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Emerging Trends on Abiotic Stress Tolerance Investigation in Crop Plants

Pandiyan Muthuramalingam[1], Subramanian Radhesh Krishnan[1], Subramani Pandian[1] and Manikandan Ramesh[1]*

[1]*Department of Biotechnology, Science Campus, Alagappa University, India*

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***Corresponding author:** Manikandan Ramesh, Associate Professor, Department of Biotechnology, Science Campus, Alagappa University, Karaikudi, Tamil Nadu, India, Email: mrbiotech.alu@gmail.com

Abstract

In nature, plants are simultaneously exposed to number of biotic and abiotic stresses (BS and AbS), hence adversely affecting the overall plant growth and crop productivity. BS are easier to control unlike AbS are multigeneic and quantitative in nature. Thus, it is necessary to understand the molecular cross talks of environmental stress response and tolerance in plants. Therefore, for the improvement of crop plants, new methods and tools for genetic transformation is prerequisite. This could be addressed by ultrahigh-throughput computational biology. Especially, the advancement of constrains based omics approaches paves a way to characterize the plant cellular physiology under diverse AbS by publically available genomic, proteomic, ionomic, epigenomic, interactomic, metabolomic and phenomic data is used to increase agricultural crop productivity. Hence, is used to promote molecular based research in model plants as well as important crop plants. Further, the opinion will be useful for molecular biologist and plant physiologists to derive or design agronomically related strategies for the development of large spectrum AbS tolerant crops.

Keywords: Abiotic stress; Crop plants; Genomics; Proteomics; Metabolomics; Phenomics; Epigenomics; Interactomics; Ionomics

Abbreviations: BS: Biotic Stress; AbS: Abiotic Stress

Introduction

Emerging trends and enhancements in agricultural practices to speculate the global and future food security challenges are pivotal responses under changes in the climatic conditions. Now a days, crop yield is negatively encounter an increased number of biotic and abiotic stresses (BS and AbS), mainly on AbS [1-8]. AbS such as drought, salinity, submergence, metal, ozone, light, low and high temperatures are main destructive parameters on crop production. Precise measurement of plant morpho-molecular traits particularly in field scale shows an essential role in the genetic trait improvement of crop plants. Therefore, computational studies are crucial to know about the molecular cross talks of AbS conditions on agricultural crop productivity.

Public availability of whole transcript sequences, recent game changing sequencing technologies have invigorated sequencing approaches in genomics and has developed the opportunities for more emerging analytical applications. Driven by technological advances, multiple new omics based research is powerful approach to understanding the molecular interactions and mechanism under AbS conditions. The advancement of omics and bioinformatics related approaches in genome, proteome, interactome, epigenome, hormonome, ionome and metabolome is a better platform to identify and understanding the molecular systematics that underlying the diverse plant functions especially the crop plants. Combined studies from omics related resources are specially focused on identifying the molecular system insights and biochemical properties that accelerates gene mining and its functional characters.

The era of genomics, proteomics, metabolomics and phenomics of crop stress biology involves transformation, mining and functional ontology annotation, promoter and SNP analysis, gene expression, pathway enrichment analysis, microRNA prediction, subcellular localization, gene structure analysis, physicochemical properties imputations, comparative analysis, interactome, protein function analysis, tissues specific and developmental stage expression analysis, simulation and focused on morpho-molecular differences in AbS exposed and affected crop plants and also the model plants give an novel insights on biological mechanisms that can hinder or regulate its survival. The identified potent key players into crop plants make an effort to generate AbS tolerance, enhancement of nutrients in crop plants. This omics based approaches are broadly used to

understand the key players and their stress-specific traits that are needed to effectively target the different stress signalling pathways.

Conclusion

In conclusion, emerging advances in omics and bioinformatics approaches was to afford a well understanding about the abiotic stress (AbS) responsible crop plant development. Moreover, in several crop plant species, the development of omics resources has been developed to focus the particular biological mechanisms of individual species. Incorporation of knowledge from omics based research is an advanced issue as plant molecular researchers seems to identify the importance, gaining molecular biological novel insights and promote translational research in AbS biology in crop plants.

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