



Transient GUS and GFP Expression in Spanish Red Cedar (*Cedrela odorata* L.) Somatic Embryos. Optimization of Bombardment Conditions and Evaluation of Selective Agent Lethal Dose

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ABSTRACT

Cedrela odorata is a tropical tree widely appreciated for its wood. Commercial plantations are frequently hampered by the attack of the meliacea borer, *Hypsipyla grandella*, and the lack of resistant varieties. *C. odorata* traditional breeding would consume very long periods of time, thus direct transfer of entomotoxic coding genes to generate resistant varieties is a promising alternative. There are two prerequisites for gene manipulation of this species: 1) to set the conditions for transgene delivery and 2) to have a way to select regenerating transformed plants. In this paper, we report the optimal biolistics conditions for transient expression of *uidA* and *gfp* reporter genes in *C. odorata* somatic embryos and the selective doses for kanamycin, spectinomycin, phosphinotrycin and hygromycin to screen transformed cells.

KEYWORDS

Biolistics; Genetic Transformation; Tree Genetic Modification; Tropical Wood

Cite this paper

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References

- [1] Abdollahi, M. R., Moieni, A., Salmanian, A. H., & Mousavi, A. (2009). Secondary embryogenesis and transient expression of the β -glucuronidase gene in hypocotyls of rapeseed microspore-derived embryos. *Biologia Plantarum*, 53, 573-577. doi:10.1007/s10535-009-0104-1
- [2] Able, J. A., Rathus, C., & Godwin, I. D. (2001). The investigation of optimal bombardment parameters for transient and stable transgene expression in Sorghum. In *Vitro Cellular & Developmental Biology—Plant*, 37, 341-348. doi:10.1007/s11627-001-0061-7
- [3] Campbell, M. M., Brunner, A. M., Jones, H. M. & Strauss, S. H. (2003). Forestry's fertile crescent: the application of biotechnology to forest trees. *Plant Biotechnology Journal*, 1, 141-154. doi:10.1046/j.1467-7652.2003.00020.x
- [4] Casas, A. M., Kononowicz, A. K., Zher, U. B., Tomes, D. T., Axtell, J. D., Butler, L. G., Bressan, R. A., & Hasegawa, P. M. (1993). Transgenic sorghum plants via microprojectile bombardment. *Proceedings of the National Academy of Sciences USA*, 90, 11212-11216. doi:10.1073/pnas.90.23.11212
- [5] Catlin, D. W. (1990). The effect of antibiotics on the inhibition of callus induction and plant regeneration from cotyledons of sugarbeet (*Beta vulgaris* L.). *Plant Cell Reports*, 9, 285-288. doi:10.1007/BF00232303
- [6] Drewinko, B., Freireich, E. J., & Gottlieb, J. A. (1974). Lethal activity of camptothecin sodium on human lymphoma cells. *Cancer Research*, 34, 747-750.

