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Lia Lamacque, Florian Sabin, Thierry Ameglio, Guillaume Charrier, Stéphane Herbette

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Variations of the stem diameter as an indicator of plant mortality under extreme drought in lavender

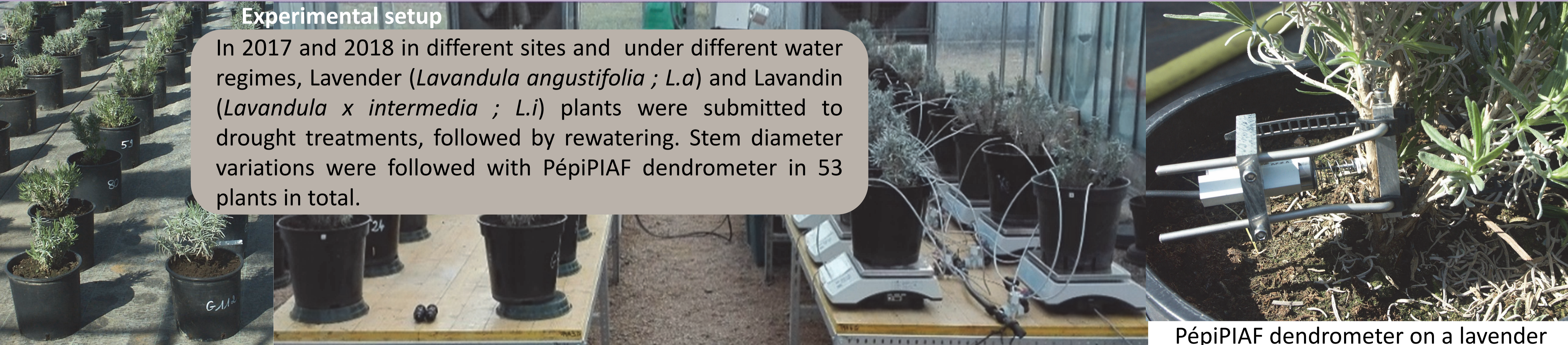
Context: French lavender crops suffer from a high rate of mortality due to drought events and we need to improve our capacity to monitor and predict plant mortality under drought.

- Aims:**
- Find a new accurate mortality index (or point of non-return) based on continuous measurement of stem diameter.
 - Investigate the mechanisms of drought-related mortality in lavender

Percentage Loss of Diameter as a « point of non-return »

Experimental setup

In 2017 and 2018 in different sites and under different water regimes, Lavender (*Lavandula angustifolia* ; *L.a*) and Lavandin (*Lavandula x intermedia* ; *L.i*) plants were submitted to drought treatments, followed by rewatering. Stem diameter variations were followed with PépiPIAF dendrometer in 53 plants in total.



