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EDITORIAL

Stepping forward and taking reverse as we move ahead in genetics

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Several limiting factors reduce the agricultural productivity under adverse climatic conditions (Pareek et al. 2010). In addition, feeding the burgeoning world population will also become a daunting task in future. Thus, to ensure a sustainable food security, there is an urgent need to increase the crop productivity. Detailed characterization of complex plant genomes and exploitation of their genetic diversity is necessary to meet these challenges (Lakra et al. 2018). Genetic improvement through conventional breeding has played a crucial role in optimization of crop production and performance optimization during past several decades. However, only limited progress has been made through conventional breeding to develop cultivars with improved stress tolerance. It is believed that high throughput genomics technologies will facilitate the exploitation of beneficial alleles that control a combination of traits and solve intractable problems for the development of elite germplasms. In forward genetics, sets of genes that are responsible for a certain phenotype in an organism are identified using different techniques such as OMICS and sequencing (Nongpiur et al. 2016). However, in reverse genetics, functions of gene(s) are analyzed by observing the phenotypic character of the organism after manipulating the gene(s). Over the years, several reports relating to these two approaches have got various scientific recognitions through publications. Thus, by using both forward and reverse genetics approaches, functions to the candidate genes can be assigned, which can further be used to detect allelic diversity in the germplasm and to rapidly select the gene pool for providing new foundations for improvising better breeding strategies (Bahuguna et al. 2018). The seamless integration of genomics with the breeding programs will have far reaching impacts on genetic advancement of crops.

In this endeavour, to address the fundamental questions about improvement of crop plants using forward and reverse genetics approaches, this special issue of Indian Journal of Plant Physiology is being published with 09 review articles and 10 research articles, which were contributed by more than 88 authors from globally reputed institutes and universities. The manuscripts presented in this issue underpin different newly emerging forward and reverse genetics approaches to further advance the crop improvement strategies.

The recently developed MutMap based on high throughput next-generation sequencing technologies for forward genetics is used to identify the causative variations in the genome gap regions in complicated mapping populations and genetic elements associated with phenotypic variations. Here, Tribhuvan et al. (2018) reviewed the basic principles of MutMap and discuss its future applications in next generation sequencing-based forward genetic mapping and crop improvement programs. Further, to overcome the limitations of chromosomal mapping, while performing large scale mutagenesis, Kumar and Jain (2018) discussed the radiation hybrid (RH) mapping for crop improvement. Taking rice as a model system, Bahuguna et al. (2018) shed

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light on recent forward and reverse genetics approaches to develop combined stress tolerance in crop plants. Similarly, using reverse genetics approach, Kaur et al. (2018) isolated and characterized the heat stress responsive transcript Hsp17.9 from the Khejri tree, which grows under extreme environments, while Vivitha et al. (2018) unfold the transcript abundance of photosynthetic related parameters in rice.

Authors Kishor et al. (2018) and Tanwar et al. (2018) discuss the current genome editing strategies including CRISPR/Cas9 for genetic improvement of peanut and algae. Another manuscript by Dutt et al. (2018) prove that external application of NADPH improves the efficiency of pentose phosphate pathway resulting in enhanced biomass accumulation and seed germination. While Badigannavar et al. (2018) and Chen et al. (2018) try to fill the gap for limited water availability using physiological and molecular strategies as well as efficient root systems in crop plants such as Sorghum. Further, Mishra and Kant (2018) develop a low-cost hydroponic system to grow halophytic and ornamental garden cress plant.

Morphological, physiological, biochemical, and molecular responses of plants such as lentil, rice, common bean and coffee under drought and control condition has been studied by Sinha et al. (2018), Prathi et al. (2018), Sofi et al. (2018) and Mishra et al. (2018), respectively. High throughput techniques such as QTL mapping, and gene expression analysis, and functional annotation of RNAs for *Eucalyptus*, *Oryza sativa* and *Dichanthium annulatum* under salinity has been highlighted by Subashini et al. (2018), and Pushpalatha and Kumar (2018) respectively. An article on the molecular breeding for developing heat tolerant crops has been discussed by Priya et al. (2018). An article on the importance of the plasma membrane intrinsic proteins for abiotic stresses and metalloids transportation in plants are also discussed by Kumar et al. (2018). Taken together, the reviews and research articles presented in this issue entitled “Forward and Reverse Genetics for Crop Improvement” will help the readers to develop nutritionally-improved, high-yielding stress-tolerant crop plants

As the guest editors of this special issue, we would like to thank all the authors and the reviewers for their valuable contributions towards the successful completion of the issue. Without their efforts and critical comments, the issue would not have been possible in the stipulated time. Editors believe that this special issue will not only benefit the contributors by highlighting their research work but also feature the science of forward and reverse genetics as one of the ways that agriculture scientist can contribute to the vision of “zero hunger” under its 18 sets of Sustainable Development Goals of the United Nations.

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