**FORESTRY BIOTECHNOLOGY: CHALLENGES AND OPPORTUNITIES IN THE GREEN ERA**

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Owing to increasing human population and the increasing global demand for wood, consumption is exceeding the natural rate of regeneration in many areas (Fenning and Gershenzon 2002). For this reason, it is necessary to enrich traditional breeding programmes with biotechnological tools able to increase the quantity and quality of forestry plants produced. FAO’s definition of forest biotechnology encompasses different techniques for cloning forest trees. Using in vitro technologies, organogenesis is generally restricted to the young seedling as explant source (Bonga 2017). For this reason, initially, organogenesis techniques in pinus species in order to produce clonal plants from selected seeds were developed (Moncaleán et al. 2005; De Diego et al. 2011; Montalbán et al. 2011). Then, in order to reproduce exactly the genotype of the donor plant, adult trees were used applying various rejuvenating pre-treatments, e.g., pruning, and spraying with cytokinins (Monteuuis et al. 2011), using vegetative buds of different Pinus species (De Diego et al., 2008; 2010; 2010b; Montalbán et al. 2013) or fewer needle primordia of 3- and 7-year-old trees (Prehn et al. 2003). After getting this extraordinary goal, we realised all the problems associated at this technique: low in vitro rooting, small acclimatization percentage, poor growth, etc..For all these reason, in 2007 we comprised all our efforts in the development of somatic embryogenesis systems. Somatic embryogenesis is a fascinating developmental pathway through which plants can be regenerated from bipolar structures derived from a single or a few somatic cells that it was first described more than 50 years ago in carrot by Reinert (1958) and Steward et al. (1958). Pinus spp. somatic embryogenesis presents different inconveniences. During the last years, we were focused in overcoming some of the problems: the competence window problem (Montalbán et al. 2014), the low initiation frequencies (Montalbán et al. 2012), the low rates of maturation (Montalbán et al. 2010), poor germination rates (Montalbán and Moncaleán 2018), low regeneration capacity in conserved cell lines (Montalbán and Moncaleán 2017), etc.. Moreover, we developed combined systems to increase the efficiency of SE in embryogenic cell lines with recalcitrance to be cryopreserved (Montalbán et al. 2011) and procedures in different conifers species (Montalbán et al. 2013) including hybrids (Hargreaves et al. 2017).

Parallel, one of our main research areas of interest was the study of the physiological mechanism controlling the tolerance to drought conditions in Pinus species (De Diego et al. 2012; 2013a, b; 2015). During the last years and taking into account all the knowledge generated as well as the fact that it has been found that different temperatures applied during the process of embryo formation produced clonal somatic plants with different phenology (Kvaalen and Johnsen 2008), our challenge is being to modulate the drought tolerance in Pinus spp; Different stressful environmental conditions has been applied along the different stages of somatic embryogenesis [initiation (García-mendiguren et al. 2015; Pereira et al. 2016), proliferation (Pereira et al. 2017) and maturation in order to obtain clonal plants with different degrees of water stress tolerance. Preliminary results have showed that somatic plants coming from EMs initiated at lower temperatures showed higher water use efficiency that control ones (Montalbán et al. 2016). At the same time, aminoacid and sugars analysis and the ultrastructure at cellular level was studied in order to know the structural changes succeed after extreme temperatures (30,40,50 and 60ºC) as well as the metabolites involved in the different SE response.

Key words: Abiotic stress, conservation, embryogenic cell lines, metabolites, organogenesis, physiological mechanism, somatic embryogenesis.

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