PépiPIAF dendrometer on a lavender

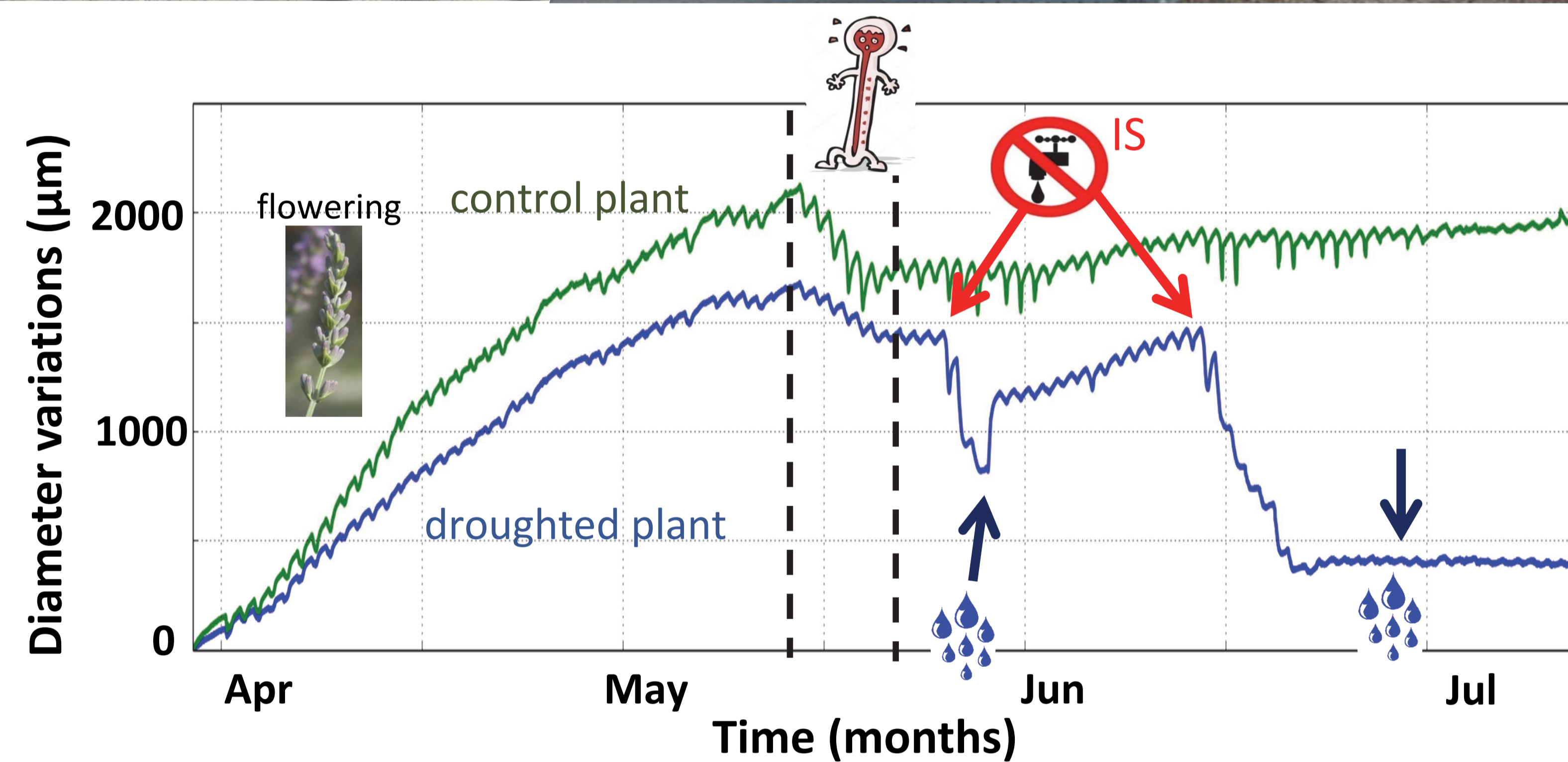


Fig 1. Example of continuous diameter variation during the growing season for a control (green) and a droughted plant (blue): two successive irrigation stops followed by rewatering.

