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Growth kinetics and architectural development of the rose bush according to thermal time

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INTRODUCTION

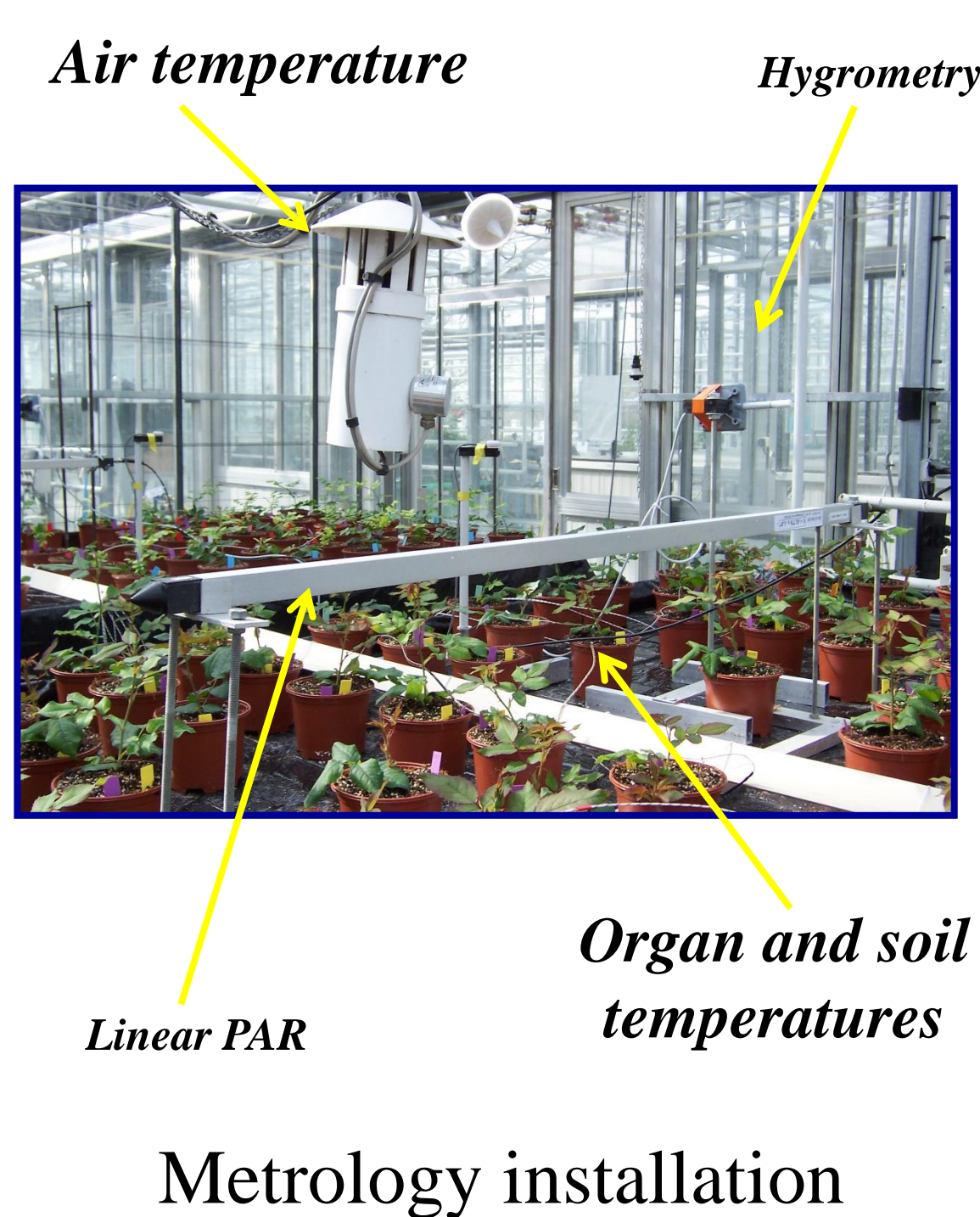
- The **architecture of ornamental plants**, such as the rose bush (*Rosa hybrida*) determines their shape and aesthetic quality, thus their **commercial value**.
- The team is developing a **3D dynamic model** that simulates the development of rose bush plant in a non-stressed environment to integrate different approaches (biochemical, genetic...).
- This study is organized in two complementary parts (1) experimental data acquisition on plant (2) model implementation using the Lindenmayer systems (see poster Favre *et al.*).

