The role of residual trnspiration in poplar drought tolerance

Lise-Marie Billon, Philippe Vernay, Stéphane Herbette, Cochard, Adnane Hitmi

The role of residual transpiration in poplar drought tolerance

Billon Lise-Marie, Vernay Philippe, Herbette Stéphane, Cochard Hervé and Hitmi Adnane

UCA, INRA, PIAF, 63000 Clermont-Ferrand, France

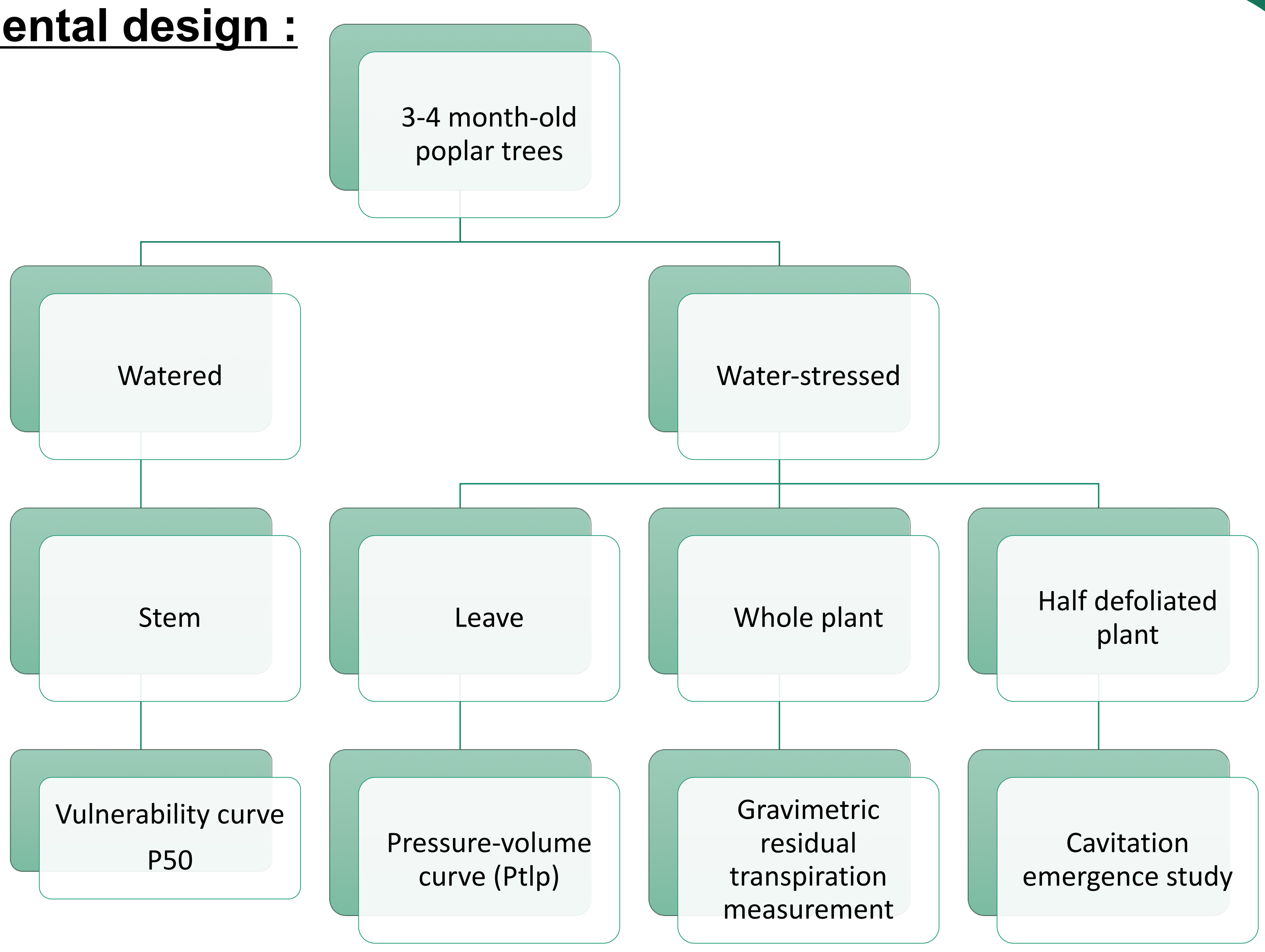
lise-marie.billon@etudiant.univ-bpclermont.fr