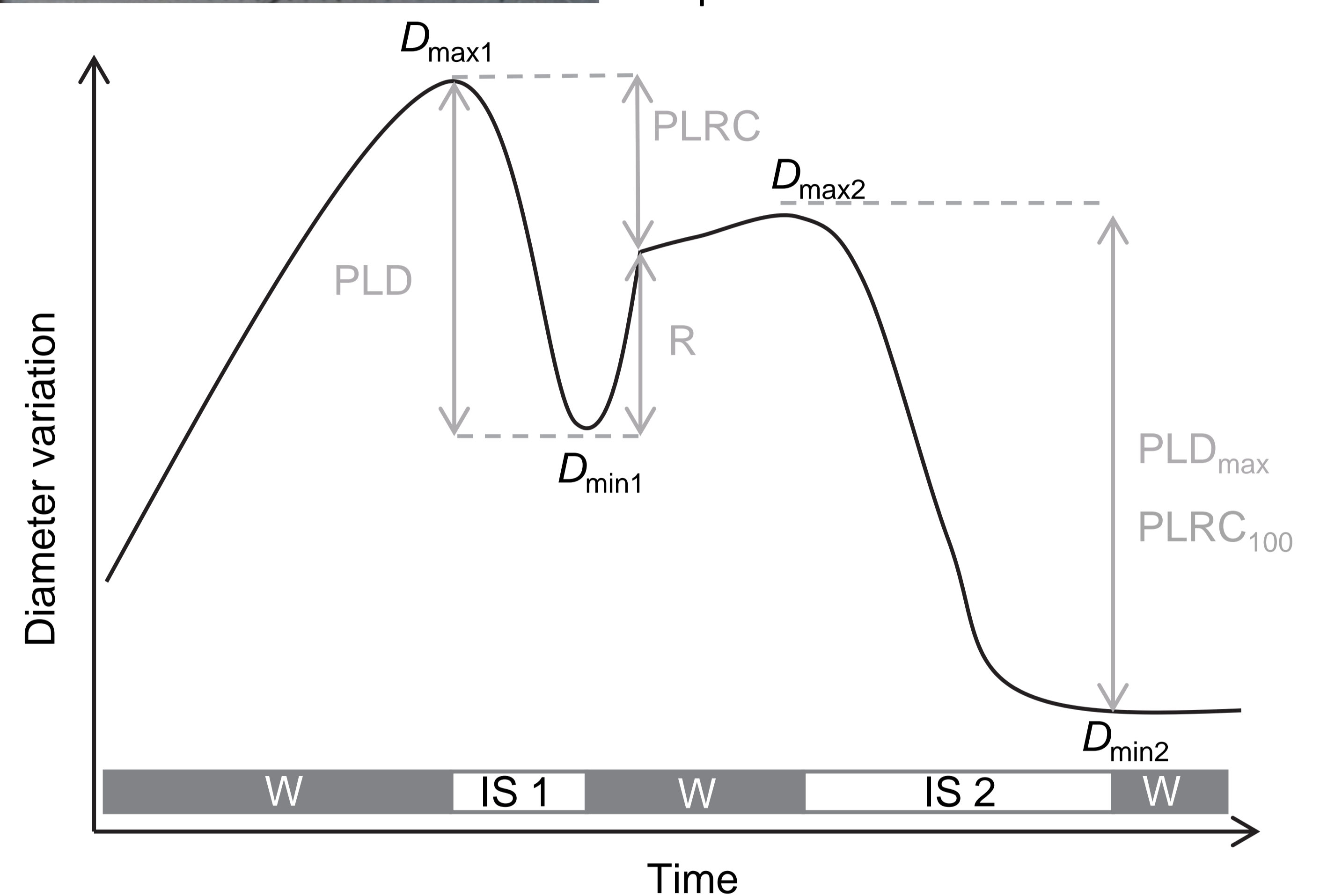


Fig 2. Typical branch diameter variation versus time during drought experiments. W indicates optimal watering conditions and IS irrigation stops. D_{max} and D_{min} represent the maximum and minimum diameter before IS and before rewatering, respectively. Computed indexes are: percentage loss of diameter (PLD), Recovered diameter (R) and percentage loss of rehydration capacity (PLRC). **PLD_{max} and PLRC₁₀₀ were reached when no recovery was observed after a rewatering.**

