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Production of phytopharmaceuticals from tissue cultures of medicinal plants

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Abstract

Alternative avenues for plant products have gained prominence during the past few years and plant biotechnology has a major role to play in plant based industries. Recently the production of secondary metabolites using plant cells has been the subject of extended research. Secondary metabolite production has mostly been studied in suspension culture because of their rapid growth and the apparent similarities to dispersed microbial cultures. Callus and cell suspension cultures of Capsicum annum (Solanaceae), Cephalis ipecacuanha (Rubiaceae), Taxus wallichiana and T. canadensis (Taxaceae), Coleus forskohlii (Labiatae), Azadirachta indica (Meliaceae), Nothapodytes foetida (Iccacinaceae), Castanospermum australe (Leguminosae) and Toddalia asiatica (Rutaceae) were able to produce secondary metabolite capsaicin, cephaeline and emetine, baccatin-III and deacetyl bccatin-III, forskolin, azadiracthin, camptothecin and 9-methoxy camptothecin, castanospermine and nitidine respectively. In most of studies elicitors, precursors employed had a positive influence on bioproduction of secondary metabolites. In few studies growth retardants and metabolic inhibitors were unable to accelerate biosynthesis of secondary metabolites. An alternative method of producing biologically active compounds involves use of differentiated cultures of shoots or roots because of their behavior are more predictable than that of undifferentiated cell suspension cultures. Shoot cultures initiated from callus cultures Hypericum perforatum (Hypericaceae) accumulated significantly higher levels of hypercin and pseudohypercin. Genetic transformation would be a powerful tool for enhancing the productivity of novel secondary metabolites of limited use. Hairy roots induced from leaf explants of Catharanthus roseus (Apocynaceae) following infection with Agrobacterium rhizogenes A4 strain were able to produce ajmalicine, serpentine and catharanthine. Abiotic elicitors, precursors, permeabilizing agents and metabolic inhibitors stimulated significantly the alkaloid production. A cell culture can be obtained from any plant species. In such culture, each cell has all genes necessary for all the functions of a plant including secondary metabolism. Hairy roots, transformed with A. rhizogenes have been found to be suitable for the production of secondary metabolites because of their stable and high productivity in hormone-free culture conditions. A number of plant species including many medicinal plants have been successfully transformed with A. rhizogenes. Plant transformed technology has now reached a platform of commercial reality.

Biography

Ciddi Veeresham received his undergraduate degree in pharmacy from Department of Pharmacy, Kakatiya University, and Warangal AP 506009. He completed his master of pharmacy from Birla institute of technology, Mesra, Ranchi. He has done his Ph. D from Kakatiya University, Warangal. He also worked as lecturer in pharmacy before completing Ph. D at KRES College of pharmacy Bidar. In 1991, he joined the faculty at University College of pharmaceutical Sciences, Kakatiya University, and Warangal AP 506009. He was a department of biotechnology overseas associate ship to do Postdoctoral research work ar Cornell University, School of biochemical Engineering, Ithaca, NY .USA and also UNESCO BAC fellow. He worked associate professor of Pharmacognosy and professor of Pharmacognosy at School of Pharmacy, Addis Ababa University, Addis Ababa, Ethiopia under UNDP Program for 4 years. Presently working at Kakatiya University and produced 13 Ph. D s and published 90 peer reviewed research papers apart from one Book on medicinal plant biotechnology. He is also reviewers for several national and international journals. He worked as principal & Head, University college of Pharmaceutical sciences apart from working has chairperson Board of studies in Pharmaceutical sciences, Kakatiya University, and Warangal AP 506009. Dr.Ciddi is also member of many professional organizations, editorial board and Board of studies in pharmacy and biotechnology.