Editorial

Raising the curtain in the centenary year of the Indian Botanical Society - learning the advancing frontiers.

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Introduction

The Indian Botanical Society has completed its 100-year journey on 6th December 2020. On this day, the Society has brought out an Archival issue containing representative articles covering different disciplines of botanical sciences <https://indianbotsoc.org/archive_issue.php?id=53>. Further, to mark the centenary year the Executive council of the Indian Botanical Society during its meeting held on 6th Nov.2019 at the University of Calicut, Calicut decided to bring out a Centenary Volume of the JIBS containing high quality review articles covering various disciplines of plant sciences. The society entrusted this task upon Prof PC Trivedi as the Guest Editor to bring out the special issue befitting the accomplishing occasion. The council had suggested that the Centenary issue may cover the advancements made in various branches of Plant Science providing an overview that could cater the need of post-graduate students aspiring higher learning beyond the textbooks. Twenty-two such articles were contributed by the experts from the different fields that are presented in this volume. As the Chief Editor, it is incumbent upon me to provide a glimpse of the articles contained in this volume - and the same is succinctly given here under.

The Overview

The very first article by Sikarwar [20] vividly draws the history and footprints of plant explorations in India tracing the roots from our ancient Indian scriptures like Vedas, Puranas, Epics and Samhitas documenting India's rich natural diversity, heritage and knowledge of plant wealth utilization, and its robbery by the invaders. The article gives a systematic account of Pre Linnaean and Post Linnaean explorations, identifying the key researchers and their specific contribution recorded in the collections and literature available in various herbaria and libraries in India and Kew in United Kingdom. As such this article is a must read for the students and teachers of Plant Sciences to invigorate the past traditions to build upon.

Sharma and Harsh [18] provide a historical account of palaeobotanical investigations conducted in India beginning by Mesozoic exposures of plant fossils at the Rajmahal Hills, Cutch, Jabalpur, Madras outliers and south Rewa basin, Palaeozoic strata of India, fossil plants of the Gondwana land by B Sahni's group, as well as, Palaeozoic, Mesozoic and Tertiary exposures and identification of fossils of all the groups of plants i.e. algae to angiosperms, by the teachers and scientists of various institutions, spread across India. In addition to just palaeobotanical explorations, an extensive account is provided on extinct spores and pollen grains, besides portrayal of a new pattern of study on the chemistry of fossil plants, including chromatographic identification of amino acids by Sharma's group at Jodhpur.

Shivanna [19] provides a collective account on non-reproductive roles of pollen grains which affect humans either directly or indirectly in a number of ways is being present around our surroundings and impacting our life, including perceived allergy. It is emphasized that pollen grains provide an ideal ultra-rapid model system for screening the effects of any chemical or physical agents on a wide range of developmental processes of plants at cellular or organism level, aiding in solving the legal cases (forensic palynology), in oil exploration and in

archeology, and extensive use in cosmetic industry and health food supplements. The article also covers pharmaceutical utility of pollen grains pinpointing that exine shells of pollen, after removing other components, form an ideal vehicle to deliver vaccines and drugs through oral route. The author is an authority on pollen biology, but through this article he had covered an altogether different aspect of pollen and is an eye opener on the fascinating area.

While India is a biodiversity rich country with high degree of endemism. Despite extensive explorations undertaken on floristics, not much has been done to deduce evolutionary lineages. To fill the gap and need of time, Pandey *et al.* [17] provides an overview of molecular systematic studies with particular emphasis on utilization of nrDNA ITS and cpDNA *trn*L-F markers-based work done in India with a brief discussion citing working examples on the changing perspectives of plant taxonomy. The information provided is helpful to the beginners and specialist alike to develop further on such foundation.

Choudhury and Rajam [3] provide an overview of RNA interference and artificial micro-RNA technology as new promising tools for engineering insect resistance in crop plants to realize abiotic and biotic stress tolerance as well as other improvement for agronomic traits in crop plants. The article further reviews the progress made in the field of crop improvement to achieve insect resistance by RNAi technology.

Bhadauria [2] while providing an overview of As contamination in the environment including the soil and water resources in India discuss potential threats of long term exposure as a health hazard, necessitating the need for preventive measures for safer environment.

Rice cultivation suffers from imminent threat of high Arsenic uptake in the grain on account of plant's inherent tendency of high As absorption from the contaminated soil and water. Therefore, there is a need to develop cultural strategies to harvest rice grain with low Arsenic content. Srivastava *et al.* [21] discuss the prospective strategies for growing low grain arsenic rice emphasizing that in addition to screening for low grain arsenic accumulation cultivars there is a need to develop cultural strategies for As reduction in the grain following: (a) abiotic strategies through elemental supplementation of chemicals and biomolecules that mitigate As bioavailability, as well as (b) biotic strategies such as bacterial inoculants, fungal inoculants. Further, it is highlighted that efforts are in place to develop low As accumulating varieties through transgeneic approach that is likely to be the game changer to combat perceived threat of As in the food chain.

Meena *et al.* [14] provide a brief overview of various plant horomones that are naturally secreted in certain organs and translocated to regulate growth and differentiation as well as to combat the environmental abiotic and biotic adversities. Particular emphasis is laid on the discovery of novel phytohormones including brassinosteroids (BRs), and the latest technology to develop stable synthetic analogues, especially BRs and their effective utilization to realise higher crop yields.

