinosa* and *Acacia pachyceras* through axillary bud culture showed different morphogenic potentials depending on species type and ratio of 1-naphthylacetic acid (NAA) to 6-benzylaminopurine (BAP) supplemented in Murashige and Skoog (MS) culture medium. Production of adventitious shoots from callus was the common and frequent response in all tested species. This was mostly achieved at low concentration of NAA within the NAA and BAP combinations applied. Induction of embryogenic callus in *Acacia pachyceras* var. *najdensis* was achieved from embryo axes explants. The largest callus mass was initiated on MS medium supplemented with 0.1 mg/l 2,4-dichlorophenoxyacetic acid (2,4-D) and 0.5 mg/l BAP. Regeneration of new plantlets from the induced embryogenic callus was achieved on MS medium supplemented with BAP only. In contrast, initiation of embryogenic callus from leaf explants of *A. pachyceras* was achieved on MS medium supplemented with 0.5 mg/l BAP in combination with 0.5 mg/l or 0.1 mg/l 2,4-D. This is the first report of somatic embryogenesis in *A. pachyceras*.

Speaker Biography

Suad Almazrooei is currently working as a Professor in Kuwait University. He is in the department of Biological Sciences. He has completed several projects and has expertise in the field of conservation genetics and microsatellites

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Fingerprinting of different cultivars of Banana *Musa sp* L using microsatellite DNA marker

S R Mulla
University of Horticultural Sciences, India

Banana is an important crop grown worldwide and is one of the most important food crops after maize, rice, wheat and cassava globally. Despite the importance of the crop, production is threatened by various constraints such as pests and by a multitude of serious bacterial, viral and fungal diseases. Banana breeding programs are currently focused on the introgression of diverse traits that range from disease resistance/tolerance to yield and fruit quality. Molecular genetic studies are of fundamental importance for increasing our knowledge base and resources for accelerated genetic improvement of the Banana, by allowing the analysis of genetic diversity. The present investigation was demonstrated the potential use of SSR markers for assessment of genetic diversity and relationship among forty ecotypes of four genotypes of Banana (Elakki, Rajapuri, Red Banana and Rasabale). Suckers were collected from different geographical regions of southern part of India (Karnataka, Kerala and Tamil Nadu). In order to see the inter-relationship among the Banana ecotypes, a phylogenetic tree was constructed from the pairwise distance matrices. Genetic diversity of Banana genotypes was analyzed using Darwin's software with 10,000 boot straps. The dendrogram based on UPGMA cluster analysis separated the genotypes into four major clusters but the distinctiveness between the ecotypes was not observed. The cluster I consisted of all the Elakki ecotypes, whereas, Rajapuri ecotypes were located in cluster II, and Red banana ecotypes were located in cluster III and cluster IV consisted of Rasabale ecotypes. This revealed that there was close relatedness between ecotypes, which could not differentiate them irrespective of their different places of origin and utilization of less number of primers for screening the ecotypes.

Speaker Biography

S R Mulla did his Ph.D. from University of Agricultural Sciences, Bengaluru, India. He is presently serving as Assistant Professor, Department of Biotechnology and crop improvement, University of Horticultural Sciences, Bagalkot, India. He has published more than 10 papers in reputed journals.

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Role of abiotic factors on the epidemiology of wilt of pomegranate caused by *Ceratocystis fimbriata*

