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THE PRESSURE COLLAR TECHNIQUE APPLIED TO GRAPEVINE SHOOTS ELUCIDATES CONTRIBUTION OF ABSCISIC ACID (ABA) AND GENE EXPRESSION OF VESSELS ASSOCIATED CELLS (VACs) DURING EMBOLISM FORMATION AND REPAIR

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In woody plants, xylem embolization and ABA root-to-shoot signaling act together to trigger stomata closure.

The pressure collar (PC) technique was applied to shoots of grapevines to induce embolism formation (by PC pressurization) and recovery (by PC depressurization) in xylem vessels without metabolic interference. In parallel, embolism formation and recovery were induced on other plants by water stress (WS) and rehydration. The PC was applied on a branch of an irrigated plant, whereas another branch was used as irrigated (IRR) control. We measured leaf gas exchange and stomatal conductance (gs) with an Infra Red Gas Analyzer, leaf water potential (ψ_{leaf}) by pressure chamber technique, and hydraulic resistance by High Pressure Flow Metering (HPFM) to assess the percent loss of conductivity (PLC) caused by embolism. In addition, we assessed foliar ABA content.

Five hours of PC treatment increased PLC and reduced ψ_{leaf} and gs to values similar to WS plants. Thereafter, we depressurized PC branches and irrigated WS plants. In PC branches, ψ_{leaf}, gs and PLC recovered four hours later, whereas WS plants recovered after rehydration more slowly (two days later) following a gradual, ABA-affected recovery of gs.

Leaf petioles of plants subjected to PC or WS were sampled at end treatment (maximum stress conditions) contemporarily with petioles of IRR controls. In addition, PC and WS leaf petioles were sampled when PLC was recovered. The sampled petioles were processed in order to isolate Vessels Associated Cells (VACs) with Laser Micro Dissection (LMD) technique after paraffin embedding. To analyze VACs activity during the cycles of formation and recovery of embolism, transcripts of sugar transporters, genes related to ABA metabolism, aquaporins and stress-related transcription factors were detected by RT-PCR assays. VACs metabolic involvement, as specifically triggered during embolism formation and recovery, was elucidated and discriminated from recovery from water stress.