

## Genetic analysis of berry, flower and seed traits in two ‘Tempranillo Tinto’ populations: Influence of the *Sex* locus

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### Abstract

Berry weight, berry shape, seed content and ripening date are relevant traits to viticulturists in order to establish the quality and consumer acceptance of wine grapes. We performed a genetic analysis of 12 berry (berry weight, berry diameter, berry length and berry shape), flower (ovary and pistil length, flower diameter and ovary and pistil shape), flowering date and seed traits (seed number and seed weight) relevant to breeding in order to elucidate their genetic control and the association with flower sex. QTL analyses were conducted in two segregant populations obtained from crossing Tempranillo tinto as the pollen parent, with Graciano (Gra x Te, 151 genotypes) and Grenache (Gre x Te, 133 genotypes), respectively. Populations were phenotyped during at least two vintages in different locations. Significant QTL were detected for berry diameter (25% variance explained) and berry weight (26%) in LG3, LG5 and LG18, and for berry shape in LG1 (18%) and LG9 in both genetic backgrounds.

Sex locus was mapped close to markers VVIB23 and VMD34 in LG2, in a region where QTL for flower morphology, seed traits and flowering date were mapped. Sex locus strongly influenced flower morphology traits such as ovary shape in both progenies as expected. In one population (Gre x Te), co-localization of QTL for flower morphology-related traits, and flowering date was observed in LG7 and LG13. Besides a QTL region in LG17 was found significantly associated to berry morphology and seed parameters, suggesting close linkage or pleiotropic effects. In Gra x Te progeny, co-localizations of QTL for flower morphology, seed traits and phenology events were detected in LG3 and LG11 explaining up to 30% of the variance. For that progeny QTL for seed traits in LG18 resulted associated with locus *SDI*, and significant effects for berry seed and flower traits on LG5 co-localized with the *FERONIA* locus. A candidate gene with a function in pollen morphology is proposed associated to the highly significant QTL detected in LG11 for flower traits in both progenies.

The present study provides new evidence that Sex locus has a broader influence on phenology and berry traits than just flower sex determination. This result may have significant implications for future breeding programs.

**Keywords:** QTL, flowering date, grape quality, grape breeding, berry shape, seed traits