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# ION-MEDIATED REGULATION OF XYLEM HYDRAULICS IN THE GENERA *FRAXINUS* AND *ACER*: RELATIONSHIPS WITH XYLEM ANATOMY AND DROUGHT ADAPTATION

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*Water availability, vessel grouping, ionic effect*

Leaf gas exchange and photosynthetic rates are limited by plant hydraulic properties and in particular by xylem hydraulic conductance ($K_{XYL}$) [1]. Under drought stress conditions, cavitation-induced embolism can lead to significant reductions of $K_{XYL}$, consequent stomatal closure and impairment of carbon balance [2]. Plants can transiently up-regulate $K_{XYL}$ by modulating xylem sap ionic concentration, a phenomenon known as 'ionic effect' [3]. In particular, it has been suggested that enhanced potassium ($K^+$) concentration might interfere with the negative charges of the pectic matrix at the interconduit pit membrane, thus inducing pectin shrinking and consequent increase of pit membrane pore dimensions and, finally, of $K_{XYL}$. In drought-stressed plants, up-regulation of residual $K_{XYL}$ would partially compensate for embolism-induced loss of hydraulic efficiency [4]. The magnitude of the ionic effect is correlated to intervessel connectivity [5]. In particular, the ionic effect was found to be related to vessel grouping index. Interestingly, high vessel grouping is an anatomical trait more commonly observed in drought-adapted taxa [6]. Hence, it can be hypothesized that high vessel grouping in drought-adapted plants translates into high ionic effect and consequent possibility for plants to compensate for drought-induced embolism and maintain positive net carbon exchange under stressful conditions. We tested this hypothesis in *Acer* and *Fraxinus* species adapted to different levels of aridity. In the genus *Acer*, the ionic effect was higher in the xerophylous than in the mesophylous species, and the magnitude of ion-mediated enhancement of $K_{XYL}$ was positively correlated to vessel grouping index. In the genus *Fraxinus*, vessel grouping was higher in the xerophylous species than in the mesophylous one, with no apparent relationship to the magnitude of ionic effect. Overall, our data offer only partial support to the hypothesis that high vessel grouping is a trait conferring higher drought resistance to woody plants through enhanced potential for ion-mediated regulation of $K_{XYL}$.

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