INRA SCIENCE & IMPACT Auvergne-Rhône-Alpes — UCA UNIVERSITÉ Clermont Auvergne — U.M.R. PIAF

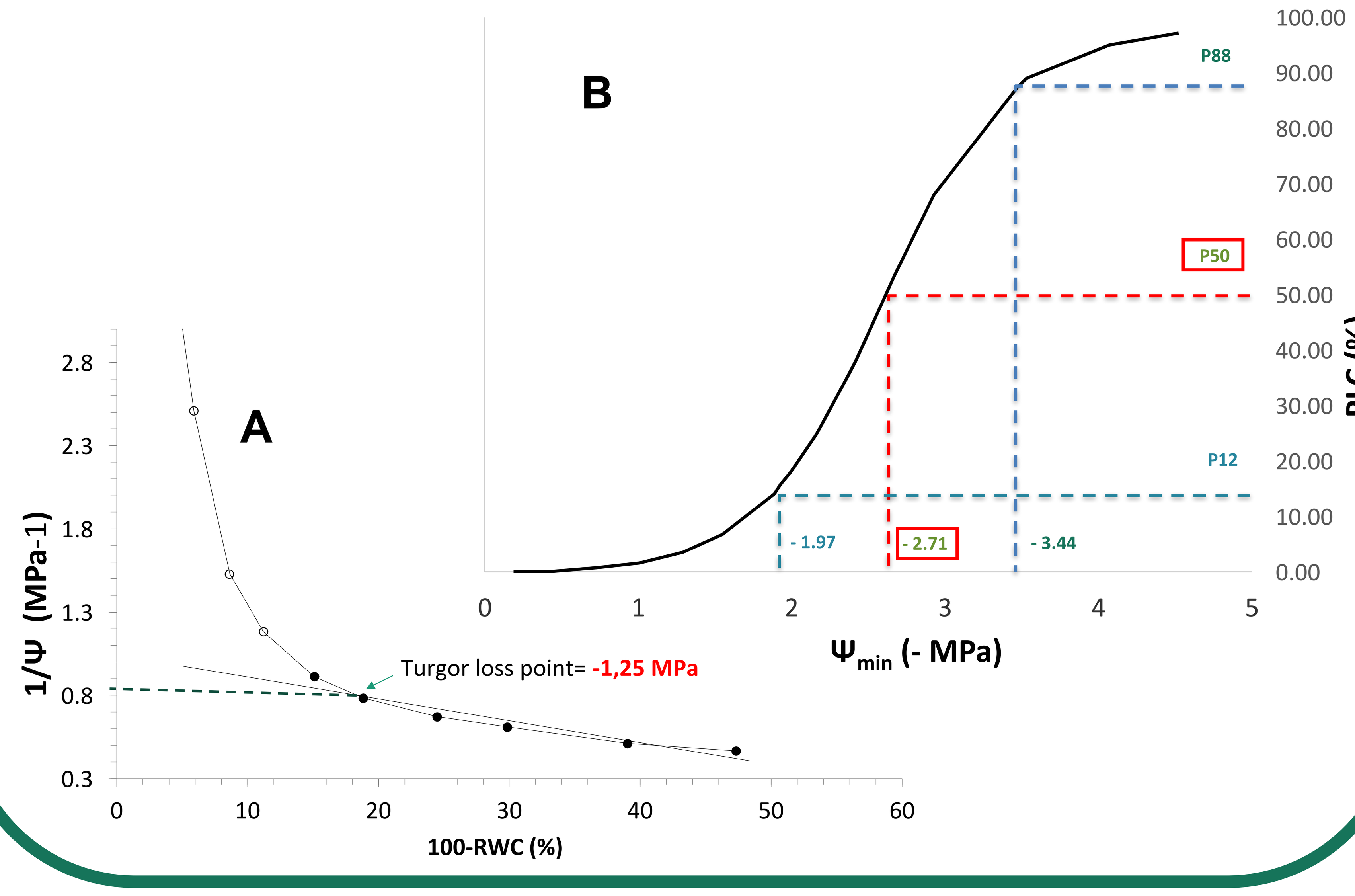
Introduction

Xylem cavitation is a major health issue causing tree mortality under drought conditions. Xylem intrinsic resistance to cavitation is now well documented but the *timing* of cavitation formation in situ is still difficult to predict. During drought, cavitation occurs after stomatal closure which suggests a key, but yet unexplored, role of plant residual transpiration. This study aimed at defining an experimental design to measure accurately plant residual transpiration and at showing how far it plays a role in the timing of cavitation formation in poplar.