AIMS

- Characterization, **in thermal time**, of the plant growth and architectural development at the **organ scale**.
- Determination of the allometric relationships to identify the most characteristic scaling factors.

MATERIALS & METHODS

Greenhouse experiment



Plant material

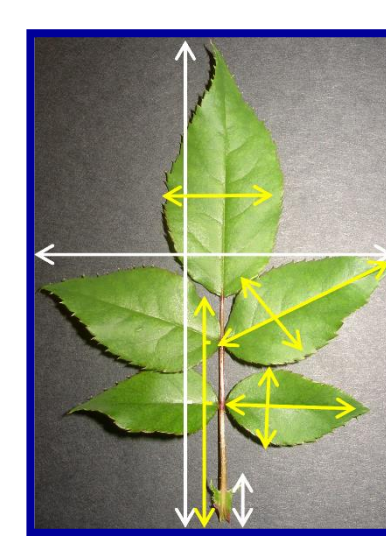


Rosa hybrida
Knock Out® "Radrazz"
(from single internode cutting of one clone)

Measurements

Destructive (60 plants)

- Morphometric measures (cm):



- stipule length
- leaf & leaflet lengths
- leaf & leaflet widths
- rachis length
- Architectural sequences (number of stipules and leaflets...)
- Physiological data (floral stages, bud outgrowth...)

Non destructive (60 plants, in progress)



- Daily measures of leaf and internode lengths (50 plants)
- Plant photography (10 plants) and analyses with MATLAB software (organ spatial position, color, flowering...)