Aquaporins (AQPs) are highly specialized plant channels that are located on cellular as well as various subcellular membranes, that conduct water and other substrates during plant growth and development. Kumari *et al.* [9] has presented a comprehensive review on the function, regulation and modulation of different aquaporin isoforms under abiotic stress.

Secondary metabolites which are mainly produced as adaptation strategy by plants are also important resource as pharmaceuticals on account of their biological activity. Certain alkaloids have proved indispensable for treatment of life threatening diseases including Cancer for which no synthetic substitutes are available necessitating our dependence on natural sources. Advances in in-vitro, cell and organ culture, including hairy root culture technologies have made it possible to harvest value added metabolites at industrial level.

Bansal and Bharati [1] reviews the developments in this area citing specific examples and success stories.

Kumari *et al.* [10] provides a descriptive account of microbial (bacteria and fungi) tools as biremedial measures to de-pollute the pollutants into less detrimental forms by interacting in the root zone of plants to realize endurance to heavy metals.

Goswami [4] based on his life time and firsthand knowledge on the botanical organization and evolutionary dynamics of pteridophytes claims that *Isoetes pantii* GOSWAMI & ARYA is a unique plant that offers a model system to understand form and function in plants. To substantiate his claims he has extensively discussed the various aspects of plant biology of the said species ranging from structural, reproductive including sex chromosomes, genetic and phylogenetic perspective.

Maheshwari and Dheeman [11] provide a comprehensive account of our understanding on the interactions between plants and their microbial guests, and role of plant-microbes interactions in enhancing agricultural productivity, citing success stories and bottlenecks based on their own work, particularly with respect to plant growth promoting rhizobacteria (PGPR).

AM (arbuscular mycorrhizal) fungi are obligate biotrophs, belonging to the phylum Glomeromycota that form an association with the roots of the higher plants. Such AM association with plant roots has been reported to improve growth and yield of the plant under stressful conditions. Kehri *et al.* [8] discuss the significance of AM in alleviating abiotic stress with particular emphasis on AM fungi versus stress for salinity, heavy metals, drought, cold and nutritional deficiency.

Nehra *et al.* [16] discuss the various diagnostic indicators and fungal diseases *per se* associated with coconut, and reviews the disease management for economic harvest of this important plantation crop.

Although, a lot has been done on identification and management of pests and diseases of crop plants but not much has been reported for medicinal and aromatic crops (MACs) that have emerged as a valuable component of secondary agriculture. Kedar and Pandey [7] have aptly covered this area and provided an illustrated account of the pests and diseases, including viral and nematode diseases infesting the MACs, and have discussed the possible disease management strategies for better crop productivity.

A detailed account on differentiation and development of plant galls induced by mites and insects has been furnished by Mishra *et al.* [15] citing appropriate examples. Although induced galls adversely affect the host plants, but there are instances where plant galls have been found to be important source of pharmaceutically useful secondary metabolites, as well as of compounds of nutritional value. The article provides an import information source on plant galls covering various gamuts of gall biology from scientific and utilitarian perspective.

Joshi *et al.* [5] based on exhaustive survey of literature, herbarium repository and on their own study provide an enumerated account of 104 lichenicolous fungi and lichens belonging to 51 genera hosted by 117 lichen species explored from 11 districts of Uttarakhand. The article could serve as a valuable resource for researchers, teachers and students alike interested in this unique group of plants.

Kaur *et al.* [6] through their article on xylanases provide a comprehensive and illustrated account on their type forms, properties, and potential industrial applications, including utility as food supplement in animal feed, bioremediation, manufacture of bread, production of foods and drinks, pulp and paper industry etc.

Tripathi and Vishwakarma [22] discuss the biology of *Fusarium* wilt, a wide-spread disease infesting pulse crops. They further discuss upon the biological management of this disease through plant extracts and secondary products that could be effectively used as biopesticides, as an alternative to chemical pesticides mitigating the environmental hazard posed by the latter.

Mathur [13] reviews the utility of Hydrophobins - the unique proteins produced by fungi that could degrade different sort of plastics. She underscores for a need to adopt an interdisciplinary research and innovative fungal strategies for biodegradation of plastics, laying emphasis on reduced use of biocides and antioxidant stabilizers used in the plastic manufacturing process, as well as the types of oxidizers (photosensitizers).

While pinpointing that the India is the cradle for fungal diversity as it harbours 5% of global fungal population, and approximately 29000 diversified fungal genera, Manoharachary [12] estimates that 95% of our fungal flora has yet remained unexplored. He calls for a need to identify and classify them based on morphotaxonomic and molecular parameters. Further in view of ever-increasing knowledge on biotechnological application of fungal wealth and their utility in day-to-day human life, and their role in agriculture, industries, pharmaceuticals, environment, plant protection, health, food industry, and fermentation, he underscores that the conservation of the threatened species is quite necessary. The article provides an overview on diversity of fungi from India from utilitarian and conservation perspective.

It is hoped that the students, researchers and teachers would find the contents informative to enrich the basic understanding in the fascinating world of plants.

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