XYL'EM : DESIGN AND PERFORMANCE OF A NEW APPARATUS FOR MEASURING XYLEM CONDUCTANCE AND EMBOLISM.

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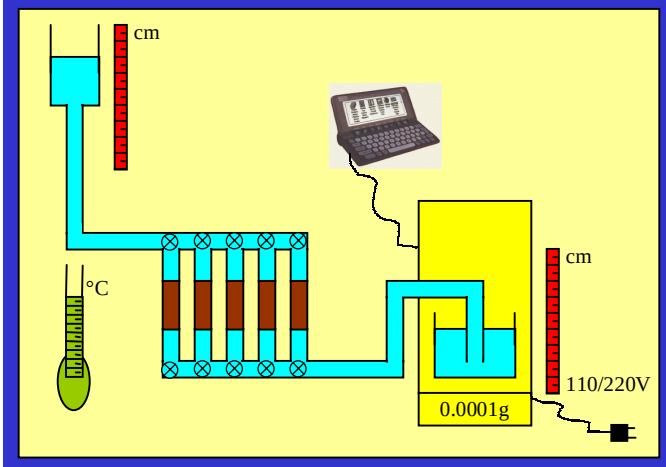
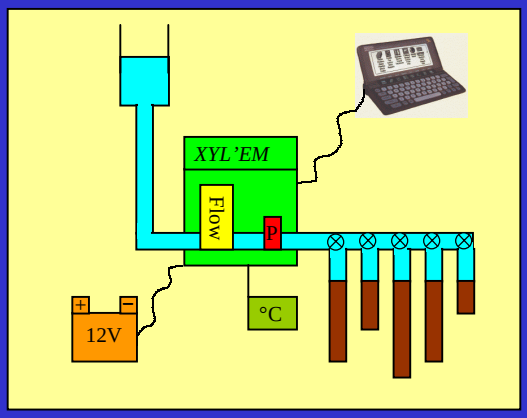
Introduction : Studies involving measurements of xylem embolism are becoming more and more frequent. There is currently no apparatus commercially available devoted to embolism analysis. Following Sperry *et al* (1988), people had to construct their own systems and develop their own software. This poster presents the prototype of a new apparatus, and compares its performances against the previous system.

Classical method : The amount of xylem embolism is best detected by its impact on the loss of hydraulic conductance (Sperry *et al* 1988, PCE 11:35-40). Conductances are computed as water flows per hydrostatic pressure gradient. Calibrated pipettes or analytical balances have so far been used to measure water flows. Pressure heads and temperature are entered manually.



XYL'EM method : Embolism is also estimated by changes in xylem conductances with the *XYL'EM* (*xylem embolism meter*) method, but water flows are measured by a high precision liquid flowmeter and pressure gradients are assessed by an electronic pressure transducer. This system overcomes some of the disadvantages of the classical method: practicability (samples are fitted into tubing at one end only), portability (12V operated), ruggedness (water proof), integrated software (DOS or Windows).



Performances of the *XYL'EM* method : We have compared the performances of a *XYL'EM* prototype using a 5g/h range flowmeter with the classical method based on a 0.1 mg analytical balance (Mettler AT400). Capillary tubes instead of plant segments were used during these tests. Water flows readings were similar with both technique (Figure 1), but the XYL'EM was much more precise whatever the flow rate and the scrutation rate (Figure 2). Conductances were independent of the water pressure head (Figure 3), highlighting the accuracy of the pressure transducer.

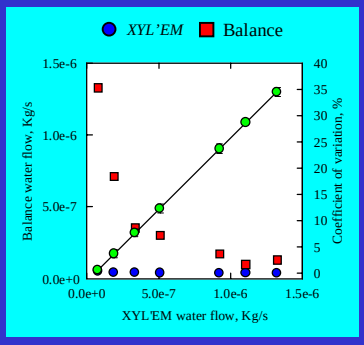


Figure 1 : Water flow through a capillary tube measured with an 0.1mg balance and the new *XYL'EM* apparatus. The flow rate was changed by changing the water pressure head. The coefficient of variation around the mean was much lower with the *XYL'EM* method than the classical method and nearly independent of the water flow.

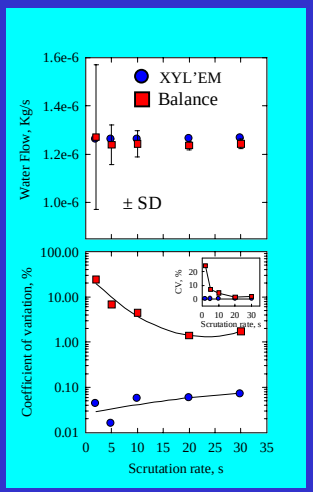


Figure 2 : Effect of the time (seconds) between two successive readings on the accuracy of the flow measurement with a balance and the new *XYL'EM* apparatus.

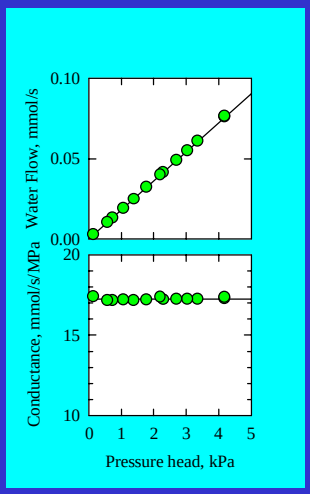


Figure 3 : Effect of the water pressure head (1 kPa = 10 cm) on the conductance of a capillary tube as measured with the new *XYL'EM* apparatus.

Conclusions : The performances of the *XYL'EM* apparatus exceed those of the classical method on many aspects. The *XYL'EM* prototype will be commercialized if there is enough demand for it.

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