

**PROPAGATION OF *PAEONIA OSTII* ‘FENG DAN’ BY ADVENTITIOUS SHOOTS INDUCED *IN VITRO*  
FROM LEAF AND PETIOLE EXPLANTS**

**Chengcheng Fan<sup>1,2</sup>, Kexin Li<sup>1,2</sup>, and Li Xu<sup>1,2\*</sup>**

<sup>1</sup>Hubei Key Laboratory of Biologic Resources Protection and Utilization, Hubei Minzu University, Enshi, Hubei Province, 445000 China, \*E-mail: 2277172273@qq.com

<sup>2</sup>Gardening and Horticulture Plant Germplasm Resources Innovation Research Group, School of Forestry and Horticulture, Hubei Minzu University, Enshi, Hubei Province, 445000 China.

**REFERENCES**

- BATISTA D., ASCENSÃO L., SOUSA M. J., PAIS M. S. (2000). Adventitious shoot mass production of hop (*Humulus lupulus L.*) var. Eroica in liquid medium from organogenic nodule cultures. *Plant Science*, 151: 47-57.
- BATISTA D., FONSECA S., SERRAZINA S., FIGUEIREDO A., PAIS M. S. (2008). Efficient and stable transformation of hop (*Humulus lupulus L.*) var. Eroica by particle bombardment. *Plant Cell Reports*, 27: 1185-1196.
- CHENG F. Y. (2007). Advances in the breeding of tree peonies and a cultivar system for the cultivar group. *International Journal of Plant Breeding*, 1: 89-104.
- CHRIUMAMILLA P., GOPU C., JOGAM P., TADURI S. (2021). Highly efficient rapid micropropagation and assessment of genetic fidelity of regenerants by ISSR and SCoT markers of *Solanum khasianum* Clarke. *Plant Cell, Tissue and Organ Culture*, 144: 397-407.
- COMPTON M. E. (1994). Statistical methods suitable for the analysis of plant tissue culture data. *Plant Cell, Tissue and Organ Culture*, 37: 217-242.
- DAL VESCO L. L., GUERRA M. P. (2010). *In vitro* morphogenesis and adventitious shoot mass regeneration of *Vriesea reitzii* from nodular cultures. *Scientia Horticulturae*, 125: 748-755.
- DANCHEVA D. (2014). Rooting and acclimatization of micropropagated shoots of *Fraxinus excelsior* L. *Oltenia Journal for Studies in Natural Sciences*, vol. 30 (1): 75-80.
- DE KLERK G.-J. (2002). Rooting of microcuttings: theory and practice. *In vitro Cellular & Developmental Biology-Plant*, 38: 415-422.
- DU Y. M., CHENG F. Y., ZHONG Y. (2020a). Induction of direct somatic embryogenesis and shoot organogenesis and histological study in tree peony (*Paeonia* sect. *Moutan*). *Plant Cell, Tissue and Organ Culture*, 141: 557-570.
- DU Y. M., ZHONG Y., SHANG H. Q., CHENG F. Y. (2020b). Callus induction and differentiation from the filaments of *Paeonia ostii* ‘Feng Dan’. *Bulletin of Botanical Research*, 40: 514-522.
- GHARARI Z., BAGHERI K., KARIMKHANLOOEI G., SHARAFI A. (2021). Study of tissue culture and *in vitro* organogenesis of *Scutellaria bornmuelleri* using benzylaminopurine, Isopentenyl adenine and thidiazuron. *South African Journal of Botany*, 139: 458-469.
- HAENSCH K.T. (2004). Thidiazuron-induced morphogenetic response in petiole cultures of *Pelargonium × hortorum* and *Pelargonium × domesticum* and its histological analysis. *Plant Cell Reports*, 23: 211-217.
- HARTMANN H. T., KESTER D. E., DAVIES F. T., GENEVE R. L. (2002). Hartmann and Kester’s plant propagation. Principles and practices. Seventh edition. Prentice Hall. Upper Saddle River, New Jersey, 880 pp.
- HOU J., SU P., WANG D., CHEN X., ZHAO W., WU L. (2020). Efficient plant regeneration from *in vitro* leaves and petioles via shoot organogenesis in *Sapium sebiferum* Roxb. *Plant Cell, Tissue and Organ Culture*, 142: 143-156.
- HUANG Z., XU C., LI Y., WANG P., LI Y., KANG X. (2015). Induction of somatic embryogenesis by anther-derived callus culture and plantlet ploidy determination in poplar (*Populus × beijingensis*). *Plant Cell, Tissue and Organ Culture*, 120: 949-959.
- KHAN A., SHAH A. H., ALI N. (2021). *In-vitro* propagation and phytochemical profiling of a highly medicinal and endemic plant species of the Himalayan region (*Saussurea costus*). *Scientific Reports*, 1: Article 23575.
- LLOYD G., McCOWN B. (1980). Commercially-feasible micropropagation of mountain laurel *Kalmia latifolia*, by use of shoot-tip culture. *Combined Proceedings of International Plant Propagators’ Society*, 30: 421-427.
- McCOWN B. H., ZELDIN E. L., PINKALLA H. A., DEDOLPH R. (1988). Nodule culture: a developmental pathway with high potential for regeneration, automated micropropagation, and plant metabolite production from woody plants. In: Hanover J. W., Keathley D. E. (Eds). *Genetic Manipulation of Woody Plants*. Plenum, New York: 149-166.
- MINH D. T., NGUYEN Q. T., PHAM T. (2021). Regeneration of plants via callus-mediated organogenesis from leaf, petiole, and inter nodal segment of *Ardisia silvestris* Pitard. *Propagation of Ornamental Plants*, 3: 96-103.
- MONTALBÁN I. A., DE DIEGO N., MONCALEÁN P. (2011). Testing novel cytokinins for improved *in vitro* adventitious shoots formation and subsequent ex vitro performance in *Pinus radiata*. *Forestry*, 84: 363-373.
- MURASHIGE T., SKOOG F. (1962). A revised medium for rapid growth and bio assays with tobacco tissue cultures. *Physiologia Plantarum*, 15: 473-479.
- PARTANEN C. R. (1965). Cytological behaviour of plant tissues *in vitro* as a reflection of potentialities in vivo. In: White P. R., Grove A. R. (Eds). *Proceedings of an International Conference on Plant Tissue Culture*. Berkeley: 88-100.
- PANG J. X., XIONG Y. P., ZENG Y. J., CHEN X. H., ZHANG X. H., LI Y., WU K. L., ZENG S. J., DA SILVA J. A. T., MA G. H. (2023). Shoot organogenesis and plant regeneration from leaf and petiole explants of *Corydalis saxicola* Bunting. *In Vitro Cellular & Developmental Biology-Plant*, 59: 121-128.

