Our Invited Speakers

Keynote Address by

Dr. N. Krishna Kumar

Regional Representative, Biodiversity International,
Former DDG Horticulture Sciences, ICAR, New Delhi

Insects in Ecological balance and Ecosystem services through Insects for a future secure world Post COVID

Abstract

The conflict for food between man and insects is as old as agriculture itself. Insects by far outnumber all other forms of life and they have been in existence for more than 400 million years in comparison to man who inhabited this planet just two-four million years ago. Hexapods are one of most resilient and successful organisms having survived three mass extinction and witnessed the birth and death of dinosaurs. The diversity of insects can be gauged by the fact that there could be one billion insects per ha in a tropical forest and constitutes 55% of all animals by weight. They are found in deserts, mountain tops in evergreen forests and sea. They could be a mere 0.1mm or to 300 mm. While some are aquatic, other are terrestrial and often crop and tree dwelling. One of the unique features of insects is their reproductive potential. A queen termite can lay ~30000 eggs per day whereas, a human female in her lifetime can give birth to a maximum 25 children. Similarly, metamorphosis, conferring several advantages to insects to tie over adverse ecological conditions, has rendered insects, by far, to outnumber all other forms of life. Insects were the first to conquer air much before birds and mammals. The insect flight is a marvel of nature. They fly with four wings, unlike an aeroplane, which has two. While a horsefly can fly at 150 km/hour, human being can maximum run 48 km. The proficiency in communication to find a potential mate or food or the presence of coordinated 1000 eyes have rendered them experts in evolution. The ability of insects to produce light is phenomenal as it is 99% energy efficient. The chemical ecology or communication through chemicals or social livings or chemical warfare or mimicry were mastered by arthropods 100s of millions of years ago. They were the one of first to use tools much before we started using sickle and hammer. They have migrated 1000 of miles to capture the entire world, building termite mound or a tailored leaf or a honey coomb, each an engineering marvel, surpassing the best architects. Insect societies still hold an example to the civilized

world, the essence of living. They give us very useful products like honey, lac, silk and many more. As pollinators par excellence they enrich plant diversity and evolution. Insects act as excellent natural enemy to plant pests and above all they turn the litter into bits and pieces for microbes to carry the baton further leading to soil organic carbon the edifice of all life on this earth directly or indirectly. Only a tiny fraction of the insects is harmful more so as we ourselves have disturbed nature and pay a price.

Nearly 75% of all animals are insects. Thus, 'class insecta dominates the living earth', is not a euphemism. They from a very important part of Natural Biodiversity. Biodiversity, the foundation of economic development is threatened globally. Declining Biodiversity (BD) and Ecosystem services (ES, such as conversion of litter into organic matter, pollination, and natural regulation of pests through natural control to mention a few) will not be able to support sustained economic growth or living standards. At a global level, the Millennium Ecosystem Assessment (MEA) notes that humans have made unprecedented changes to the natural world in recent decades to meet growing demands for food, fresh water, fibre and energy and that this demand will only increase as the global population grows and consumption patterns change. It is a complex economics like a spider web to understand BD and ES.

Ecosystem encompasses a whole range of layers of soil fauna, flora etc., but data availability is a big issue. Furthermore, one has to keep in mind that arthropod biodiversity (ABD) is only a subset of biodiversity. There are oceans, forests, disserts which are ecosystems in themselves. While we quantify the contributions of ABD to agriculture, one must include landscape level processes and also consider both direct and indirect role of biodiversity on agrobiodiversity. Most species and ecosystems are not traded in markets, so prices are often absent, and biodiversity is under-provided. Economics of biodiversity& ES must be valued for direct and indirect services.

India was the first country to organize the first international agrobiodiversity congress in November 2016. The meeting was inaugurated by the Honorable Prime Minister of India. Development of an agrobiodiversity index, sustainable agriculture, plant genetic resources, conservation of landraces, problems associated with pollination, conservation of indigenous cattle breeds and concern for environment without compromising agricultural productivity, invasive pests were some of the issues discussed. This was a historical development and a milestone in sustainable agriculture. This is now called 'Delhi declaration'. It primarily focuses on the Millennium Development Goals (MDG) and two of them happens to be the sustainable agriculture and poverty alleviation.

