

## Parental heterozygosity and origin of 2n gametes in mandarin: two key parameters for Citrus triploid breeding projects

José Cuenca<sup>1</sup>, Luis Navarro<sup>1</sup> and Patrick Ollitrault<sup>2</sup>

<sup>1</sup> Instituto Valenciano de Investigaciones Agrarias. Carretera Moncada-Náquera Km. 4,5 46113 Moncada, Valencia, Spain

<sup>2</sup> CIRAD, UPR 75, IVIA Carretera Moncada-Náquera Km. 4,5 46113 Moncada, Valencia, Spain

(e-mail: jcuenca@ivia.es)

**ABSTRACT:** Citrus are the most important fruit crop in Spain and worldwide. Spain is the fifth producing country and the first in fresh fruit exportation. Seedlessness is a key characteristic for the fresh fruit market. Mandarin varietal structure in Spain causes important commercial problems because of cross-pollination between Clementines and late maturing mandarin hybrids, which produces seeds in both groups of varieties, in spite of their self-incompatibility. Development of triploid hybrids could be a solution for this problem, since they are sterile and they produce seedless fruits, and do not pollinate other varieties (Navarro et al., 2002). Triploid citrus hybrids can be obtained by several strategies (Ollitrault et al., 2008), including hybridization between diploid parents. In the case of Citrus it has been shown that the 2n gametes producing the triploid are of maternal origin. It has been proposed that the origin of 2n gametes is from the second division restitution (SDR) in Clementines and from the first division restitution (FDR) in sweet oranges. No data is available for other genotypes and particularly Fortune, a mandarin hybrid producing very high rate of triploids in 2x x 2x crosses and massively used to create triploid progenies. Mechanism of 2n gametes formation and its implication on parental heterozygosity restitution, as well as the male parent heterozygosity and parental differentiations, are the main parameters determining the genetic and phenotypic structure of the triploid population. Thus, the aim of this work was to evaluate heterozygosity level and differentiation between several male parents and Fortune mandarin and to analyse the mechanism of 2n gamete formation in Fortune. Fifteen parental genotypes used in the IVIA triploid breeding project have been analyzed with 35 codominant molecular markers SSRs (Simple Sequence Repeat), 25 of them being polymorphic for the analyzed genotypes. Heterozygosity levels vary between 37% for Fremont and Ellendale and 54% for Pineapple 4n. Likewise, the same SSR markers were used for analyzing 67 triploid hybrids from the cross between Fortune as female parent and Murcott as male diploid parent. This later was the more genetically distant to Fortune according to information of the previous study ( $D=0.49$ ). This analysis allows us to study the mechanism of formation of the Fortune 2n gametes. The obtained results are in favour of the SDR hypothesis, rather than FDR. The SDR hypothesis is coherent with the results published in case of the clementine (Luro et al., 2004), which is one of the parents of the Fortune variety.

### References

- Navarro L, Juárez J, Aleza P, Pina J.A. 2002. Recovery of triploid seedless mandarin hybrids from 2n x 2n and 2n x 4n crosses by embryo rescue and flow cytometry. I. K. Vasil (ed.), *Plant Biotechnology 2002 and Beyond*, 541-544.

- Ollitrault, P., Dambier, D., Luro F. and Froelicher Y. 2008. Ploidy manipulation for breeding seedless triploid citrus. *Plant Breed. Rev.* 30:323-352.
- Luro, F., F. Maddy, C. Jacquemond, Y. Froelicher, R. Morillon, D. Rist, and P. Ollitrault. 2004. Identification and evaluation of diplogyny in clementine (*Citrus clementina*) for use in breeding. *Acta Hort.* 663:841-847.