Rootstock influence on xylem embolized vulnerability and scion behavior under severe water deficit

José M. Escalona[1,2*], Luis Flor[1,2], Guillermo Toro[4], Antoni Sabater[2], Marc Carriquí[1,3] Hipólito Medrano[1,2] and Ignacio Buesa[5]

[1] *Research Group of Plant Biology under Mediterranean conditions. University of Balearic Islands (PlantMed)*
[2] *Agro-Environmental Sciences and Water Economics Institute. University of Balearic Islands (INAGEA-UIB)*
[3]*Instituto de Ciencias Forestales (ICIFOR-INIA), CSIC, Carretera de La Coruña km. 7.7. 28040 Madrid, España.*
[4] *Centro de Estudios Avanzados en Fruticultura (CEAF). Las Parcelas 882, Rancagua, Chile*
[5]*Centor de investigaciones sobre desertificación (CIDE-CSIC-UV-GVA). Moncada, Valencia, España*

[*]*Corresponding author: jose.escalona@uib.es*

Abstract

Severe water stress events can induce cavitation damage by xylem embolism in grapevine, diminishing plant hydraulic conductance. This work aimed to determine the rootstock effects on 1) xylem embolism vulnerability to understand its function failure under severe drought, including segmentation processes from leaf to root; and 2) hydraulic conductance across water deficit and its recovery. For this purpose, two complementary experiments were performed in one-year-old *Vitis vinifera* cv. Tempranillo grafted onto two different rootstocks (110-Richter and SO4) under well-watered 12L pot conditions. In experiment 1, the water-stress induced xylem embolism was monitored in leaves and stems, above and below grafting-point, by using “Cavicam” for determining the percentage of embolized vessels (at P12, P50 and P88). In experiment 2, analogue plants were submitted to a progressive water deficit while assessing vine water status and physiological behavior. In addition, the anatomical characteristics of leaf and stem xylem tissues were analyzed. Results of experiment 1 revealed that the embolism process started from the leaf to the root, showing hydraulic segmentation. Significant differences were found in the ψ at different P stages in the two combinations. However, neither significant rootstock effects were found on any of the parameters derived from pressure-volume curves, nor on hydraulic segmentation. Nevertheless, hydraulic segmentation seems to be correlated with the size of xylem diameter. In experiment 2, rootstock xylem anatomy was found to be related the scion behavior, influencing plant hydraulic conductivity and net photosynthesis in both well-watered and water-stressed conditions. Further studies are needed to confirm these results.

Keywords: Cavitation, xylem vessels, gas exchange, drought, recovery.