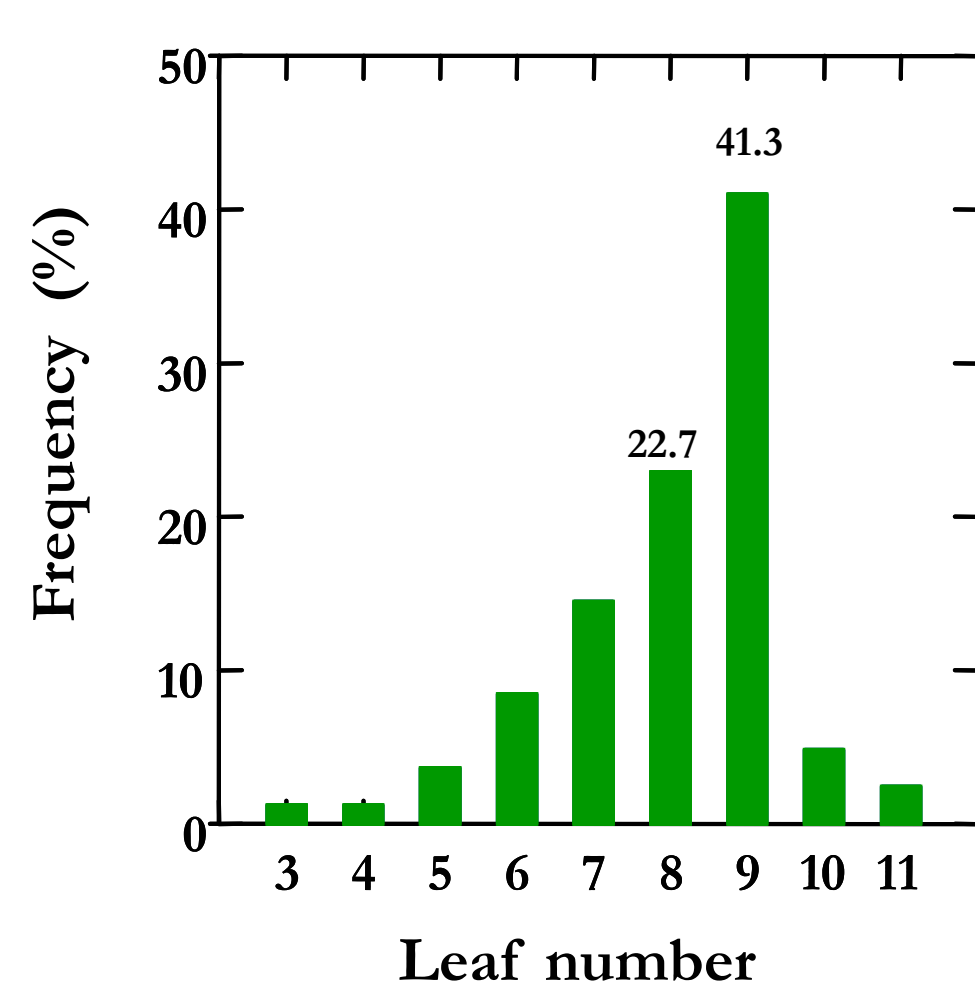
Integration

3D dynamic model

Integration

RESULTS

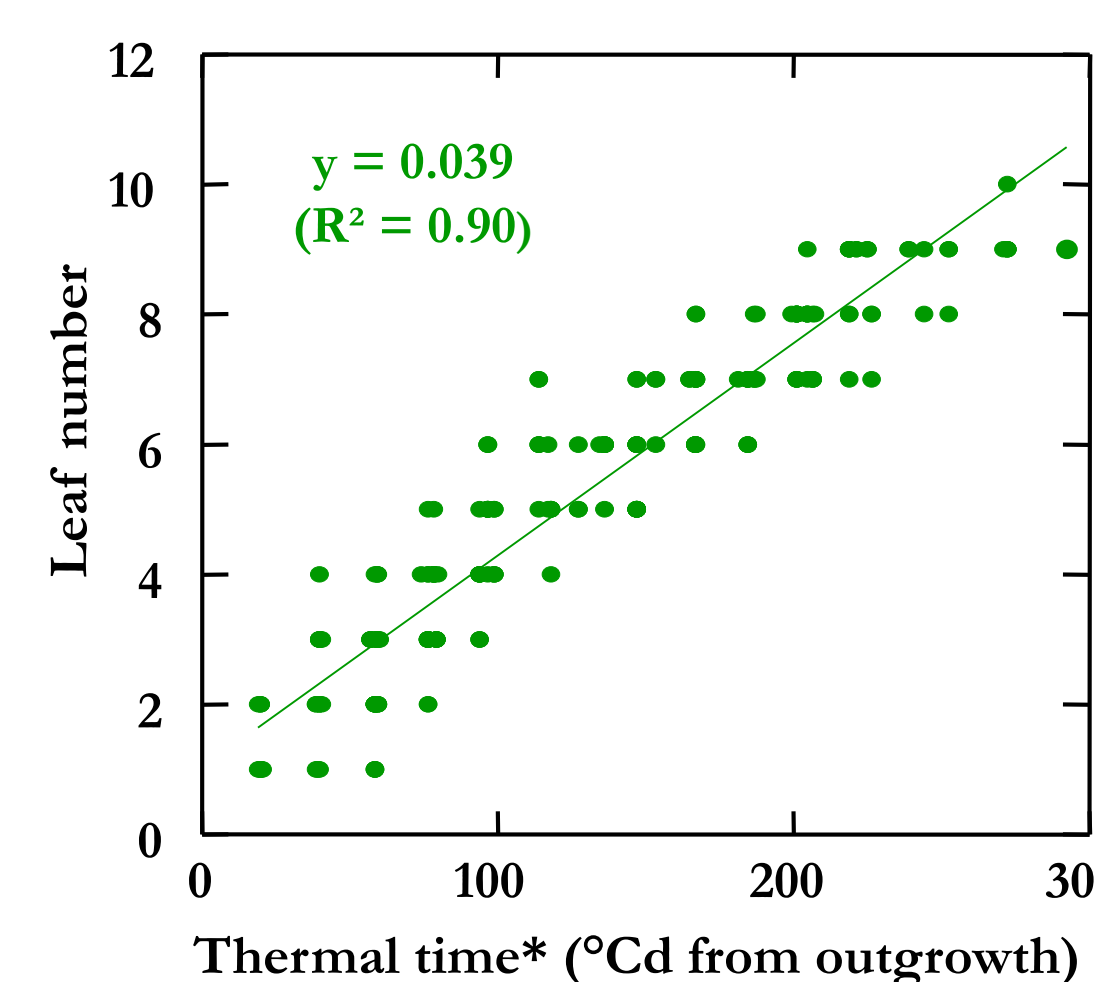
Description of the main axis (N= 110)



Frequency of leaf number on main axis

- Important variation in leaf number within a same clone (3 to 11 leaves);
- 64% of axis were composed of 8-9 leaves;
- For 98% of axis, the first leaf was a 5-leaflet (5);
- Typical foliar sequence: 0 0 5 5 5 7 7 5 3 1