Sustainable agriculture has often become a buzzword and is not used in its scientific sense in planning our agriculture policies and research. We are all witness to Delhi pollution and significant policy decisions could only be taken when pollution in Delhi and other cities were quantitatively measured and the results are there for others to see

Today's biodiversity index, that of tomorrow, year after next and in a sequence will form the sustainability index. The 20th century was predominantly successful because of green revolution assisted by use of hybrid varieties, irrigation, application of fertilizers, pesticides, intensive cultivation. At that point of time maximizing production and productivity to feed hungry mass was the focus of the nation. Recently, Dr M.S.Swaminathan, a noted personality in field of Indian Agriculture, made a statement that if Ecology and environment are going to be the main concern for future agriculture, a paradigm shift has be made from productivity at any cost to sustainable development where the future generation can harness effective healthy soil, healthy environment, healthy water, healthy air, safe food for their survival and the survival of the future generations to come. Today our soil carbon is around 0.2 to 0.3 per cent, the water table has collapsed to the level from 40 feet to 800 feet and below, much

of the plant genetic diversity has been lost. Soil health is not merely a question of what minerals the soil contains but it is the recycling of organic carbon brought about by millions of microorganisms, insects that keeps the soil healthy. A healthy soil supports better water holding capacity, a better water holding capacity supports plants and animals life, a better plant and animal life is the very basic aspect of biodiversity and agriculture is not far away from this but whether it is pollination, whether it is soil fertility, whether it is plant genetic diversity, whether it is population associated with aquatic life, fisheries or the fodder that we provide for the cattle and landraces, agrobiodiversity has to be holistically viewed because farmers at least under Indian and south Asian conditions view all aspects as integrated into one. None of these parameters operate in isolation and each one of them is closely interconnected in a complex web of interactions which needs to be understood if we have to stabilize environment.

In order to do this, it requires a multidisciplinary approach involving ecologists, environmentalists, agronomists, entomologists (who are associated with pollination, persons working on biological control), people associated in conservation of PGR and forestry, persons associated with aquatic wealth and more importantly statisticians for studying interaction associated all the disciplines. Ultimately neither the air nor the water that we have taken for granted as free, everything comes at a cost and if we don't safe guard it today, tomorrow we have to pay a price like we are paying to every water bottle today and paying price for polluted air in Delhi. Agriculture in India should not move in this direction, in order to do that it's a time to develop a robust Agrobiodiversity Index (ABD) that could be an indicator or policy guidelines for government to make calibrated decisions for our future agriculture decisions, whether it is joining the rivers, whether it is giving subsidies to farmers, whether it is encouraging biological control or pollination or what species of tree to be planted, everything has to be measured and accordingly we can make scientific policy matter decisions

It is my perception that the greatest threat to human existence on earth is either from an atom or virus, both the nanoparticles at best. The very edifice of our way of life across the world was threatened by COVOD19. The gross cost can never be estimated either economically or socially. COVID19 impacted human life, education, politics including American presidential election, medicine, research, preparedness, tourism, aviation, hospitality, and everything under the sky.

Every setback is an opportunity to learn the lessons of life and COVID is no exception. The virus made us realize that we are in a global village and each one of us have a role to play. What we have understood is little but need to understand more at micro and macrolevels. While vaccines can be developed by probing deeper into subcellular functions and organization, the epidemiology of COVID, a zoonotic disease must have a better appreciation of nature and our way of life. As a spin off, the earth experienced less warming, greenhouse gas emission. In our regular rat race, it gave us humans to make time to watch birds and bees. The quarantine validated that many of the sectors can equally work from home, communication can be effective or more effective virtually and our daily routine was more a mirage than reality. For sure the world has better appreciation of life and biodiversity as a foundation of our security which strongly hinges on millions of flora and fauna including microbials. Meta-analysis of the data and the region, regional cooperation, increased funding for basic and strategic work in Biodiversity conservation and ES, micro-arthropod and microorganisms interactions in soil health, direct and indirect benefits of pollination ecology, role of detritovores, saprophagous insects, need importance. The role of insects in epidemiology of human and zoonotic diseases is assuming great importance. One of the important predictions of climate change and global warming is the increased incidence of vector-borne diseases. Thus, it is imperative that the role of insects in stabilizing biodiversity and ES need to be discussed in detail if we need to meet the sustainable development goals in this millennium.

