



## Guest Editorial

### Special Issue: Cellular signals and molecular physiology of plant responses

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Plants constantly perceive and respond to the three basic environmental stimuli namely light, temperature and water. Their interactions with the cues from the environment shape their growth and fate. Fluctuations in the surrounding environment pose great challenge to the plants and trigger their stress response machinery, which in extreme cases may have a detrimental effect on plant performance and yields. Research efforts have been directed towards elucidating how plants transmit these signals through molecular networks to effectively govern their genetic machinery, orchestrating growth and ensuring survival. We are still very far from unravelling and comprehending the intricate cellular mechanisms through which plants perceive individual and concurrent environmental cues.

Padmashree Prof Sudhir K Sopory is an eminent plant biologist who has made substantial contributions in the field of Plant Physiology and Plant Molecular Biology. This Special Issue follows the institution of “Prof S.K. Sopory Endowment awards” at the ICgeb, New Delhi on 07th January 2023, on the occasion of his 75th birthday. The awards align with his vision to inspire the young aspiring researchers to embark on a journey that not only advances scientific knowledge but also addresses critical challenges in agriculture and plant biology. Through this special issue we wanted to continue to celebrate his vision by bringing plant sciences into limelight.

The special issue presents a collection of 35 research and review articles spread across 3 volumes. They provide

evidence and insights on plant growth and development, physiology, functional genomics, molecular genetics and genomics in response to favourable and stressful environmental stimuli. The collection not only showcases a rich diversity of the research areas but also a range of plant systems right from microalgae to major staples, oil yielding crops, legumes and alternative crops or millets like foxtail millet and Fagopyrum.

The first issue (Volume 29, issue 10) was released in October 2023. It contained 11 research articles and 4 reviews. The genomics and genetics section of the issue includes manuscript by Prof. Renu Deswal that describes the meta analysis of multi-omics data to map the global changes in plants in response to cold stress. The manuscript communicated by Dr. Pradeep Sharma describes the genome wide identification of DCL, AGO and RDR gene family in wheat and their expression in response to heat stress. Dr. Sandip Das has described the evolutionary history of VQ gene family in Brassicaceae genomes and sub-genomes by comparative genomics and micro-synteny analysis. This group has contributed another manuscript on role of MIR159 in regulating stamen and carpel development and provided mechanistic insights on these regulatory networks for manipulating fertility traits. Another article from Dr. Lakshmi Sethee very lucidly explains miRNA regulation of nitrogen response and nitrogen use efficiency in wheat. In another article, functional genomics of UDP-glucose pyrophosphorylase (UGP1) in rice is described by Dr. W. Zhang. This transporter is a positive regulator of sucrose accumulation, and is required for maintaining P homeostasis in rice. On similar lines, the manuscript by Dr. Rivera-Madrid analyzes the lycopene cyclase genes in *Bixa orellana*, which are responsible for high carotenoid content of its seeds.

This volume also includes research articles explaining the role of antioxidants and protective metabolites. Dr. Surekha Bhatia’s manuscript emphasizes the role of ascorbate and glutathione in growth-phase dependent antioxidative defense

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in euryhaline and freshwater microalgae. Dr. Aryadeep Roychoudhury has studied the role of osmolytes and antioxidants by comparing differential phytotoxicity caused by arsenic and fluoride in aromatic and non-aromatic rice seedlings. Dr. Joseph Amoah has demonstrated a role of drought hardening on antioxidant defense in foxtail. Dr. Nilanjan Chakroborty has described the role of spermine in osmotic stress amelioration in lentils. Dr. Sytar Oksana has investigated the role of phenolic acids and flavonoids in response of buckwheat to drought stress.

The review by Dr. Mohammad Faizan and Dr. Pravej Alam provides details on the biosynthesis, signal transduction and antioxidant functions of Vitamin E, along with its role in stress regulation. Another review by Dr. Yashwanti Mudgil describes the integration of light signalling components with various environmental cues. Dr. Deepak Bhardawaj explores the properties of non-canonical Gα subunits (XLGs) and reflects on the various developmental, abiotic and biotic stress signalling pathways controlled by these.