Raghavendra K Mesta
University of Horticultural Sciences, India

Wilt of pomegranate caused by *Ceratocystis fimbriata* Ellis and Halst. is a major threat in the successful cultivation of the crop in northen Karnataka state of India. A study on the role of soil and weather parameters on the development of this disease was conducted at University of Horticultural Sciences, Bagalkot, India. The survivability of *C. fimbriata* in host debris at different environmental conditions revealed the fungus survived in infected host debris up to 34, 22 and 28 weeks at different conditions viz., refrigeration, room temperature and field condition. Soil temperature on *C. fimbriata* was tested and per cent colonization of the fungus was maximum at 250C (89.67 % colonization), while it was minimum at 350C (7.00 % colonization) and 150C (6.33 % colonization). There was no growth obtained at 100C and above 400C. The cent per cent disease incidence was recorded at moisture level of 50, 60 and 70 per cent. The result indicated that the per cent disease incidence was 10.00 in the month of October, 2015, which reached a peak of 82.50 per cent in the month of September 2016. Similarly the highest AUDPC (142.50 per cent) and apparent rate of infection 'r' (0.13) also reached maximum in the month of September 2016. Multiple regression equation developed to establish relationship between weather parameter and per cent disease incidence of wilt, revealed that all the weather parameters contributed to significant variation in per cent disease incidence. The equation developed is Y= 117.784 + 0.452RF – 6.162Tmax + 6.914Tmin – 0.605RH with co-efficient of determination (R2) of 44 per cent. Further, step wise multiple regression analysis indicated that the weather parameters explained 44.94 per cent variation in per cent disease incidence. The rainfall explained a maximum of 30.66 per cent of total variation in disease incidence.

Speaker Biography

Raghavendra K Mesta did his Ph.D. from University of Agricultural Sciences, Dharwad, India. He is presently serving as Professor and Head, Department of Plant Pathology, University of Horticultural Sciences, Bagalkot, India. He has published more than 50 papers in reputed journals.

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Physiological and molecular facets of plant iron nutrition and interactions in global scenario

Akhouri Hemantaranjan
Banaras Hindu University, India

Elucidation of physiological and molecular facets of iron (Fe) nutrition and interactions in plants is essential for development of sustainable agricultural practices under iron nutrition stress. Iron interactions with zinc, nitrogen, boron, aluminium and vanadium in important agricultural crops were encouraging. Subsequently, considerable progress were made towards the explanation of the roles of transport proteins in plant Fe homeostasis. Iron in symplast is reduced to Fe2+, mainly by the action of FRO proteins, whereas *FDR3* gene has an important role in transporting Fe. Likewise, Strategy I confirms that Fe3+ reduced by Ferric Reduction Oxidase 2 (FRO2) at plasma membrane before transport across the membrane by Iron-Regulated Transporter 1 (IRT1). The emerging physiological and molecular understandings of Fe uptake and translocation in grains also indicate accumulation of some toxic metals, which needs clarifications. Besides these, plant leaves are important sink tissue for iron in plastids and mitochondria for numerous enzymes and indispensable for photosynthesis and other cellular metabolic processes. Investigations exhibited that Fe deficiency inhibits symbiotic nitrogen fixation by affecting growth and survival of rhizobial species, nodule formation and nodule function, for Fe2+ being part of nitrogenase, leghaemoglobin and ferredoxin regulated by nodulin-like genes. *Phaseolus vulgaris* revealed significant roles of Fe in host-rhizobium association. Amazing roles of 24-Epibrassinolide was recently evaluated in maintaining physiologically active iron besides seed loading, stored in vacuoles or in ferritin of many crop species. Under changing climate, greater insights needs to be derived for enhancing judicious use and efficiency of iron in plants through sensible researches at molecular levels.

Speaker Biography

Akhouri Hemantaranjan completed his PhD at the age of 26 years from Banaras Hindu University India. He is the Professor and Ex-Chairman of Plant Physiology Department, Institute of Agricultural Sciences, Banaras Hindu University, India. Currently, working as a Senior Professor with over 160 publications that have been cited over 1500 times, and his/her publication H-index is over 20 and has been serving as an editorial board member of reputed Journals besides Editor in Chief of the UGC Approved International Treatise Series on Advances in Plant Physiology publishe 18 volumes till date. Honoured with Agricultural Excellence Award, 2013 and Life Time Achievement Award, 2014; Reviewer of 16 international journals; delivering Guest Lectures/Keynote Address in many World Universities. He has forty years of research experience who guided 13 Ph.D; 30 years of post-graduate teaching experience; several years of administrative experience in elite Central University biggest in Asia. He elucidated several facts of underlying mechanisms for stress tolerance in crops. With his expertise in physiology of abiotic stresses and micronutrients, he commendably established doses of salicylic acid, zinc, brassinolide and paclobutrazol in stress mitigation.

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