About the speaker

Prior to his joining Bioversity International, Dr. Kumar worked for ICAR, where he served close to 40 years in a number of capacities - most recently as DDG (Horticultural Science). Prior to this, he was Director, National Bureau of Agriculturally Important Insects, Bangalore; Acting Director and Principal Scientist at Indian Institute of Horticultural Research; and Head, Entomology and Nematology. Dr. Kumar has contributed significantly in horticulture pest management strategies and insect-vector studies, molecular biology and IPM. He developed DNA barcode for 50 different species of insect-pests, designed species-specific markers for major insect-pests of horticultural crops, among many other accomplishments.

Dr. Kumar serves in a variety of associations in India concerning horticultural ecosystems, entomology and technology management. He is associated with many national and international professional societies in various capacities and is a founding member of the Entomology Academy of India.

1. Dr. Anantanarayanan Raman, **Ph.D., D.Sc.**

Senior Scientist
Council for Scientific & Industrial Research Organization (CSIRO) (Health & Biosecurity), Underwood Avenue, Floreat, WA 6014 &
Adjunct Professor
(Ecological Agriculture & Sustainable Land Management), Charles Sturt University, PO Box 883, Orange, NSW 2800, Australia

Gall-inducing Insects and Plants: the Induction Conundrum

Abstract

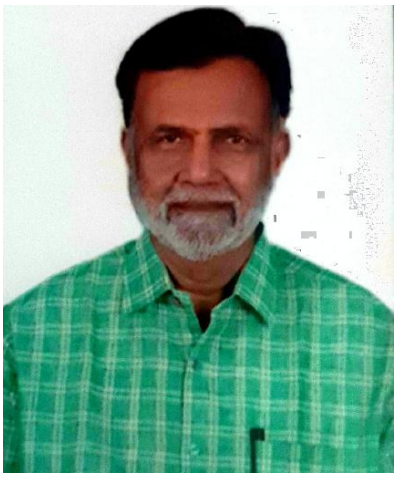
Galls induced by insects and mites (insects, hereafter) have been a subject of interest to insect ecologists because of the unusual habit of gall induction and for their tightly connected relationships. These specialist insects and mites have been explored to explain the nature of interactions between them and plants by entomologists, ecologists, and plant physiologists over the last two centuries. However, the questions why only certain insect taxa induce galls on specific species of plants and how galls are induced remain challenging. Whereas many efforts made across the world implicate plant-growth regulators (PGRs) in answering the question how galls are induced, the present article emphasizes the establishment of a metaplasied cell at the location where the tip of the chitinous mandible or ovipositor first hits in the plant. In the light of the differentiation of a metaplasied cell, the earliest plant response, it is but critical is to evaluate the physiology of that cell and the 'new' physiological events triggered around it, heralding gall initiation. PGRs certainly play a role in gall growth, but during later stages. This article does not answer the question 'how galls are induced?'. But it brings to light the gaps that need to be addressed in future in the backdrop of the efforts made over years. Because we need to deal with the physiological changes that occur in a metaplasied cell and a few adjacent cells, the use of sophisticated optical equipment and pertinent software to achieve a structured

and articulate explanation impresses as the way to go.

About the speaker

Dr. Raman holds a masters and two doctoral degrees. He has extensive undergraduate and graduate teaching experience in basic biological subjects as well as focussed disciplines such as Agricultural Ecology, Forestry, Ecological Entomology, Agricultural and Forest Entomology, Plant Pathology and Nematology. He has been investigating issues relative to sustainability and sustainable land management over last 15 years. Dr. Raman is an internationally recognized expert in the field of insect and plant interactions and is the winner of the prestigious Fulbright *Award in 1990, and the* Deutscher Akademischer Austaush Dienst [DAAD] *Award, twice, in 1991 and 2003. He has to his credit substantial record of research publications documented in international journals and several books and monographs. He has proven independent research abilities, a strong capability to organize and administer teaching and research projects, and critically analyze their outcomes. Have a strong commitment to the development of higher education and pedagogical processes, with highly developed written and oral communication skills. Also an effective teacher and a motivated researcher with accomplished leadership with co-operative, problem solving, and group facilitation skills, Dr. Raman is well supported by an extensive international work experience.*

2. Prof. TVK Singh,



Dean of Agriculture , PJTSAU (Retd). and ANGRAU (Retd),
Emeritus Scientist - ICAR (Former) .
Adjunct Professor in Dr. YSR Horticultural University, Andhra Pradesh
Consultant - ICRISAT (Former).

