

Dr. K. MANOHARAN

Professor & Head

Dept of Plant morphology
Centre for Excellence in Genomic Sciences
School of Biological Sciences
Madurai Kamaraj University, Madurai 625 021



RESEARCH AREAS:

Plant tissue culture

HONORS AND AWARDS:

Fellow, Brain Pool in Plant Biotechnology (S.Korea)

CONTACT DETAILS:

Email: manohara2000@yahoo.com

Phone : 0452-2459975

RESEARCH INTERESTS:

My group is working on the mode of action of stress factors in the induction of senescence by employing two systems of study. These include young seedlings of Indian mustard and *in vitro* systems of black gram and green gram. Supra-optimal concentrations of auxin (2,4-dichlorophenoxyacetic acid), exogenous supply of abscisic acid (ABA) and dehydration are employed as stress factors. Outcome of the studies are envisaged to understand the control and regulation of leaf senescence. In the case of legume *in vitro* systems, working out defined conditions for the induction of somatic embryogenesis by imposing stress factors is set to be the goal. Auxin induced leaf senescence in seedlings of Indian mustard, *Brassica juncea L* and other plants are being studies. In brief, I am working in the following aspects:

- Induction of somatic embryogenesis in legumes species
- Occurrence of programmed cell death during embryogenesis
- Role of signal transduction molecules during somatic embryogenesis
- Histological evaluation of somatic embryogenesis pathway
- Role of membrane lipids in the regulation of *in vitro* responses

I also have been working on the biochemical and molecular basis of *in vitro* morphogenesis by employing plant systems, such as, organ, tissue, cell and protoplast cultures. The plant species in which I have carried out my works include: *Oryza sativa* (rice), *Datura innoxia*, *Datura metal* (buck-weeds), *Nicotiana tabacum* (tobacco), *Sinapis alba* (mustard), *Brassica napus* (oil mustard), *Daucus carota* (carrot), *Vigna mungo* (mung-bean) and *Arachis hypogaea* (ground-nut). Studies, with each of these systems, have been carried out to work out the biochemistry and molecular biology of specific aspects of differentiation responses *in vitro*. Besides employing *in vitro* systems for experimental studies, I have also carried out a few studies related to establishing *in vitro* systems for specific applications. Selected studies for this aspect include, (a) working out the polyamine requirement of fine suspension cultures of rice, (b) devising a system of micro-droplet culture for suspension cells of Brassica sps for routine use in studies on the identification and characterization of embryogenic factors and (c) establishment of a plated cell-culture-system for the delivery of genes by employing the micro-projectile particle bombardment system.