The second issue (Volume 29, issue 12) was released in December 2023 and it contained 11 research articles and 6 reviews. In this issue Dr. Neeti Sanan-Mishra has presented a brief on the fundamental workflow of the CRISPR-Cas system along with an update on the current regulatory landscape in different countries on the CRISPR-Cas edited plants to emphasize the far-reaching impact of the genomic editing technology. In another article, Dr. Renu Deswal has summarized the NO research in plants and the translational potential of NO to improve agricultural yield and post-harvest crop loss.

Dr. Amit Singh has reviewed the role of epigenetic regulations in plants during meiosis with special attention to euchromatin and heterochromatin marks. Dr. Surekha Katiyar-Agarwal performed the genome-wide identification and characterization to unveil the roles of pseudouridine synthase (PUS) family in rice. These enzymes catalyse the modifications of uridine in plant RNAs during development and stress response.

Calcium signals was another key area covered in this issue. Dr. Shailendra P. Singh provided a comprehensive update on light-sensing and molecular signalling cascades found in cyanobacteria. Two other articles highlighted the role of calcium signalling in plants. Dr. Stanley Roux summarized and updated the role of that calcium-dependent steps in transducing phytochrome-initiated responses. Whereas Dr. Girdhar Pandey presented an excellent review on the usage, improvement and advancement of Ca<sup>2+</sup> based dyes, genetically encoded probes and sensors to monitor Ca<sup>2+</sup> dynamics in vivo. In another study Dr. A.S.N. Reddy

showed that a part of the TIG domain in CAMTA suppresses the NRM activity as CAMTA<sup>517</sup> failed to rescue the *camta3* autoimmune phenotype.

Overproduction and accumulation of reactive oxygen species by a variety of factors causes oxidative stress in higher plants, making it an important topic for investigation. Dr. A.S. Raghvendra showed that restricting the photorespiratory conditions increased the extent of oxidative stress in plants. While Dr. Praveen Guleria showed that MgO-NPs mediated oxidative stress in spinach Dr. Inayatullah Tahir and his co-workers examined the role of jasmonates and salicylic acid in delaying the petal senescence of detached stalks of *Cosmos sulphureus* and showed that the hormones act by averting oxidative stress. The study by Dr. Reyazul Rouf Mir showed that antioxidant enzymes, phenols and flavanoids play a significant role in the defense mechanism of common bean plants against *Colletotrichum lindemuthianum* invasion. Dr. Dinakar Challabathula studied the role of trehalose in modulating photosynthesis and ROS-antioxidant balance for improving drought tolerance in rice. In another study, Dr. Amin Salehi investigated the impact of vermicompost and foliar application of zinc sulfate in reducing the oxidative stress of drought stressed *Borago officinalis*. Dr. Anita Singh used H<sub>2</sub>S to reduce the cadmium toxicity in spinach by enhancing the levels of antioxidative enzymes.

This issue also includes some interesting reports of diverse nature. The manuscript by Dr. Wricha Tyagi explains generation of water stress tolerant genotypes by pyramiding two drought tolerant yield QTLs qDTY<sub>1.1</sub> and qDTY<sub>3.1</sub> into high yielding rice variety Samba Mahsuri Sub-1. Dr. Siddra Ijaz communicated her work on comparing the metabolites, nutrients, and minerals in *Chenopodium quinoa* accessions of varying panicle architecture.

The third and final set contains 5 articles published as a special section (in Volume 30, issue 2) released in 2024. It contains 1 research article and 4 reviews. In the genomics section, Dr. Arun Sharma has provided insights on the transcriptional regulation of tomato fruit ripening. Dr. Pradeep Agarwal has profiled the metabolites changes in groundnut in response to Sargassum extract and *Sclerotium rolfsii*. In a similar context Dr. Ralf Oelmüller has reviewed signal initiation and propagation in systemic resistance mediated by azelaic acid. The role of plant specific Gy proteins in regulating the agronomic potential is reviewed by Dr Sona Pandey, while Dr. Jamilur Rahman provides an overview on plant stress memory.

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