- PREECE J. E., SUTTER E. G. (1991). Acclimatization of micropropagated plants to the greenhouse and field. In: Debergh P. C., Zimmerman R. H. (Eds). *Micropropagation. Technology and Application*. Kluwer Academic Publishers. Dordrecht, Boston, London: 71-93.
- QIN L., CHENG F. Y., ZHONG Y., GAO P., YU H. P. (2012). Callus development in tree peonies (*Paeonia* sect. *Moutan*): Influence of genotype, explant developmental stage and position, and plant growth regulators. *Propagation of Ornamental Plants*, 12: 117-126.
- ROHELA G. K., JOGAM P., SHABNAM A. A., SHUKLA P., ABBAGANI S., GHOSH M. K. (2018). *In vitro* regeneration and assessment of genetic fidelity of acclimated plantlets by using ISSR markers in PPR-1 (*Morus* sp.): an economically important plant. *Scientia Horticulturae*, 241: 313-321.
- SARROPOULOU V., MALOUPA E., GRIGORIADOU K. (2023). Cretan dittany (*Origanum dictamnus* L.), a valuable local endemic plant: *in vitro* regeneration potential of different type of explants for conservation and sustainable exploitation. *Plants*, 1: 182.
- SCHERER R. F., GARCIA A. C., FRAGA H. P. F., DAL VESCO L. L., STEINMACHER D. A., GUERRA M. P. (2013). Nodule cluster cultures and temporary immersion bioreactors as a high performance micropropagation strategy in pineapple (*Ananas comosus* var. *comosus*). *Scientia Horticulturae*, 151: 38-45.
- WEN S. S., CHENG F. Y., ZHONG Y., WANG X., LI L. Z. M., ZHANG Y. X., QIU J. M. (2016). Efficient protocols for the micropropagation of tree peony (*Paeonia suffruticosa* ‘Jin Pao Hong’, *P. suffruticosa* ‘Wu Long Peng Sheng’, and *P. × lemoinei* ‘High Noon’) and application of arbuscular mycorrhizal fungi to improve plantlet establishment. *Scientia Horticulturae*, 201: 10-17.
- WEN S. S., CHEN L., TIAN R. N. (2020). Micropropagation of tree peony (*Paeonia* sect. *Moutan*): a review. *Plant Cell, Tissue and Organ Culture*, 141: 1-145.
- WANG X., CHENG F. Y., ZHONG Y., WEN S. S., LI L. Z. M., HUANG L. Z. (2016). Establishment of *in vitro* rapid propagation system for tree peony (*Paeonia ostii*). *Scientia Silvae Sinicae*, 52: 102-110.
- XU L., CHENG F. Y., ZHONG Y. (2022a). Efficient plant regeneration via meristematic nodule culture in *Paeonia ostii* ‘Feng Dan’. *Plant Cell, Tissue and Organ Culture*, 149: 599-608.
- XU L., CHENG F. Y., ZHONG Y. (2022b). Histological and cytological study on meristematic nodule induction and shoot organogenesis in *Paeonia ostii* ‘Feng Dan’. *Plant Cell, Tissue and Organ Culture*, 149: 609-620.
- XIONG Y. P., CHEN S. Y., WU T., WU K. L., LI Y., ZHANG X. H., DA SILVA J. A. T., ZENG S. J., MA G. H. (2022). Shoot organogenesis and somatic embryogenesis from leaf and petiole explants of endangered *Euryodendron excelsum*. *Scientific Reports*, 1: Article 20506.
- YU S., DU S., YUAN J., HU Y. (2016). Fatty acid profile in the seeds and seed tissues of *Paeonia* L. species as new oil plant resources. *Scientific Reports UK*, 6: Article 26944.
- ZHONG Y., CHENG F. Y., QIN L. (2011). Meristematic Nodule: a valuable developmental pathway for plant regeneration. *Chinese Bulletin of Botany*, 3: 350-360.
- ZHU X., LI X. Q., DING W. J., JIN S. H., WANG Y. (2018). Callus induction and plant regeneration from leaves of peony. *Horticulture Environment and Biotechnology*, 59: 575-582.