PUBLICATIONS

- Rajasekhar, V.K., **Manoharan, K.**, Sopory, S.K. and Guha-Mukherjee, S. (1981): Phytochrome and blue-light regulation of peroxidase activity during early phase of germination in wheat. *Indian J. Biochem. Biophys.* 18(4): 168 -172.
- Manoharan, K.** (1985): Fusion of dye entrapped liposomes with protoplasts. In: *Experimental Manual for Short-Term Training Course in "Genetic Manipulation of Plant Protoplasts"*. S. Guha-Mukherjee (ed.), Plant Research Laboratory, School of Life Sciences, Jawaharlal Nehru University, New Delhi, India, pp 33-36.
- Manoharan, K.**, Prasad, R. and Guha-Mukherjee, S. (1985): Greening related lipid changes in leaves, protoplasts and a plasmamembrane enriched fraction of pea. *Phytochemistry* 24: 431-433.
- Manoharan, K.**, Prasad, R. and Guha-Mukherjee, S. (1987): Greening and shoot differentiation related lipid changes in callus cultures of *Datura innoxia*. *Phytochemistry* 26: 407-410.
- Manoharan, K.**, Guha-Mukherjee, S. and Prasad, R. (1988): Differentiation responses in callus cultures of *Datura innoxia* by phospholipid precursors. *Phytochemistry* 27: 411-413.
- Manoharan, K.**, Prasad, R. and Guha-Mukherjee, S. (1990): Senescence related lipid changes in callus cultures of *Datura innoxia*. *Phytochemistry* 29: 2529-2531.
- Manoharan, K.** and Gnanam, A. (1990): Growth stimulation by conditioned medium and spermidine in low density suspension cultures of rice. *Plant Cell Physiol.* 33: 1243-1246.
- Muthumeenakshi, N. Theriappan, P., Sathishkumar, R., Ramesh, M., **Manoharan, K.**, Gupta, A.K. and Gnanam, A. (1993): *In vitro* plant regeneration in *Arachis hypogaea* L. and *Glycine max* L. In: *Proceedings of the Symposium on "Photosynthesis and Plant Molecular Biology"* published by the Department of Atomic Energy, Govt. of India, pp 187-196.
- Sathishkumar, R. and **Manoharan, K.** (1996): Lipid changes due to growth-factor supplements in callus and plasmamembrane enriched fraction of rice cultures. *Phytochemistry* 43: 1171-1174.
- Sathishkumar, R. and **Manoharan, K.** (1996): A cell culture based genetic transformation system for rice by employing microprojectile bombardment. In: *Recent Advances in Biotechnological Applications of Plant Tissue and Cell Cultures*. G.A. Ravishankar (ed.), Oxford-IBH Publishing House, New Delhi, India, pp 429-433.
- Sathishkumar, R., Agrawal, S. and **Manoharan, K.** (1998): Particle mediated DNA-delivery and transient expression of GUS gene in plated cells of rice. *Biol. Plant.* 40: 305-309.
- Manoharan, K.**, Lee, T.K., Cha, J.M., Kim, J.H., Lee, W.S., Chang, M., Park, C.W. and Cho, J.H. (1999): Assimilation of *Prorocentrum minimum* (Dinophyceae) to prolonged darkness by use of an alternative carbon source from triacylglycerides and galactolipids. *J. Phycol.* 35: 287-292.

- Manoharan, K.**, Chae, H.S., Cho, S.H. and Lee, W.S. (2000): Synthesis of phosphatidylserine in carrot cells cultured under carbon source starvation. *Plant Cell Physiol.* 41: 1143-1148.
- Karuppanapandian, T. and **Manoharan, K.** (2003): Bioinformatic analysis on the distribution, homology and role of satellite DNA in plants. In: Challenges and Applications in Bioinformatics, M. Vivekanandan (Ed.), Publications Division, Bharathidasan University, Tiruchirappalli, India, pp 24-35.
- Mishra, G., Sathishkumar R., Karuppanapandian, T., Agrawal, S., Jagannathan, V. and **Manoharan, K.** (2004): Induction of plantlet regeneration and embryogenic callus in black gram, *Vigna mungo* (L.) Hepper cv Co4. In: Proceedings of the 26th Annual Meeting of the Plant Tissue Culture and Biotechnology Association (India), L. D'Souza, Anuradha M., Shashikiran Nivas, Smitha Hedge and K. Rajendra (Eds.), SAC Publishers, Mangalore, India, pp 269-282.
- Manoharan K** (2005) Mechanism and control of programmed cell death (PCD) in plants – A review. *J Swamy Bot-CI.* 22: 1-4.
- Manoharan K.**, Mishra, G., Sathishkumar R., Sinha P.B., Karuppanapandian, T., Agrawal, S., and Jagannathan, V. (2005) Induction of embryogenic callus and direct plantlet regeneration in black gram (*Vigna mungo* (L.) Hepper). *J Swamy Bot-CI.* 22: 39-46.
- Manoharan K.**, Karuppanapandian, T., Sinha, P.B., and Prasad R. (2005): Membrane degradation, accumulation of phosphatidic acid, stimulation of catalase activity and nuclear DNA fragmentation during 2,4-D-induced leaf senescence in mustard. *J Plant Biol.* 48: 394-403.
- Karuppanapandian T., Karuppururai T., Sinha P.B., Kamarul Haniya A., and **Manoharan K.** (2006) genetic diversity in green gram [*Vigna radiata* (L.)] landraces analysed by using random amplified polymorphic DNA (RAPD). *Afr J Biotechnol.* 1214-1219.
- Manoharan K.**, Prasad R and Guha-Mukherjee S (2006) PEG-induced fusion of phosphatidylcholine-liposomes with protoplasts and post-fusion evaluation of plating efficiency and enrichment in plasmamembrane phosphatidylcholine of protoplasts in *Datura innoxia* Mill. *Indian J Exp Biol.* 44: 955-963.
- Manoharan K.** (2006) Somatic embryogenesis in legumes: avenue for crop improvement through genetic transformation – A review. *J Swamy Bot-CI.* 23: 63-68.
- Karuppanapandian T., Sinha P.B., Premkumar G., **Manoharan K.** (2006). Chromium toxicity: Correlated with increased in degradation of photosynthetic pigments and total soluble protein and increased peroxidase activity in green gram (*Vigna radiata* L.) seedlings. *J Swamy Bot-CI.* 23: 117-122.
- Karuppanapandian T., Sinha P.B., Kamarul Haniya A., Premkumar G., **Manoharan K.** (2006). Aluminium-induced changes in antioxidative enzyme activities, hydrogen peroxide content and cell wall peroxidase activity in green gram (*Vigna radiata* L. cv. Wilczek) roots. *J Plant Biol.* 33(3): 241-246.
- Karuppanapandian T., Sinha P.B., Kamarul Haniya A., **Manoharan K.** (2006). Differential antioxidative responses of ascorbate-glutathione cycle enzymes and metabolites to chromium stress in green gram (*Vigna radiata* L. Wilczek) leaves. *J Plant Biol.* 49(6): 440-447.

