11th International Workshop on Grapevine Trunk Diseases July 7-12, 2019. Penticton, British Columbia, Canada

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Genetic Basis of Xylem Morphology in Grapevine: Impact on Hydraulic Conductivity and Resistance to P. chlamydospora.

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Vascular diseases of cultivated grapevine, Vitis vinifera L. sativa, are factors that can considerably limit vineyards productivity and longevity. Among these diseases, Esca disease is one of the most prevalent and destructive worldwide. While complete resistance toward Esca causal agents does not exist within the Vitis genus, differences in the ability of cultivars to limit the movement of pathogens have been reported. Previous studies provided clues about the role of xylem vessel diameter in the ability of some commercial cultivars to respond to the infection of an Esca causal agent, Phaeoacremonium chlamydospora. Here, we tested this concept within a grapevine rootstock experimental progeny (F2, V. riparia cv. 'Gloire de Montpellier' x V. vinifera cv. 'Cabernet Sauvignon'). Two hundred and sixty-one genotypes from the progeny were characterized for various xylem morphological traits and a QTL analysis was performed over 2 years of observation. Our results showed that strong and stable QTLs associated with various xylem morphological traits can be found in this progeny, including for the diameter of vessels. Based on this analysis, subsets of genotypes were further characterized for functional traits (hydraulic conductivity, resistance to P. chlamydospora). A QTL found for vessel diameter was seen to impact xylem hydraulic conductivity significantly. In addition, our results confirmed that within this progeny as well, the density of vessels of wide diameter was positively correlated with the level of susceptibility to the pathogens. This study provides useful insights about genetic basis responsible for xylem morphological traits in perennial plants, and their potential impact on vascular diseases resistance.