Impact of Pesticides on Environment- methods and measurements

Abstract

Pesticides have hijacked the agriculture since the advent of green revolution . In many of the crop production systems pesticides remain to be main control tactics, and many of the farmers resort to chemicals for pest control. Although, pesticides provide adequate control of target pests but they leave a detrimental footprint which poses risks to flora and fauna , apart from affecting human beings in many ways.

Intensive use of agricultural pesticides is a major issue in agriculture development, which is well known to one and all. Growing concerns about health hazards of pesticides necessitated the consensus among the various stakeholders to measure the impact on pesticides on the environment. Scientists have proposed several environmental impact assessment and pesticide risk indicators to measure the hazard of pesticides to environment and other nontarget organisms. These methods are typically qualitative or semi-quantitative. Some of well-known models/indicators used to measure the impact are risk index persistence, bioconcentration factor, groundwater ubiquity score, hasse-diagrams, System for predicting the environmental impact of pesticides, Environmental Yardstick for pesticides, Synoptic Assessment of Plant Protection Products, p-EMA, Environmental Potential Risk Indicator for Pesticides, Pesticide Environmental Risk Indicator, hectare-doses and Environmental impact quotient.

For determination of the environmental impact of pesticides several factors are considered such as pesticide active ingredient, dose rate, application frequency and method, environmental conditions and available surface water resources, presence of biological species etc. The purpose of these rating schemes is to provide growers and other decision makers with information so that they can discriminate among pesticides based on their risk to such entities as people, other non-target organisms, and water quality.

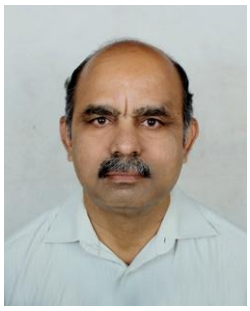
Although there are several uncertainties in the models with respect to pesticide toxicity to non-target organisms and other processes in the environment, the impact assessment models provide valuable information in comparison to costly evaluation method of sampling and monitoring of pesticides. Many pesticide indicators are based only on toxicological data and physico-chemical characteristics without any consideration of exposure. Some indicators provide information on only single environmental compartment.

Among the various models, Environmental Impact Quotient (EIQ) is most widely used. The EIQ is essentially a mathematical formula wherein all the toxicological and physiochemical information of a pesticides active ingredient is converted into arbitrary rating scale of 1, 3 and 5 to determine environmental impact of that pesticide. The EIQ model considers eight environmental parameters to determine the effect of pesticides on pesticide applicators, harvesters, consumers, groundwater, fish, birds, bees and beneficial arthropods. These EIQ values are further used to calculate field use ratings to calculate pesticide impact on environment. In this article we provide information on various methods, comparison between the methods, usefulness and restrictions of various methods so as to help users to adopt methods that are best suited for their situation.

About the speaker

Prof. T.V.K. Singh, former Dean of Agriculture, PJTSAU, Rajendranagar and ICAR- Emeritus Scientist, Adjunct Professor is specialized in Agricultural Entomology, and has more than 30 years of experience as a teacher, extension Entomologist and researcher. His fields of specialization include Insect Ecology & Population Dynamics, Integrated Pest Management, Economic Entomology and Insecticide Resistance. He has guided 15 M.Sc. and 5 Ph.D. students as major guide. Prof. Singh has published over 150 research papers, 13 books, 4 book chapters and scores of other publications. He has organized two summer institutes, several national and international conferences and symposia; acted as member on important committees and is member of academic societies.

3 Dr. Gururaj Katti



Principal Scientist and Head Entomology (Retd.)
ICAR-Indian Institute of Rice Research, Hyderabad

Crop Protection technologies for food crops – An Overview

Abstract

Increasing yields of food crops in existing land resources facing challenges of ever-growing human population, climate change scenario along with concomitant alterations in diverse insect pest profiles, requires continuous improvement of crop protection technologies to minimise pest caused losses before and after harvesting. Integrated Pest Management (IPM) is the strategy best suited to preserve our environment and natural resource base in the long term and is also a globally accepted strategy for promoting sustainable agriculture. The aim is to develop an ecologically sound framework for managing pests through a combination of crop protection techniques such as use of resistant varieties, biological control, modification of agronomic practices and habitat manipulation as well as deploying ecofriendly insecticides, only as last resort.

