

SOMATIC CELL TECHNOLOGIES FOR GENETIC IMPROVEMENT OF ORNAMENTAL PLANTS

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REFERENCES

- Barbosa L. V., Vieira M. L. C. (1997). Meiotic behaviour of passion fruit somatic hybrids, *Passiflora edulis* f. *flavicarpa* Degener. plus *P. amethystina* Mikan. *Euphytica*, 98: 121-127.
- Binsfeld P. C., Cerboncini C., Schnabl H. (2003). A viable strategy for gene transfer in sunflower using wild relatives. *Journal of Applied Botany*, 77: 108-110.
- Boase M. R., Winefield C. S., Lill T. A., Bendall M. J. (2004). Transgenic regal pelargoniums that express the *rolC* gene from *Agrobacterium rhizogenes* exhibit a dwarf floral and vegetative phenotype. *In Vitro Cellular and Developmental Biology-Plant*, 40: 46-50.
- Borsani O., Valpuesta V., Botella M. A. (2003). Developing salt tolerant plants in a new century: A molecular biology approach. *Plant Cell, Tissue and Organ Culture*, 73: 101-115.
- Boss K., Sreekantan L., Thomas M. R. (2006). A grapevine *TFL1* homologue can delay flowering and alter floral development when overexpressed in heterologous species. *Functional Plant Biology*, 33: 31-41.
- Casanova E., Trillas M. I., Moysset L., Vainstein A. (2005). Influence of *rol* genes in floriculture. *Biotechnology Advances*, 23: 3-39.
- Chang H., Michelle L., Jones G., Banowitz M., Clark D. (2003). Overproduction of cytokinins in petunia flowers transformed with PSAG12-IPT delays corolla senescence and decreases sensitivity to ethylene. *Plant Physiology*, 132: 2174-2183.
- Chen W. H., Tseng I. C., Tsai W. C., Chiang M. S., Chen Y. H., Chen H. H. (2006). AFLP fingerprinting and conversion to sequence-tag site markers for the identification of *Oncidium* cultivars. *Journal of Horticultural Science and Biotechnology*, 81: 791-796.
- Davey M. R., Anthony P., Power, J. B., Lowe, K. C. (2005). Plant protoplasts: status and biotechnological perspectives. *Biotechnology Advances*, 23: 131-171.
- Davey M. R., Anthony P., Prentice R., Patel D., Power J. B., Lowe K. C. (2007) *Ornamentals*. In: Kole C. and Hall T. C. (Eds.). *A compendium of transgenic crop plants*. Vol. 7. Blackwell, Malden, MA, USA (In press).
- Fitter J. T., Thomas M. R., Niu C., Rose R. J. (2005). Investigation of *Nicotiana tabacum* (+) *N. suaveolens* cybrids with carpelloid stamens. *Journal of Plant Physiology*, 162: 225-235.
- Forkmann G., Martens S. (2001). Metabolic engineering and applications of flavonoids. *Current Opinion in Biotechnology*, 12: 155-160.
- Gardner N., Melberg T., George M., Smith A. G. (2006). Differential expression of *rolC* results in unique plant phenotypes. *Journal of the American Society for Horticultural Science*, 131: 82-88.
- Hazarika B. N. (2006). Morpho-physiological disorders in *in vitro* culture of plants. *Scientia Horticulturae*, 108: 105-120.
- Horita M., Morohashi H., Komai F. (2002). Regeneration of flowering plants from difficile lily protoplasts by means of nurse culture. *Planta*, 215: 880-884.
- Horita M., Morohashi H., Komai F. (2003). Production of fertile somatic hybrid plants between Oriental hybrid lily and *Lilium x formolongi*. *Planta*, 217: 597-601.
- Inoue K., Kato T., Nobukuni A., Kunitake H., Yabuya T. (2006). Characterization of tetraploid plants regenerated via protoplast culture of *Iris fulva* and their crossability with Japanese irises. *Scientia Horticulturae*, 110: 334-339.
- Jain S. M., Jenks M. A., Rout G. R., Radojević L. (2006). Micropropagation of ornamental potted plants. *Propagation of Ornamental Plants*, 6: 67-82.
- Keskitalo M., Angers P., Earle E., Pehu E. (1999). Chemical and genetic characterization of calli derived from somatic hybridization between tansy (*Tanacetum vulgare* L.) and pyrethrum (*Tanacetum cinerariifolium* (Trevir)

