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LEAF HYDRAULIC VULNERABILITY CORRELATES WITH DROUGHT RESISTANCE IN *ACER* AND *QUERCUS* SPECIES

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Leaves represent the major hydraulic bottleneck in long distance water transport systems of terrestrial plants [1]. Previous studies have shown that leaf hydraulic evolution was among the major factors leading to high photosynthetic productivity of Angiosperms [2]. Indeed, gas exchange rates are correlated to leaf hydraulic conductance (k_{leaf}) across a wide range of vascular plants [3]. In turn, k_{leaf} has been shown to be correlated to structural traits like vein density and xylem conduit dimensions [4]. Leaves are the plant organ most vulnerable to drought-induced hydraulic dysfunction. Leaf water potential (Y_{leaf}) values between -1.0 and -2.5 MPa commonly induce 50% loss of leaf hydraulic conductance (P50) in broad-leaved plants. P50 has been shown to be not correlated to maximum k_{leaf} [5] suggesting that no trade-off exists between hydraulic efficiency and vulnerability at the leaf level. Recent studies have identified a number of leaf structural traits correlated to P50 across several vascular plants. The major limit of published studies resides in the very heterogeneous species' assemblages used to test leaf structural-functional relationships. In fact, trait correlations can be confounded by interactions between environmental adaptation and phylogenetic relationships between species. In order to test the adaptive value of leaf hydraulic and structural traits in closely related taxa, three *Acer* (*A. pseudoplatanus, A. campestre, A. monspessulanum*) and three *Quercus* (*Q. petraea, Q. pubescens, Q. ilex*) species were studied. Within each genus, the species selected represent increasing levels of adaptation to dry habitats. Leaf hydraulic capacity was measured using the rehydration kinetic technique over a wide range of initial leaf water potentials to assess water stress-induced changes in k_{leaf}. Minimum seasonal Y_{leaf} values were recorded in the field. The following leaf structural traits were also measured: specific leaf area, vein density, midrib xylem conduit diameter, mesophyll thickness, stomatal density. Overall, our data suggest that species from drought-prone habitats have lower maximum k_{leaf} and are more resistant to drought-induced xylem dysfunction. The possible structural bases of such differences and ecological consequences are highlighted and discussed in the poster.

REFERENCES

[1] Nardini A, Tyree MT. 1999. Root and shoot hydraulic conductance of seven *Quercus* species. *Annals of Forest Science* 56: 371-377.

[2] Brodribb TJ, Feild TS. 2010. Leaf hydraulic evolution led a surge in leaf photosynthetic capacity during early angiosperm diversification. *Ecology Letters* 13: 175-183.

[3] Brodribb TJ, Holbrook NM, Zwieniecki MA, Palma B. 2005. Leaf hydraulic capacity in ferns, conifers and angiosperms: impacts on photosynthetic maxima. *The New Phytologist* 165: 839-846.

[4] Nardini A, Gortan E, Salleo S. 2005. Hydraulic efficiency of the leaf venation system in sun- and shade-adapted species. *Functional Plant Biology* 32: 953-961.

[5] Blackman CJ, Brodribb TJ, Jordan GJ. 2010. Leaf hydraulic vulnerability is related to conduit dimensions and drought resistance across a diverse range of woody angiosperms. *The New Phytologist* 188: 1113-1123.