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- [7] Duke, S. O. (1996). Herbicide-resistant crops: Agricultural, environmental, economic, regulatory, and technical aspects. Boca Raton, FL: CRC Press.
- [8] Elliott, A. R., Campbell, J. A., Dugdale, B., Brettel, R. I. S., & Grof, C. P. L. (1999). Green-fluorescent protein facilitates rapid *in vivo* detection of genetically transformed plant cells. *Plant Cell Reports*, 18, 707-714. doi:10.1007/s002990050647
- [9] Geier, T., Eimert, K., Scherer, R., & Nickel, C. (2008). Production and rooting behaviour of *rol* B-transgenic plants of grape rootstock 'richter 110' (*Vitis berlandieri* × *V. rupestris*). *Plant Cell, Tissue and Organ Culture*, 94, 269-280. doi:10.1007/s11240-008-9352-6
- [10] Giri, C. C., Shyamkumar, B., & Anjaneyulu, C. (2004). Progress in tissue culture, genetic transformation and applications of biotechnology to trees: An overview. *Trees*, 18, 115-135. doi:10.1007/s00468-003-0287-6
- [11] Heim, R., & Tsien, R. (1996). Engineering green fluorescent protein for improved brightness, longer wavelengths and fluorescence resonance energy transfer. *Current Biology*, 6, 178-182. doi:10.1016/S0960-9822(02)00450-5
- [12] Hunold, R., Bronner, R., & Hahne, G. (1994). Early events in microprojectile bombardment: Cell viability and particle location. *The Plant Journal*, 5, 593-604. doi:10.1046/j.1365-313X.1994.5040593.x
- [13] Ikea, J., Ingelbrecht, I., Uwaifo, A., & Thottappilly, G. (2003). Stable gene transformation in cowpea (*Vigna unguiculata* L. walp.) using particle gun method. *African Journal of Biotechnology*, 2, 211-218.
- [14] Jefferson, R. A., Kavanagh, T. A., & Bevan, M. W. (1987). GUS fusion: β -glucuronidase as a sensitive and versatile gene fusion marker in higher plants. *The EMBO Journal*, 6, 3901-3907.
- [15] Jeoung, J. M., Krishnaveni, S., Muthukrishnan, S., Trick, H. N., & Liang, G. H. (2003). Optimization of sorghum transformation parameters using genes for green fluorescent protein and β -glucuronidase as visual markers. *Hereditas*, 137, 120-128.
- [16] Klein, T. M., & Jones, T. J. (1999). Methods of genetic transformation: The gene gun. In: I. K. Vasil (Ed.), *Molecular improvement of cereal crops* (pp. 21-42). The Netherlands: Kluwer Academic Publishers. doi:10.1007/978-94-011-4802-3_3
- [17] Merkle, S. A., & Nairn, C. J. (2005). Hardwood tree biotechnology. *In Vitro Cellular & Developmental Biology—Plant*, 41, 602-619. doi:10.1079/IVP2005687
- [18] Morimoto, M., Nakamura, K., & Sano, H. (2006). Regeneration and genetic engineering of a tropical tree *Azadirachta excelsa*. *Plant Biotechnology*, 23, 123-127. doi:10.5511/plantbiotechnology.23.123
- [19] Murashige, T., & Skoog, F. (1962). A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiologia Plantarum*, 15, 473-497. doi:10.1111/j.1399-3054.1962.tb08052.x
- [20] Okumura, S., Sawada, M., Park, Y. W., Hayashi, T., Shimamura, M., Takase, H., & Tomizawa, K. I. (2006). Transformation of poplar (*Populus alba*) plastids and expression of foreign proteins in tree chloroplasts. *Transgenic Research*, 15, 637-646. doi:10.1007/s11248-006-9009-3
- [21] Parveez, G. K. A., Chowdhury, M. K. U., & Saleh, N. M. (1997). Physical parameters affecting transient GUS gene expression in oil palm (*Elaeis guineensis* Jacq.) using the biolistic device. *Industrial Crops and Products*, 6, 41-50. doi:10.1016/S0926-6690(96)00204-X
- [22] Pe?a-Ramírez, Y. J., García-Shese?a, I., Hernández-Espinoza, A., Domínguez-Hernández, A., Barredo-Pool, F. A., GonzálezRodríguez, J. A., & Robert, M. L. (2011). Induction of somatic embryogenesis and plant regeneration in the tropical timber tree Spanish red cedar [*Cedrela odorata* L. (Meliaceae)]. *Plant Cell, Tissue and Organ Culture*, 105, 203-209. doi:10.1007/s11240-010-9853-y
- [23] Pérez-Barranco, G., Torreblanca, R., Padilla, I. M. G., Sánchez-Romero, C., Pliego-Alfaro, F., & Mercado, J. A. (2009). Studies on genetic transformation of olive (*Olea europaea* L.) somatic embryos: I. Evaluation of different aminoglycoside antibiotics for *nptII* selection; II. transient transformation via particle bombardment. *Plant Cell, Tissue and Organ Culture*, 97, 243-251. doi:10.1007/s11240-009-9520-3
- [24] Pérez-Salicrup, D. R., & Esquivel, R. (2008). Tree infection by *Hypsipyla grandella* in *Swietenia macrophylla* and *Cedrela odorata* (Meliaceae) in Mexico's southern Yucatan Peninsula. *Forest Ecology and Management*, 255, 324-327.
- [25] Rasco-Gaunt, S., Riley, A., Barcelo, P., & Lazzeri, P. A. (1999). Analysis of particle bombardment

- [26] Rothrock, R. E., Polin-McGuigan, L. D., Newhouse, A. E., Powell, W. A., & Maynard, C. A. (2007). Plate flooding as an alternative Agrobacterium-mediated transformation method for American chestnut somatic embryos. *Plant Cell, Tissue and Organ Culture*, 88, 93-99. doi:10.1007/s11240-006-9170-7
- [27] Sanford, J. C., Smith, F. D., & Russell, J. A. (1993). Optimizing the biolistic process for different biological applications. *Methods in Enzymology*, 217, 483-509. doi:10.1016/0076-6879(93)17086-K
- [28] Sartoretto, L. M., Cid, L. P. B., Brasileiro, A. C. M. (2002). Biolistic transformation of *Eucalyptus grandis* × *E. urophylla* callus. *Functional Plant Biology*, 29, 917-924. doi:10.1071/PP01153
- [29] Sch?pke, C., Taylor, N. J., Cárcamo, R., Beachy, R. N., & Fauquet, C. (1997). Optimization of parameters for particle bombardment of embryogenic suspension cultures of cassava (*Manihot esculenta* Crantz) using computer image analysis. *Plant Cell Reports*, 16, 526-530.
- [30] Tadesse, Y., Sági, L., Swennen, R., & Jacobs, M. (2003). Optimisation of transformation conditions and production of transgenic sorghum (*Sorghum bicolor*) via microparticle bombardment. *Plant Cell, Tissue and Organ Culture*, 75, 1-18. doi:10.1023/A:1024664817800
- [31] Tee, C. S., & Maziah, M. (2005). Optimization of biolistic bombardment parameters for *Dendrobium Sonia* 17 calluses using GFP and GUS as the reporter system. *Plant Cell, Tissue and Organ Culture*, 80, 77-89. doi:10.1007/s11240-004-9144-6
- [32] Zuker, A., Chang, P. F. L., Ahroni, A., Cheah, K., Woodson, W. R., Bressan, R. A., Watad, A. A., Hasegawa, P. M., & Vainstein, A. (1995). Transformation of carnation by microprojectile bombardment. *Scientia Horticulturae*, 64, 177-185. doi:10.1016/0304-4238(95)00817-9