- Schultz-Bip.). *Theoretical and Applied Genetics*, 98: 1335-1343.
- Kim J. B., Bergervoet J. E. M., Raemakers C. J. J. M., Jacobsen E., Visser R. G. F. (2005). Isolation of protoplasts, and culture and regeneration into plants in *Alstroemeria*. *In Vitro Cellular and Developmental Biology-Plant*, 41: 505-510.
- Komai F., Morohashi H., Horita M. (2006). Application of nurse culture for plant regeneration from protoplasts of *Lilium japonicum* Thunb. *In Vitro Cellular and Developmental Biology-Plant*, 42: 252-255.
- Koseki M., Goto K., Masuta C., Kanazawa A. (2005). The star-type color pattern in *Petunia hybrida* 'Red Star' flowers is induced by the sequence-specific degradation of the chalcone synthase RNA. *Plant Cell Physiology*, 46: 1879-1883.
- Li P., Pei Y. (2006a). Plant biotechnology in ornamental horticulture. Part I. *Journal of crop improvement*, 17 Li P., Pei Y. (Eds.). Haworth Food & Agriculture Products PressTM. Haworth Press, Inc., New York, 300 pp.
- Li P., Pei Y. (2006b). Plant biotechnology in ornamental horticulture. Part II. *Journal of crop improvement*, 18. Haworth Food & Agriculture Products PressTM. Haworth Press, Inc., New York, 486 pp.
- Ling H. Q., Binding H. (1997). Transformation in protoplast cultures of *Linum usitatissimum* and *L. suffruticosum* mediated with PEG and with *Agrobacterium tumefaciens*. *Journal of Plant Physiology*, 151: 479-488.
- Liu J. H., Xu X. Y., Deng X. X. (2005). Intergeneric somatic hybridisation and its application to crop genetic improvement. *Plant Cell, Tissue and Organ Culture*, 82: 19-44.
- Maliga P. (2003). Progress towards commercialisation of plastid transformation technology. *Trends in Biotechnology*, 21: 20-28.
- Marchant R., Davey M. R., Lucas J. A., Lamb C. J., Dixon R. A., Power J. B. (1998). Expression of a chitinase transgene in rose (*Rosa hybrida* L.) reduced development of blackspot disease (*Diplocarpon rosae* Wolf). *Molecular Breeding*, 4: 187-194.
- McAvoy R., Khodakovskaya Y., Li Y., Wu Y., Xue S. (2003). Phenotypic characterization of petunia plants expressing an indoleacetic acid (IAA)-lysine synthetase transgene driven by a shoot specific promoter. *Acta Horticulturae*, 625: 379-385.
- Mizuhiro M., Kenichi Y., Ito K., Kadowaki S., Ohashi H., Mii M. (2001). Plant regeneration from cell suspension-derived protoplasts of *Primula malacoides* and *Primula obconica*. *Plant Science*, 160: 1221-1228.
- Nakano M., Nomizu T., Mizunashi K., Suzuki M., Mori S., Kuwayama S., Hayashi M., Umehara H., Oka E., Kobayashi H., Asano M., Sugawara S., Takagi H., Saito H., Nakata M., Godo T., Hara Y., Amano J. (2006). Somaclonal variation in *Tricyrtis hirta* plants regenerated from 1-year-old embryogenic callus cultures. *Scientia Horticulturae*, 110: 366-371.
- Ono E., Fukuchi-Mizutani M., Nakamura N., Fukui Y., Yonekura-Sakakibara K., Yamaguchi M., Nakayama T., Tanaka T., Kusumi T., Tanaka Y. (2006). Yellow flowers generated by expression of the aurone biosynthetic pathway. *Proceedings of the National Academy of Sciences of the USA*, 103: 1075-1080.
- Rout G. R., Mohapatra A., Mohan Jain S. (2006). Tissue culture of ornamental pot plant: A critical review on present scenario and future prospects. *Biotechnology Advances*, 24: 531-560.
- Serek M., Woltering E. J., Sisler E. C., Frello S., Sriskandarajah S. (2006). Controlling ethylene responses in flowers at the receptor level. *Biotechnology Advances*, 24: 368-381.
- Shimizu K., Miyabe Y., Nagaike H., Yabuya T., Adachi T. (1999). Production of somatic hybrid plants between *Iris ensata* Thunb. and *I. germanica* L. *Euphytica*, 107: 105-113.
- Sun Y. H., Xue Q. Z., Ding C. M., Zhang X. Y., Zhang L. L., Wang W. F., Ali S. (2005). Somatic hybridization between *Nicotiana tabacum* and *N. repanda* based on a single inactivation procedure of nuclear donor parental protoplasts. *Plant Science*, 168: 303-308.
- Tanaka Y., Katsumoto Y., Brugliera F., Mason F. (2005). Genetic engineering in floriculture. *Plant Cell, Tissue and Organ Culture*, 80: 1-24.
- Teixeira da Silva, J. A. (2003). Chrysanthemum: advances in tissue culture, cryopreservation, postharvest technology, genetics and transgenic biotechnology. *Biotechnology Advances*, 21: 715-766.
- Teixeira da Silva J. A. (2006a). Floriculture, ornamental and plant biotechnology: Advances and topical issues, Vols. I - IV. Global Science Books Ltd., UK, 646, 571, 586, 696 pp.
- Teixeira da Silva J. A. (2006b). *Global plant letters*. ISSN 1750-2284. Global Science Books Ltd., UK.
- Teixeira da Silva J. A. (2006c). Scientific survey. *Global Plant Letters*, 1(1): 30-63; 1(2): 2-10.
- Vainstein A. (2002) (Ed.). *Breeding for ornamentals: Classical and molecular approaches*. Kluwer Academic Publishers, Dordrecht, The Netherlands, 392 pp.
- Wang G. R., Binding H. (1993). Somatic hybrids and cybrids of *Senecio fuchsia* Gmel (x) *jacobaeanus* L. *Theoretical and Applied Genetics*, 87: 561-567.
- Winkelmann T., Specht J., Serek M. (2006). Efficient plant regeneration from protoplasts isolated from embryogenic suspension cultures of *Cyclamen persicum* Mill. *Plant Cell, Tissue and Organ Culture*, 86: 337-347.
- Zubko M. K., Zubko E. I., Adler K., Grimm B., Gleba Y. Y. (2003). New CMS-associated phenotypes in cybrids *Nicotiana tabacum* L. (plus *Hyoscyamus niger* L.). *Annals of Botany*, 92: 281-288.