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Dissection of drought response mechanisms in grapevine rootstocks

F. Emanuelli[1-2], D. Grossi[1], G.B. Simone di Lorenzo[1], S. Lorenzi[2], L. Brancadoro[1], O. Failla[1], M.S. Grando [2], A. Scienza[1]

[1]*DISAA - Department of Agricultural and Environmental Sciences -, University of Milan, Milan, Italy*
[2]*IASMA Research and Innovation Centre, Fondazione Edmund Mach, Genomics and Biology of*

Water deficit is widely recognized as one of the major constrain in the Mediterranean and semi-arid regions where a large part of the world's premium wines are produced. Since the introduction of new varieties in the wine industry is not so straightforward, breeding grapevine rootstocks for tolerance to drought is becoming a key strategy for the future. A Genome Wide Association Study (GWAS) and a Candidate Gene (CG) approach were used to investigate the genetic basis of drought response mechanisms in an *ad hoc* core-collection consisting of 96 different genotypes of *Vitis spp.* and hybrids, selected to ensure the maximum genetic variability of a larger population of commercial, germplasm and new bred rootstocks. The physiological and growth responses to water deficit of more than 500 one-year old potted cuttings were evaluated over 30 days in semi-controlled conditions. For each genotype, three well-watered control plants were mantained at 90% of the Field Capacity (FC) determined by gravimetric method and three plants were subjected to water stress. After 7 days, water deficit was gradually established to reach first a moderate stable water deficit (50% FC for 7 days) and then a more severe and stable water deficit (30% FC for 7 days). Finally, stressed plants were fully irrigated to evaluate the level of plant recovery. Stomatal conductance was correlated with plant growth evaluation (leaves and shoots biometric measures) to define different response classes and thermal infrared imaging was implemented for the first time as a valuable remote sensing tool for high-throughput phenotyping in a GWAS experiment.

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Influence of environmental conditions on midday stem water potential of the red grapevine variety Touriga Nacional

J.P. Gouveia[1*], P. Rodrigues[1], V. Pedroso[2], I. Alves[3], C.M. Lopes[3]

[1] *Escola Superior Agrária de Viseu, Viseu, Portugal*
[2] *Centro de Estudos Vitivinícolas do Dão, Nelas, Portugal*
[3] *Instituto Superior de Agronomia, Lisboa, Portugal*

Plant water status can be evaluated by several indicators being the stem water potential one of the most used indicators. Aiming to study the dependency of midday stem water potential ($\psi_{s\text{-}md}$) on soil water availability and air vapour pressure deficit (VPD) a set of data collected during five growing seasons (2006-2010) in an irrigation experiment with the red variety Touriga Nacional was analyzed. The set of $\psi_{s\text{-}md}$ values, ranging from -0.22 and -1.38 MPa, was divided in two groups according to the corresponding fraction of available soil water (FASW) calculated with a capacitance probe to a depth of 1.3 m: well watered (FASW > 40%) and water stressed (FASW < 20%). In both groups the $\psi_{s\text{-}md}$ presented a negative correlation with the VPD measured at the time of the measurements. The regression analysis using VPD as independent variable show a linear and nearly parallel response: $\psi_{s\text{-}md} = -0.285 - 0.115$ VPD ($r^2 = 0.45^{***}$) for the FASW > 40% and $\psi_{s\text{-}md} = -0.603 - 0.104$ VPD ($r^2 = 0.52^{***}$) for the FASW < 20%, indicating that the response of the $\psi_{s\text{-}md}$ to VPD is independent of the FASW. In order to