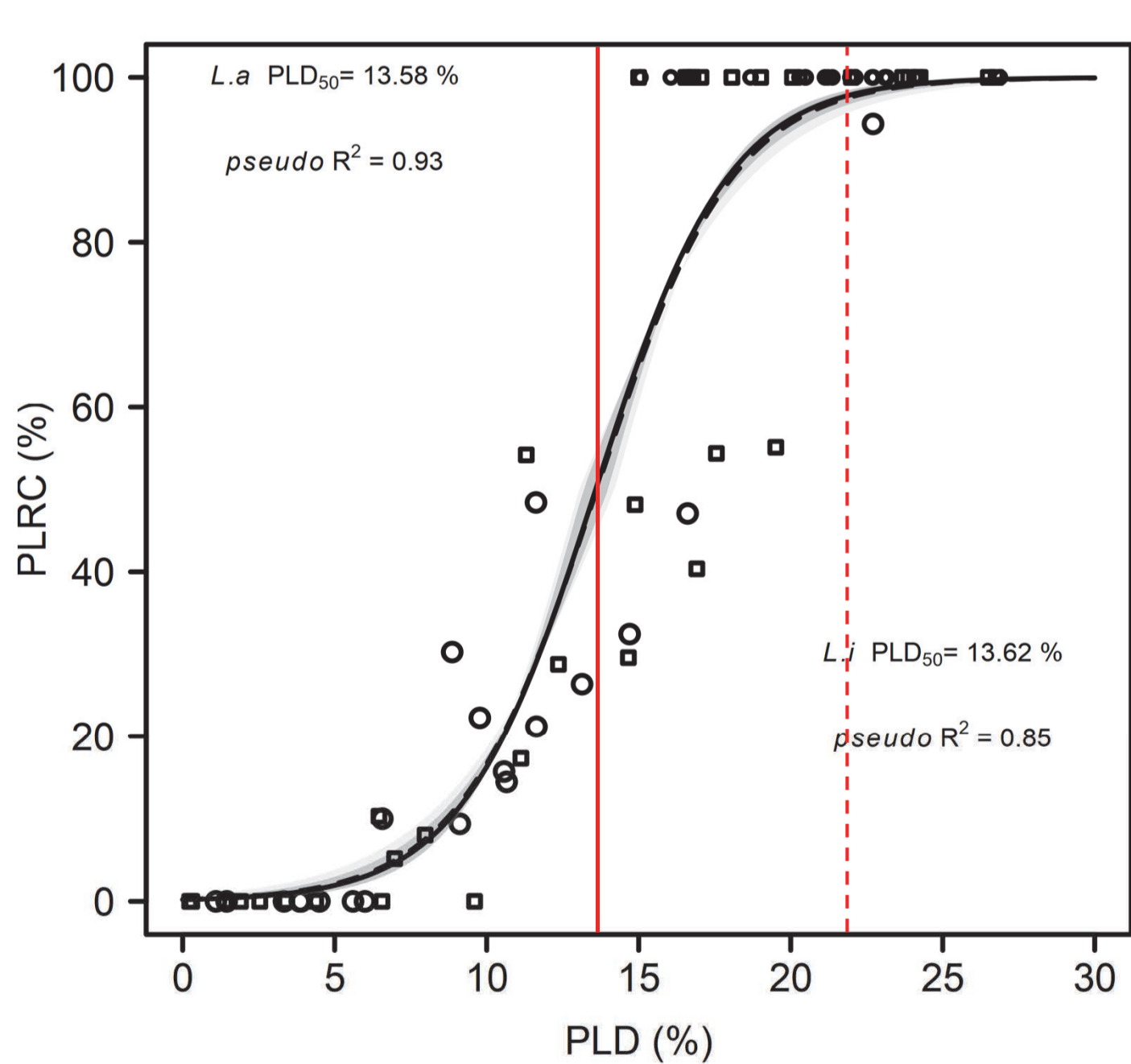


Fig 3. PLRC versus PLD or the branch diameter threshold for drought-induced mortality in Lavender (circles) and Lavandin (squares). The red vertical line is the PLD₅₀ and the red vertical dashed line is the mean PLD_{max}.

→ PLD_{max} was not significantly different between *L.a* and *L.i* and different water regimes and was associated with mortality. Mean PLD_{max} = 21.15 %

