

An overview on in vitro biomass production for secondary metabolites

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Abstract

As an overall defense strategy, plants consistently synthesize, accumulate and use a wide range of secondary metabolites, which are being used around the world as medicines for various human health problems. The production of medicinal metabolites in plants is affected by plant genetics and conditions of cultivation, contaminants (microbes and soil contaminants, e.g. pesticides), harvesting, processing and distribution. Moreover, chemical variability and compromised quality of medicinal plants remains one of the major factors in inconsistent results of clinical trials of plant -based medicines. *In vitro* cell culture and controlled environment production systems are well suited for the selection and seasonally independent propagation of elite lines with specific, consistent levels of high-value medicinal metabolites with minimum contamination, e.g. shikonin production from cell and organ cultures of *Lithospermum erythrorhizon*. *In vitro* techniques (micropropagation, cell suspension, root cultures), genetic transformation, and finally up-scale of cell cultures in a bioreactor, as well as cryo-storage of highly producing cells and organ cultures, are well suited for biomass production in producing high-value secondary metabolites (1). Date palms are nutritionally rich, produce phenolic and flavonoids, carotenoid, provitamins, and essential oils (2) have well developed micro-propagation and cell suspension cultures. Furthermore, several other aspects will be discussed in some selected medicinal plants including caffeic acid production, *Agrobacterium*-mediated transformation, gene expression in *Taxus baccata*, molecular marker analysis, root cultures, bio-transformation and cell cultures in a bioreactor. How to increase metabolite production by over expression of genes, and their prospects to withstand abiotic and biotic stresses under the climate change?

1. SM Jain and PK Saxena (Editors), 2009 .Protocols for micropropagation and secondary metabolite analysis of medicinal plants. Humana Press (Springer).
2. J.M. Al-l-Khayari and S.M. Jain. 2013. Scale-up Production of Secondary Metabolites in a Bioreactor from Cell Culture of Date Palm (*Phoenix dactylifera* L.) in a Bioreactor (Research proposal submitted).

Biography

Shri Mohan Jain, Plant biotechnologist, Department of Agricultural Sciences, University of Helsinki, Helsinki, Finland. He received M. Phil, 1973 and Ph.D., 1978, Jawaharlal Nehru University, New Delhi, India. He was postdoctoral fellow in Israel, and USA; visiting Professor in Japan and Ital; Technical Officer, Plant Breeding and Genetics, International Atomic Energy Agency (IAEA), Vienna, Austria, 1999-2005. He is a member on editorial Board member of Euphytica, In Vitro, Propagation of Ornamental Plants, Emirates J. Food and Agriculture.; reviewer in Plant Cell Reports, Mutation Research, and Plant Cell Tissue Organ Culture. His publications are more than 100 in peer reviewed journals, book chapters, and conference proceedings, and edited 42 books; invited speaker and acted as a Chair person in several international conferences worldwide. He was awarded Nobel Peace Prize, 2005 in commemoration the awarding to IAEA of the Nobel Peace Prize for 2005; also a consultant to IAEA, European Union, and the Egyptian Government.