Phyllochron (thermal time between 2 successive leaves) (N=60)



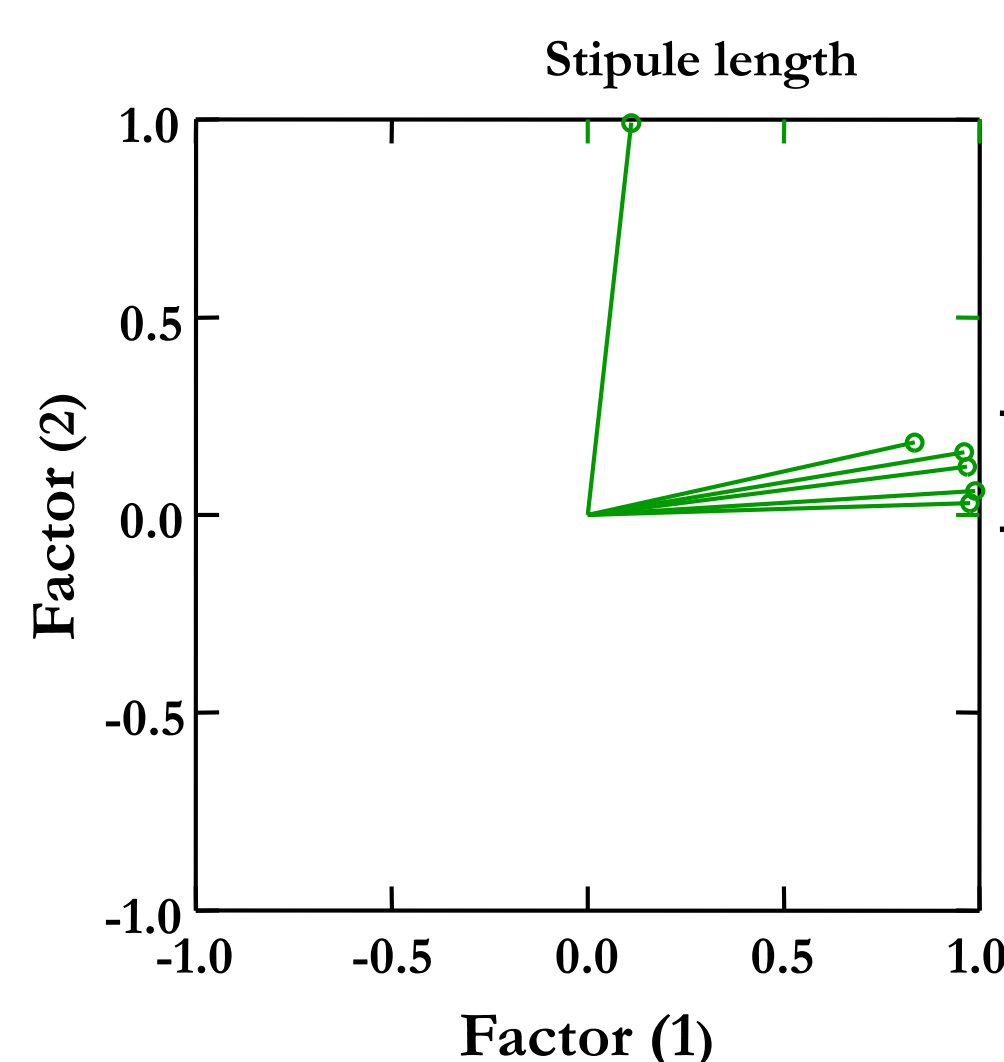
Correlation between thermal time and leaf number (N=60)

* Thermal time was calculated with base temperature of 4 °C (Massot, pers. comm.)