Mechanisms for drought-related mortality in lavender

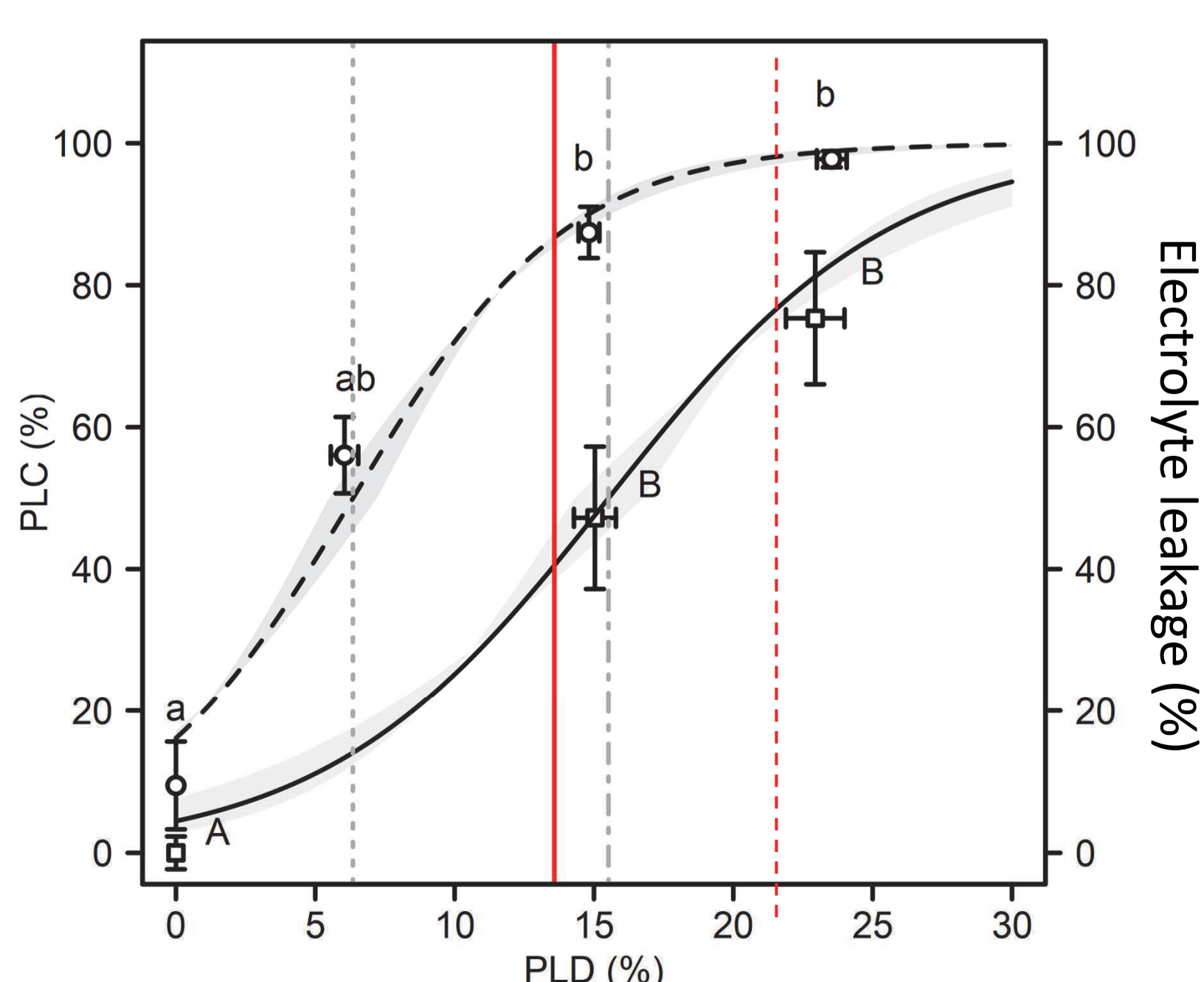


Fig 4. PLD-course of PLC (dotted line) and EL (black line) in a dehydrating *L.a*. The first grey dotted vertical line is the PLD_{50h} (PLC-driven), the red vertical line is the PLD₅₀ (Fig.3), the last grey vertical line is the PLD_{50c} (EL-driven) and the red dashed vertical line is the mean PLD_{max}. This experiment was performed in climatic chamber at constant temperature (25°C) over ca. 10 days.

→ PLD_{50c} and PLD₅₀ are similar, contrary to PLD_{50h} which is very different.

Key messages and perspectives

- PLD_{max} is a point of non return in lavender species
- Cavitation occurs mainly before cell lysis under drought
- PLD is a new indicator that could help to anticipate lavender death in the field
- Is PLD_{max} a relevant threshold in other species ?