

## CHAPTER 43

### PLANT MOLECULAR BIOLOGY

#### Doctoral Theses

399. LAJU PAUL K.  
**Molecular Analysis of Light and Hormone Signalling Mutants, pho1 and pho3, of Arabidopsis Thaliana**  
Supervisor : Prof. Jitendra P. Khurana  
Th 15400

#### *Abstract*

Attempts to characterize a special class of photomorphogenic mutants isolated from the M2 seed population of EMS (ethylmethane sulfonate) treated seeds of Arabidopsis thaliana, ecotype Estland, and screened for de-etiolated phenotype among the 3-day-old dark-grown seedlings. Focuses on the mapping of PHO<sub>2</sub> locus, physiological and molecular characterization of pho1-1 and pho<sub>2</sub> alleles and the promoter analysis of PHOT to elucidate its regulation by light and hormones. A special emphasis is given to understand the modulation of light-responsive elements (LRE<sub>s</sub>) like Z- and GATA-box in pho1 and pho3 mutant background and a genome-wide (microarray) approach has been designed to learn the global changes by expression profiling of genes in etiolated conditions, when the light and hormone responsive PHO1 and PHO3 loci are mutated.

#### *Contents*

1. Review of previous work. 2. Materials and methods. 3. Results and discussion. 4. Summary and conclusions. Bibliography.

400. LAL (Shalini)  
**Screening, EST Profiling and Generation of Transgenic Mulberry for Abiotic Stress Tolerance**  
Supervisor : Prof. Paramjit Khurana  
Th 15399

#### *Abstract*

Attempts to generate transgenic mulberry plants with genes

conferring tolerance for abiotic stresses. Agrobacterium mediated transformation of mulberry plants with HVA1 gene from *Hordeum vulgare* has been attempted. Molecular analysis of the transgenic plants revealed stable integration and expression of the transgene in the transformants. Infers that the production of HVA1 proteins helps in better performance of transgenic mulberry by probably maintaining membrane integrity of the plasma membrane as well as chloroplastic membranes from injury under abiotic stress, thus facilitating mulberry to survive and flourish under challenging abiotic conditions.

#### *Contents*

1. Introduction. 2. Materials and methods. 3. Results. 4. Discussion. 5. Summary and conclusions. 6. Literature cited. Bibliography.

401. MANOJ KUMAR  
**Expression of Vibrio Cholerae Antigens in Tomato for Development of Plants-Based Oral Vaccine Against Cholera**  
 Supervisor : Dr. Arun K. Sharma  
 Th 15401

#### *Abstract*

Attempts to express the genes encoding antigenic determinants of *Vibrio cholerae*, cholera causing bacterium, in transgenic plant selecting genes for toxin co-regulated pilus subunit A (TCPA) and accessory colonization factor subunit A (ACFA) for plant transformation fusing the regions of genes encoding P4 or P6 epitope of TCPA as well as gene encoding ACFA, to the gene encoding cholera toxin B subunit (CTB) and creating binary vectors for efficient expression of these antigens in plants by Agrobacterium-mediated transformation. The expression of TCPA, ACFA and the ability of plant expressed chimeric proteins, CTB-P4 or CTB-P6, is a step forward to produce multi-component vaccine to provide anti-toxin as well as anti-colonizing immunity. Chimeric proteins CTB-P4 or CTB-P6 as well as TCPA and ACFA have also been expressed in *E. coli*. TCPA as well as ACFA proteins have been purified from *E. coli* and have been used to raise the anti-serum. Plant-expressed antigens have been detected by using anti-sera against the respective antigens. The plant-expressed chimeric proteins have been found to bind GM1-ganglioside receptor of cholera toxin.

*Contents*

1. Review of previous work on plants as bioreactors. 2. Materials and methods. 3. Results. 4. Discussion. 5. Summary and conclusions. Bibliography.

402. PATIL (Basavaprabhu L.)  
**Study of Gene Functions in Indian Cassave Mosaic Virus**  
 Supervisor : Dr. Indranil Dasgupta  
 Th 15402

*Abstract*

Attempts to unravel the biodiversity of CIGs in India, to study their gene organization and infectivity, to analyze the different forms of the viral DNA in infected plants and to functionally dissect a gene related to the movement of the viral DNA within infected plants.

*Contents*

1. Review of literature. 2. Biodiversity in cassava infecting geminiviruses from India. 3. Cloning and sequence analysis of cassava infecting geminiviruses from India. 4. Infectivity studies of CIGs from India and association of defective DNA molecules. 5. Characterization of the functional domains of nuclear shuttle protein of ICMV. 6. Summary, conclusions and bibliography.

403. SINGLA (Bhumica)  
**Molecular Analysis of Somatic Embryogenesis in Wheat (Triticum Aestivum)**  
 Supervisor : Prof. Paramjit Khurana  
 Th 15403

*Abstract*

This study focusses on isolation of genes involved in somatic embryogenesis especially during the early phase and responsible for the transition from a vegetative to an embryogenic state in the wheat leaf base system and involves the study of the genomic organization, of SERL's, their chromosomal distribution, sequence homology and expression patterns analysis. To establish a functional genomics platform for analyzing genes of interest, the regeneration protocol of a diploid variety of wheat, *Triticum monococcum* has also been standardized for genetic transformation.

1. Molecular basis of somatic embryogenesis. 2. Analysis of expression profile of selected genes expressed during auxin-induced somatic embryogenesis in leaf base system of wheat (*Triticum aestivum*) and their possible interactions. 3. An early auxin-responsive AUX/IAA gene from wheat (*Triticum aestivum*) is induced by epibrassinolide and differentially regulated by light and calcium. 4. Molecular characterization of the serk gene family from wheat (*Triticum aestivum*) and rice (*Oryza sativa*). 5. Towards a functional genomics system in triticum monococcum and Summary and conclusions. Bibliography.