

**LOW COLCHICINE DOSES IMPROVED CALLUS INDUCTION,  
BIOMASS GROWTH, AND SHOOT REGENERATION IN *IN VITRO* CULTURE  
OF *DRACAENA SANDERIANA* SANDER EX MAST**

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**REFERENCES**

- BATES L. S., WALDREN R. P., TEARE I. D. (1973). Rapid determination of free proline for water-stress studies. *Plant and Soil*, 39: 205-207.
- BRADFORD M. M. (1976). A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Analytical Biochemistry*, 7: 248-254.
- DEY P. M. (1990). Carbohydrates. In: Dey P. M., Harborne J. B. (Eds). Series Methods in Plant Biochemistry, Vol. 2, Academic Press, London, 657 pp.
- DIPTI T., FATIMA S., MUJIB A. (2014). Morphological anomalies in somatic embryo structure in *Catharanthus roseus*: improving embryo germination by amending plant growth regulators, activated charcoal and sucrose level. *British Biotechnology Journal*, 4: 10-20.
- DHOOGHE E., VAN LAERE K., EEKHAUT T., LEUS L., VAN HUYLENBROECK J. (2011). Mitotic chromosome doubling of plant tissues *in vitro*. A review. *Plant Cell, Tissue and Organ Culture*, 104: 359-373.
- DUNCAN D. B. (1955). Multiple range and multiple F-test. *Biometrics*, 11: 1-5.
- FATIMA S., MUJIB A., DIPTI T. (2015). NaCl amendment improves vinblastine and vincristine synthesis in *Catharanthus roseus*: a case of stress signalling as evidenced by antioxidant enzymes activities. *Plant Cell, Tissue and Organ Culture*, 121: 445-458.
- FEHÉR A. (2015). Somatic embryogenesis - stress-induced remodeling of plant cell fate. *Biochimica et Biophysica Acta*, 1849: 385-402.
- HASNAIN A., NAQVI S. A. H., AYESHA S. I., KHALID F., ELLAHI M., IQBAL S., HASSAN M. Z., ABBAS A., ADAMSKI R., MARKOWSKA D., BAAZEEM A., MUSTAFA G., MOUSTAFA M., HASAN M. E., ABDELHAMID M. M. A. (2022). Plants *in vitro* propagation with its applications in food, pharmaceuticals and cosmetic industries; current scenario and future approaches. *Frontiers in Plant Sciences*, 13: Article 1009395.
- HOSHYAR A., KADHIM I., RODICA P., DORU P., MONICA H., OTILIA B. (2017). Changes induced by gamma ray irradiation on biomass production and secondary metabolites accumulation in *Hypericum triquetrifolium* Turra callus cultures. *Industrial Crops and Products*, 108: 183-189.
- JAZIB A., HOSSAIN M. T., RAJU A. I. (2019). Clonal propagation of *Dracaena fragrans* cv. Victoria through tissue culture technology. *Jahangirnagar University Journal of Biological Science*, 8: 1-11.
- JIMÉNEZ V. M., THOMAS C. (2005). Participation of plant hormones in determination and progression of somatic embryogenesis. In: Mujib A. and Samaj J. (Eds). Somatic embryogenesis. Springer, Berlin, Heidelberg: 103-118.
- KHER M. M., SONER D., SRIVASTAVA N., NATARAJ M., TEIXEIRA DA SILVA J. A. (2016). Micropropagation of *Clerodendrum phlomidis* L. F. *Journal of Horticultural Research*, 24: 21-28.
- KLUPCZYŃSKA E. A., PAWŁOWSKI T. A. (2021). Regulation of seed dormancy and germination mechanisms in a changing environment. *International Journal of Molecular Sciences*, 22: Article 1357.
- KUMAR S. P., KUMARI B. D. R. (2021). Impact of ethyl methane sulphonate mutagenesis in *Artemisia vulgaris* L. under NaCl stress. *BioTech*, 10: Article 18.
- LE K. C., HO T. T., PAEK K-Y., PARK S-Y. (2019). Low dose gamma radiation increases the biomass and ginsenoside content of callus and adventitious root cultures of wild ginseng (*Panax ginseng* Mayer). *Industrial Crops and Products*, 130: 16-24.
- LEE Y. Y. P., TAKAHASHI T. (1966). An improved colorimetric determination of amino acids with the use of ninhydrin. *Analytical Biochemistry*, 14: 71-77.
- MAQSOOD M., KHUSRAU M., KALOO Z. A., WANI T. A., MUJIB A. (2020). Colchicine quantification in salt stress treated culture of *Colchicum luteum* baker by high pressure liquid chromatography. *European Journal of Biology*, 79: 67-74.
- MOUNIR A. M., EL-HEFNY A. M., MAHMOUD S. H., EL-TANAHY A. M. M. (2022). Effect of low gamma irradiation doses on growth, productivity and chemical constituents of Jerusalem artichoke (*Helianthus tuberosus*) tubers. *Bulletin of the Natural Research Centre*, 46: Article 146.
- MUJIB A., PAL A. (1995). Inter-varietal variation in response to *in vitro* cloning of carnation. *Crop Research*, 10: 190-194.
- MUJIB A., PIPAL T., ALI M., DIPTI T., ZAFAR N., GULZAR B. (2017). *In vitro* propagation of *Althaea officinalis*: the role of plant growth regulators in morphogenesis. *BioTechnologia*, 98: 167-173.
- MUJIB A., TONK D., GULZAR B., MAQSOOD M., ALI M. (2020). Quantification of taxol by high-performance thin layer chromatography in *Taxus wallichiana* callus cultivated *in vitro*. *BioTechnologia*, 101: 337-347.
- MUJIB A., BANSAL Y., MALIK M. Q., SYEED R., MAMGAIN J., EJAZ B. (2022). Internal and external regulatory elements controlling somatic embryogenesis in *Catharanthus*: a model medicinal plant. In: Ramirez-Mosqueda M. A. (Ed.). Somatic Embryogenesis: Methods and Protocols, Humana, New York, NY.: 11-27.

- MURASHIGE T., SKOOG F. (1962). A revised medium for rapid growth and bio assays with tobacco tissue cultures. *Physiologia Plantarum*, 15: 473-497.
- NAZAROV P. A., BALEEV D. N., IVANOVA M. I., SOKOLOVA L. M., KARAKOZOVA M. V. (2020). Infectious Plant Diseases: Etiology, Current Status, Problems and Prospects in Plant Protection. *Acta Naturae*, 12: 46-59.
- SALMA U., KUNDU S., MANDAL N. (2017). Artificial polyploidy in medicinal plants: Advancement in the last two decades and impending prospects. *Journal of Crop Science and Biotechnology*, 20: 9-19.
- STORME N. D., MASON A. (2014). Plant speciation through chromosome instability and ploidy change: Cellular mechanisms, molecular factors and evolutionary relevance. *Current Plant Biology*, 1: 10-33.
- SVETLEVA D. L, CRINÓ P. (2005). Effect of ethyl methanesulfonate (EMS) and n-nitroso-n'-ethyl urea (ENU) on callus growth of common bean. *Journal of Central European Agriculture*, 6: 59-64.
- WILMS H., DE BIÈVRE D., LONGIN K., SWENNEN R., RHEE J., PANIS B. (2021). Development of the first axillary *in vitro* shoot multiplication protocol for coconut palms. *Scientific Reports*, 11: Article 18367.
- ZHONG Z., WANG X., YIN X., TIAN J., KOMATSU S. (2021). Morphophysiological and proteomic responses on plants of irradiation with electromagnetic waves. *International Journal of Molecular Sciences*, 22: Article 12239.