- Karuppanapandian T., Karuppururai T., Sinha P.B., Kamarul Haniya A., **Manoharan K.** (2006). Phylogenetic diversity and relationships among cow pea (*Vigna unguiculata* L. Walp.) landraces using random amplified polymorphic DNA markers. *Gen Appl Plant Physiol.* 32(3-4): 141-152.
- Manoharan K.**, Mishra G., Sathishkumar R. (2007) Metabolic conditioning and induction of cell division by culture/growth factor-supplements in microdroplet cell cultures of *Brassica juncea* L. In: *Plant Biotechnology: New Frontiers.* (Eds.) Kukreja A.K., Mathur A.K., Banerjee S., Mathur A., Sharma A., Khanuja S.P.S. pp. 41-50.
- Sinha P.B., Karuppanapandian T., Kamarul Haniya A., **Manoharan K.** (2007). Hydrogen peroxide-induced oxidative damage occurs on senescence green gram (*Vigna radiata* L.) leaves. *Internatl J Plant Sci.* 2(1): 175-177.
- Karuppanapandian T., Karuppururai T., Sinha P.B., Kamarul Haniya A., **Manoharan K.** (2007). Random amplified polymorphic DNA markers variability and relationships among black gram (*Vigna mungo* L. Hepper) landraces. *J Plant Biol.* 34(2): 79-85.
- Karuppanapandian T., **Manoharan K.** (2008). Uptake and translocation of tri- and hexavalent chromium and their effects on black gram (*Vigna mungo* L. Hepper cv. Co4) roots. *J Plant Biol.* 51(2): In press.
- Karuppanapandian T., Sinha P.B., Kamarul Haniya A., **Manoharan K.** (2008). Chromium-induced accumulation of peroxide content, stimulation of antioxidative enzymes and lipid peroxidation in green gram (*Vigna radiata* L. cv. Wilczek) leaves. *Afr J Biotechnol.* 6(24): In press.
- Karuppanapandian T., Kamarul Haniya A., **Manoharan K.** (2008). Effect of excess Zn-induced oxidative stress (or leaf senescence) in attached green gram (*Vigna radiata* L. cv. Wilczek) leaves. *J Plant Biol.* 35(1): In press.