In the last few years, the emphasis has been mainly on key bio-intensive components like pest monitoring, host plant resistance and judicious application of green pesticides. Habitat manipulation through natural strategies such as use of trap crop and ecological engineering is one of the recent novel attempts designed to protect crops in harmony with environment. Semio-chemicals based techniques along with the innovative scientific approach of e-surveillance using ICT tools and integration of soil, plant, pest and weather data have paved the way for developing durable pest forewarning systems. Multiple pest resistant varieties developed through exciting amalgamation of conventional and advanced molecular approaches like gene editing in tandem with rapid advances in artificial intelligence aided precision has the potential to revolutionize crop protection towards ensuring sustainable benefits for the farmers.

About the speaker

Dr. Gururaj Katti completed his post graduation in Entomology (M.Sc.) in 1982 and Ph. D (Entomology with specialization in Insect toxicology) in 1987 from Indian Agricultural Research Institute, New Delhi, India. He served Indian Council Of Agricultural research (ICAR) for 34 years (1986-2020) and has research experience of 8 years in Pulses and 26 years in rice crop. Dr. Katti superannuated as Principal

Scientist (Entomology) and Head (Crop Protection) at the ICAR - Indian Institute of Rice Research (IIRR), Hyderabad, India. As, Principal Investigator (Entomology) he also led the Entomology research programme under All India Coordinated Rice Improvement Project spread across the country. Dr. Katti was the key resource person for IPM training programmes conducted by IIRR for State department and agricultural university personnel. He has 200 research publications to his credit including 79 research papers published in National and International refereed journals and edited one book, 'Plant health management for food security – issues and approaches. 2016. Plant Protection Association of India, NBPGR Hyderabad, Astraa Publications, India.

4. Dr. Chitra Shanker

Principal Scientist
ICAR-Indian Institute of Rice Research, Hyderabad

Talking plants and insect recruits- novel strategies for biological pest management

Abstract

Crop plants are devastated by pests which are aggravated by climate change impacts. Excessive pesticides are being applied to manage pests and have increased the problems of toxic residues, environmental pollution and development of resistance in insects to the chemicals applied. The alternative will be to harness the ecosystem services provided by the naturally occurring indigenous parasitoids though various ecological strategies such as growing nectar plants that provide food to them or utilizing plant volatiles that can attract them. Phytoharmonal response differ qualitatively and quantitatively based on factors such as plant genotype, herbivore guild and their diet spectrum and various abiotic factors such as soil conditions and amendments. Sap suckers and defoliators induce different responses in the host plant which respond by release of herbivore induced plant volatiles or HIPVs. Subtle changes in volatile emissions can be perceived by natural enemies of insect herbivores. These act as cues for the parasitoids and predators to locate their host. Manipulation of direct and indirect plant defenses to improve attractiveness to beneficials could be an effective management option.

About the speaker

Dr Chitra Shanker is Principal Scientist (Entomology) at the Indian Institute of Rice Research under the Indian Council of Agricultural Research. She holds a PhD in Agricultural Entomology from Tamil Nadu agricultural University, Coimbatore. She has been with ICAR from 1994 and has worked in various parts of the country. Dr Chitra Shanker has been working on habitat management strategies to enhance biological control in rice. Her field of specialization is “Studying the biodiversity of agroecosystems, their functional significance and utilizing the ecological services provided by this biodiversity”. Her aim is enhancing natural control of insect pests in agricultural systems through habitat management and reduce insecticide use. Recently she has visited Australia on an Endeavor leadership Programme scholarship given by the government of Australia for enhancing skills in this field.

5. Dr. Sudeshna Majumdar-Leighton

Professor, Department of Botany
University of Delhi, Delhi

Revisiting the Evolution of Polyphagy in Lepidoptera

Sudeshna Mazumdar-Leighton*, Aashima Mehra and Parul Bhardwaj
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Abstract

This talk focuses on the utilization of various plant families as food by larvae of diverse Lepidoptera. It highlights multiple mechanisms of host plants defenses, both universal and unique to various plant families that evoke complex panoply of adaptive responses in lepidopteran larvae that have in turn, evolved to feed on plant poisons, anti-feedants and deterrents. Examples from the literature and data from our lab are used to describe biochemical, molecular and genomic features associated with contradictions of a generalist versus specialist way of life for larvae of non-mulberry silkworms from north-east India and crucifer pests, as well as an assessment of costs versus benefits.