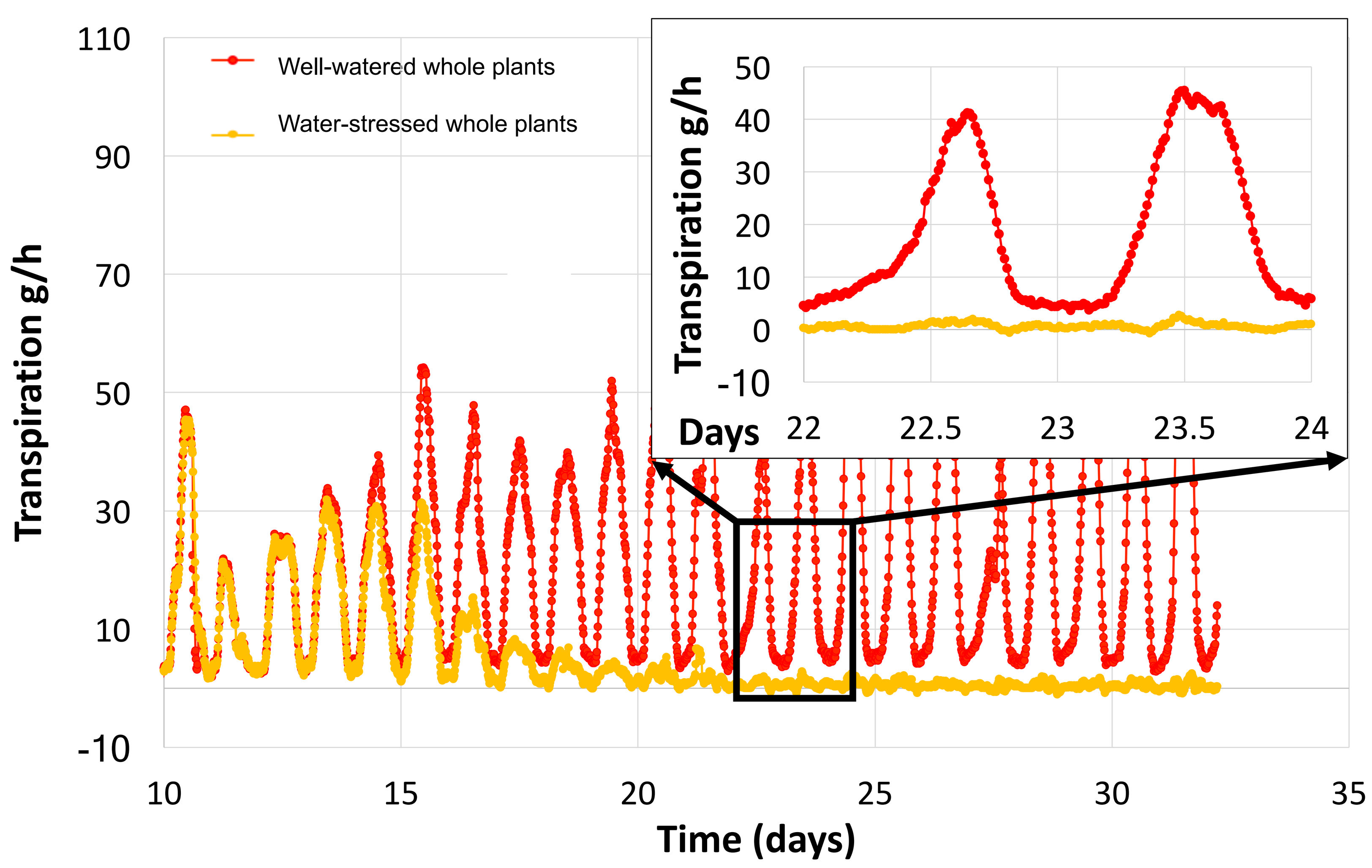
Experimental design :



Pressure-Volume (A) and Vulnerability (B) curves were obtained to estimate Ptlp and P50 values:

