

Hydraulics of transgenic grapevines overexpressing a PIP2 aquaporin

Marco Vitali, Hervé H. Cochard, Alexandre Ponomarenko, Andrea Schubert, Irene Perrone, Giorgio Gambino, Claudio Lovisolo

▶ **To cite this version:**

Marco Vitali, Hervé H. Cochard, Alexandre Ponomarenko, Andrea Schubert, Irene Perrone, et al.. Hydraulics of transgenic grapevines overexpressing a PIP2 aquaporin. Xylem International Meeting, Sep 2015, Bordeaux, France. INRA - Université de Bordeaux, 86 p., 2015, Xylem International Meeting. hal-01269262

HAL Id: hal-01269262
https://hal.science/hal-01269262

Submitted on 3 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Hydraulics of transgenic grapevines overexpressing a PIP2 aquaporin

Marco Vitali[1], Hervé Cochard[2], Alexandre Ponomarenko[2], Andrea Schubert[1], Irene Perrone[1,3], Giorgio Gambino[3], Claudio Lovisolo[1*].

[1] University of Turin, Dept Agricultural, Forest and Food Sciences, Grugliasco, Turin, Italy.
[2] UMR-PIAF, INRA-Université Blaise Pascal, Clermont-Ferrand, France.
[3] CNR, Institute for Sustainable Plant Protection, Grugliasco Unit, Turin, Italy.

*Author for correspondence: claudio.lovisolo@unito.it

Abstract:

We constitutively overexpressed *VvPIP2;4N* in *Vitis vinifera* L. 'Brachetto' and in the resulting transgenic plants we analysed i) the expression of endogenous and transgenic *VvPIP2;4N* and of four other aquaporins, ii) whole-plant, root, and leaf ecophysiological parameters, and iii) leaf abscisic acid content. Expression of transgenic *VvPIP2;4N* inhibited neither the expression of the endogenous gene nor that of other PIP aquaporins in both root and leaf. Under well-watered conditions, transgenic plants showed higher stomatal conductance, gas exchange, and shoot growth. The expression level of *VvPIP2;4N* (endogenous + transgene) was inversely correlated to root hydraulic resistance. The leaf component of total plant hydraulic resistance was low and unaffected by overexpression of *VvPIP2;4N*. Upon water stress, the overexpression of *VvPIP2;4N* induced a surge in leaf abscisic acid content, and a decrease in stomatal conductance and leaf gas exchange. Our results show that aquaporin-mediated modifications of root hydraulics play a substantial role in the regulation of water flow in well-watered grapevine plants, while they have a minor role upon drought, probably because other signals, such as ABA, take over control of water flow.

On detached leaves, hydraulic capacitance (Ch) and resistance (Rh) were assessed following recovery dynamics after leaf dehydration. The dehydration was imposed by submitting the leaves at 0.5 to 1 MPa overpressure through a Scholander bomb. The recovery after dehydration was checked in dark, in light non-transpirative condition, and in light-transpirative condition. In leaves processed in dark conditions, Rh decreased and Ch increased compared to wild type plants, suggesting that in transgenic leaves, trans-cellular pathways activated during dehydration superimposed on apoplastic ones, saving water inside cells, as in/out cell-to-apoplasm water movements were aquaporin-controlled. Upon light, either when leaves transpired or not (either by depressing vapor pressure deficit or by feeding leaves with abscisic acid, causing stomatal closure) the described effects disappeared. We conclude that light activates leaf aquaporins masking the transgene effect on controlling leaf Ch and Rh, and confirming that the *in-vivo* leaf hydraulics is not affected by transgenic aquaporin *VvPIP2;4N* overexpression.

T32