➔ Mean main axe = 2-3 stipules + 8-9 leaves + 1 flower

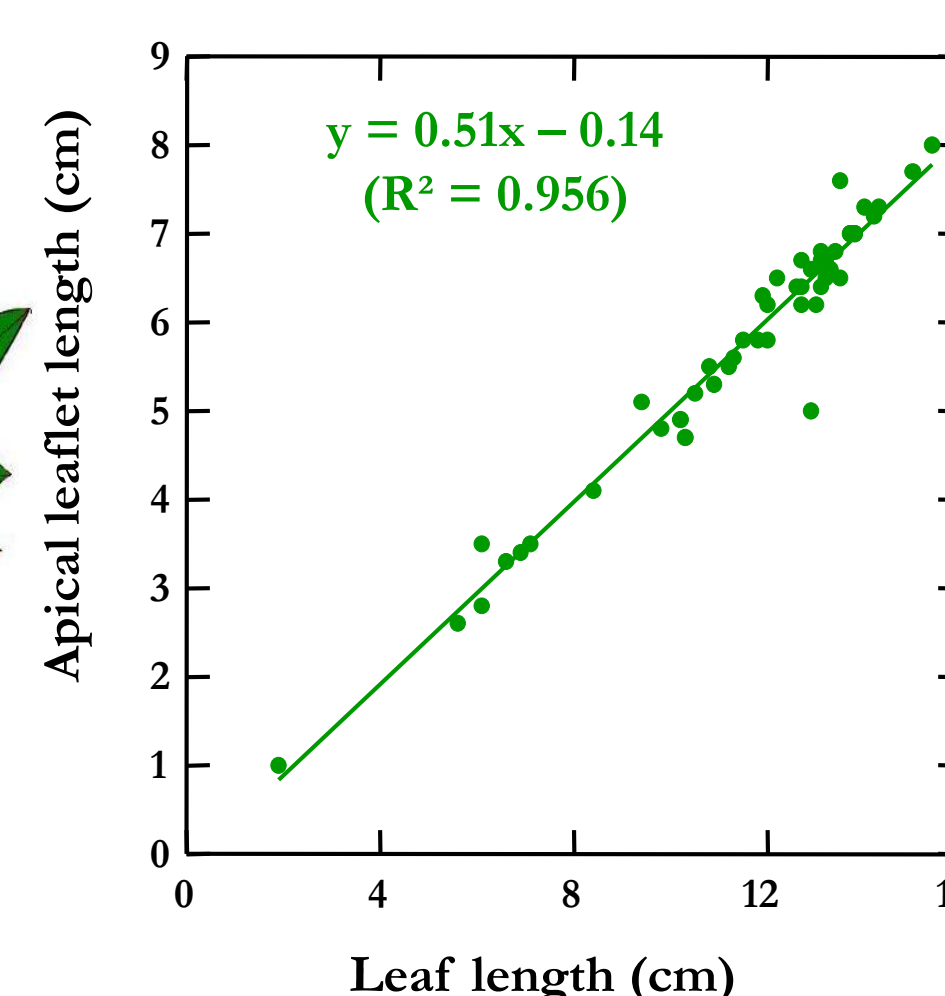
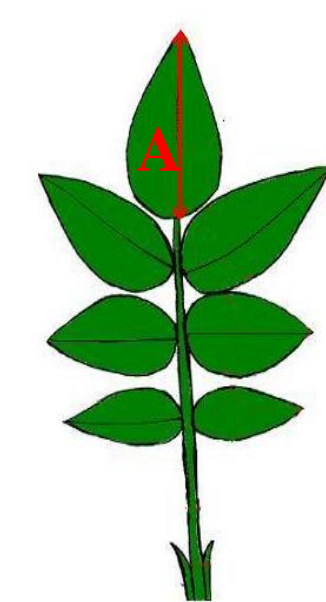
➔ Phyllochron = 25.6 ± 0.4 °C day leaf⁻¹

Examples of allometric relationships (N= 60)



Principal Component Analysis with 6 variables (Axis 1-2 : 92.8 %)

- No correlation between stipule and leaflet/leaf lengths. The stipule length was constant (1.01 ± 0.02 cm).
- High correlation between the lengths and the widths of leaflets and leaves.



Correlation between leaf and Apical leaflet (A) lengths for the 7-leaflet leaves.

- A-leaflet length = 0.51 × leaf length - 0.14
- Different linear regressions were obtained between morphometric measures according to foliar type.

➔ The most convenient factor to characterize the leaf was length

CONCLUSIONS

- These preliminary results have permitted to identify the first allometric relationships.
- A second greenhouse experiment is in progress, in purpose to :
 - ➔ establish growth curve of individual internode and leaves;
 - ➔ monitor the evolution of the secondary axis layout;
- All of these results are incorporating into the 3D dynamic model (see poster Favre *et al.*).
- Same experiments have to be done with other cultivars (e.g. wichurana) to validate this model.