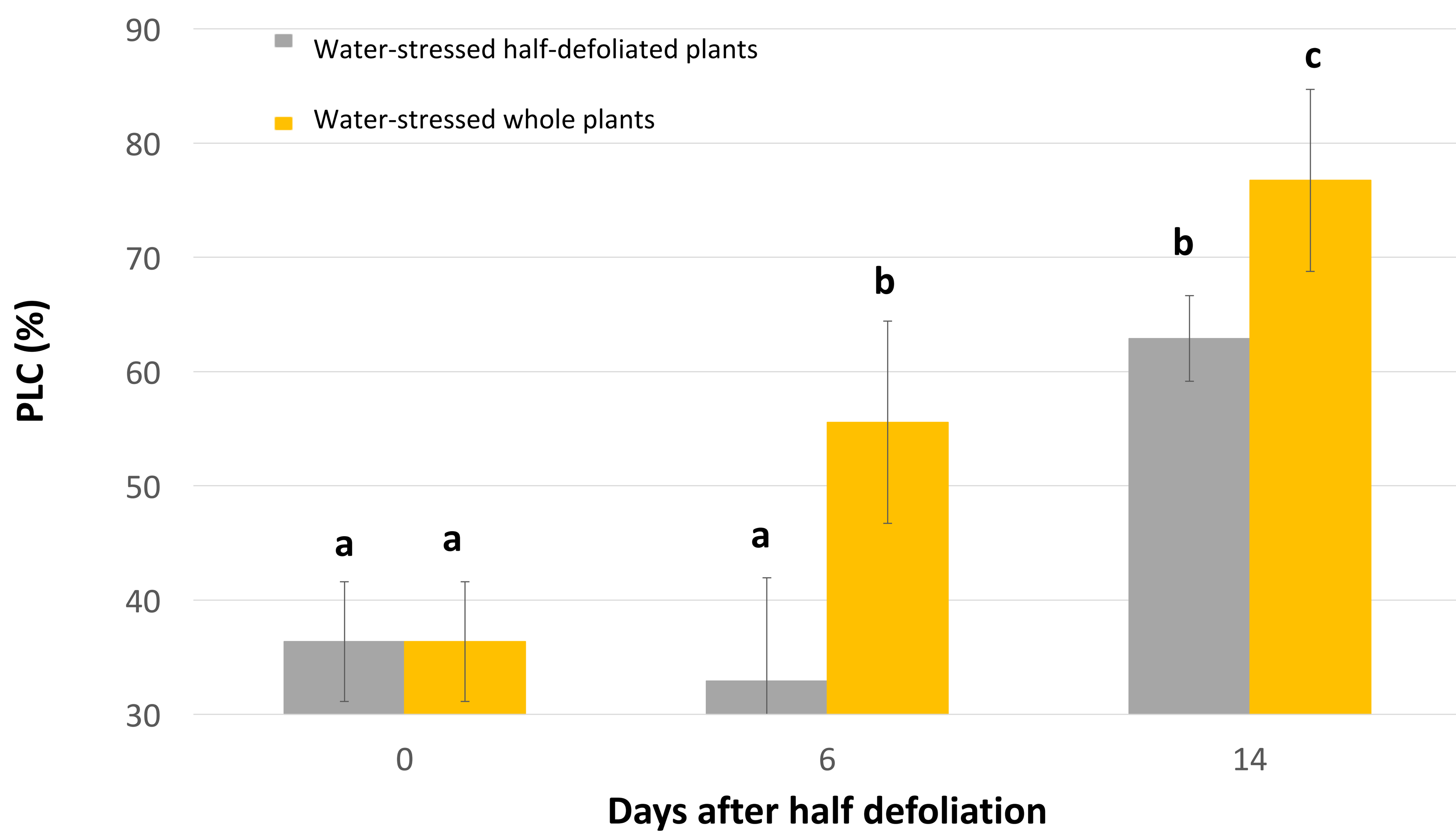


Residual transpiration estimated gravimetrically on well-watered (red) and water-stressed (yellow) poplars :



Under our experimental conditions, residual transpiration represented about 1,25% of the total transpiration of control plants.

Timing of cavitation induction for control (yellow) and 50% defoliated poplars (grey) :



Reducing plant residual transpiration by reducing plant leaf area after stomatal closure delayed significantly the induction of cavitation in the stems. Means with the same letters are not significantly different at 5% probability level (n=3).

Conclusion

Residual plant transpiration, remaining after stomatal closure during drought, can simply be estimated gravimetrically. Our work suggests that this trait plays a key role in the timing of cavitation induction during prolonged drought events, as demonstrated by our partial defoliation experiment. More information is needed on the intra and inter-specific variability of this trait and its structural and molecular basis if we are to better predict and model tree mortality under extreme drought conditions.