About the speaker

Prof. Sudeshna Mazumdar-Leighton (www.sml-botanydu.com) teaches and does research at Delhi University on insect-plant interactions with a focus on Lepidoptera of economic importance. Dr. Mazumdar-Leighton did her Ph.D. (1996) from the University of Delhi with thesis research conducted at International Center for Genetic Engineering & Biotechnology, New Delhi and International Rice Research Institute, Philippines. She did her post-doctoral stints (1996-2003) at the Departments of Entomology and Plant Pathology at Cornell University, USA. At the Department of Botany, University of Delhi, she has been pioneering the development of M. Sc. courses to include plant defense responses to herbivory, and the diversity of co-evolutionary mechanisms in insect herbivores. Her lab works on biochemistry, and molecular biology of Plant-Biotic interactions that includes adaptations of lepidopteran larvae to dietary anti-feedants and induced host plant defenses, like plant protease inhibitors. She is also very interested in effective Science communication and public outreach.

6. Dr. M. Bheemanna

Dean Agriculture

Professor of Agril. Entomology and University Head

Head, Pesticide Residue and Food Quality Analysis Laboratory

University of Agricultural Sciences,

Raichur, Karnataka

Pesticide residue as food determinants of food quality

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Abstract

Pesticide residues are defined as 'any substance or mixture of substances in food for man or animals resulting from the use of a pesticide and includes any specified derivatives, such as degradation and conversion products, metabolites, reaction products, and impurities that are considered to be of toxicological significance'. The residues and their metabolite have a great concern in the food safety and quality. The food testing and quality control is an important activity in delivering a quality and acceptable food to the consumers. The presence of food contaminants determines the quality of food. The major contaminants such as the residues of pesticides, heavy metals, toxins are important trade barriers which decide the quality of food and aids in the exchange of the agricultural and processed products at international market. Pesticides residues are the contaminants that occur after the application of the pesticides and also through accidental contamination. India uses more than 290 registered pesticides and around 1000 formulations belonging to these registered pesticides. The crops are sprayed with pesticides and harvested without following the safe waiting period in majority of the cases. This becomes the major reason for occurrence of the residues of the pesticides in the final products. Most of the pesticide standards developed and enforced by the national and international agencies/institutions are very sensitive (less than 0.01 mg/kg). The agricultural products should meet these requirements to be accepted by the global users. The adoption of good agricultural practices (GAP) in community mode for some of the export potential crops having pesticide residue issues such as grape, pomegranate, chillies, spices, nuts would help in reducing the potential residues.

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About the speaker

Dr. Bheemanna. M. Professor and Head, Pesticide Residue & Food Quality Analysis Laboratory, UAS, Raichur has over 30 years of experience in Teaching, Research and Extension particularly in the field of Agril. Entomology/Plant Protection. He is having the vast experience in the screening of various pesticide and recommendation to the various crop pests and knowledge on the pesticide usage pattern in North Karnataka. He is the guiding force for the effective implementation of the Pesticide Residue Analysis. Besides, he is an experienced cotton Entomologist which strengthens the laboratory for interpretation of results. He has conducted several training courses on safe use of pesticides for the faculty, students and farmers. He is one of the instrumental people involved in the development of Pesticide Residue & Food Quality Analysis Laboratory and accreditation from NABL. He is also involved in documentation according to NABL requirements for PRA. He has guided as major advisor 8 PhD students and 13 master degree students. He has published more than 100 research articles in the peer reviewed International and National journals. He handled many reputed ad-hoc projects funded by DST, RKVY etc.

7. Dr. Jyothilakshmi Vadassery

Staff Scientist IV,
National Institute of Plant Genome Research
Aruna Asaf Ali Marg, New Delhi -

Rapid response of plants to insect herbivory

Abstract

About the speaker

Dr. Jyothilakshmi is currently working as Staff Scientist IV at the National Institute of Plant Genome Research, New Delhi. She did her Ph.D. from International Max Planck Research School, Friedrich Schiller University, Jena, Germany after completing her M.Sc. in Genetics and Plant Breeding from IARI, New Delhi. She had her postdoctoral assignments at Department of Plant Biology, Cornell University, New York during 2009 and at Max Plank Institute for Chemical Ecology, Germany from 2010 to 2014. She returned to India to takeup Scientist position in NIPGR. She has been recently awarded EMBO Global Investigator for the period 2014 to 2020. Dr. Jythilakshmi has over 25 distinguished publications to her credit. Her current field of research are i) Mechanisms underlying plant perception of insect attack and ii) Calcium signaling in stress perception.