Breeding cut roses for better keeping quality: *first steps*

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IHC
Lisboa 2010

Introduction

- Production of high keeping quality plants is of utmost importance:
  - Increased competition in the ornamental horticultural sector
  - Key factor for consumers' satisfaction
- Water stress is the major post-harvest quality problem

  $\Rightarrow$ shorter vase life

- End of vase (at flower auction):
  - 52% water stress
    - Bent-neck
    - Leaf and flower wilting
    - Leaf drying
  - 33% *Botrytis*
  - 15% natural senescence

  (source: Van Meeteren, pers. comm)

How can we influence vase life of cut roses?

problem is already there

- Most research has been focused on post-harvest conditions
  (e.g. preservative solutions)
- Potential vase life = maximum vase life

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Objectives

Contribute to fasten the selection criteria and procedures for breeding for cultivars with longer vase life (better control of water loss)

- Screen a segregating tretraploid (K5) rose population for stomatal responses to leaf desiccation
- Analyse the variation existing in the gene pool for:
  - stomatal responses to leaf desiccation
  - cuticular transpiration
- Vase-life evaluation

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M&M: Cut rose population screening (Expt. 1)

- 110 genotypes & 2 parents
  - Population created for studing resistence to powdery mildew
  - Shows segregation for many morphological traits
- Greenhouse cultivation

- Response to leaf desiccation
  - n = 12 terminal leaflets per genotype
  - Detached and re-hydrated during 1 hr in light
  - Desiccation in test room (RH: 50±3 %, T: 21°C, 50 µmol m^{-2} s^{-1})
  - RWC after 4 hours desiccation

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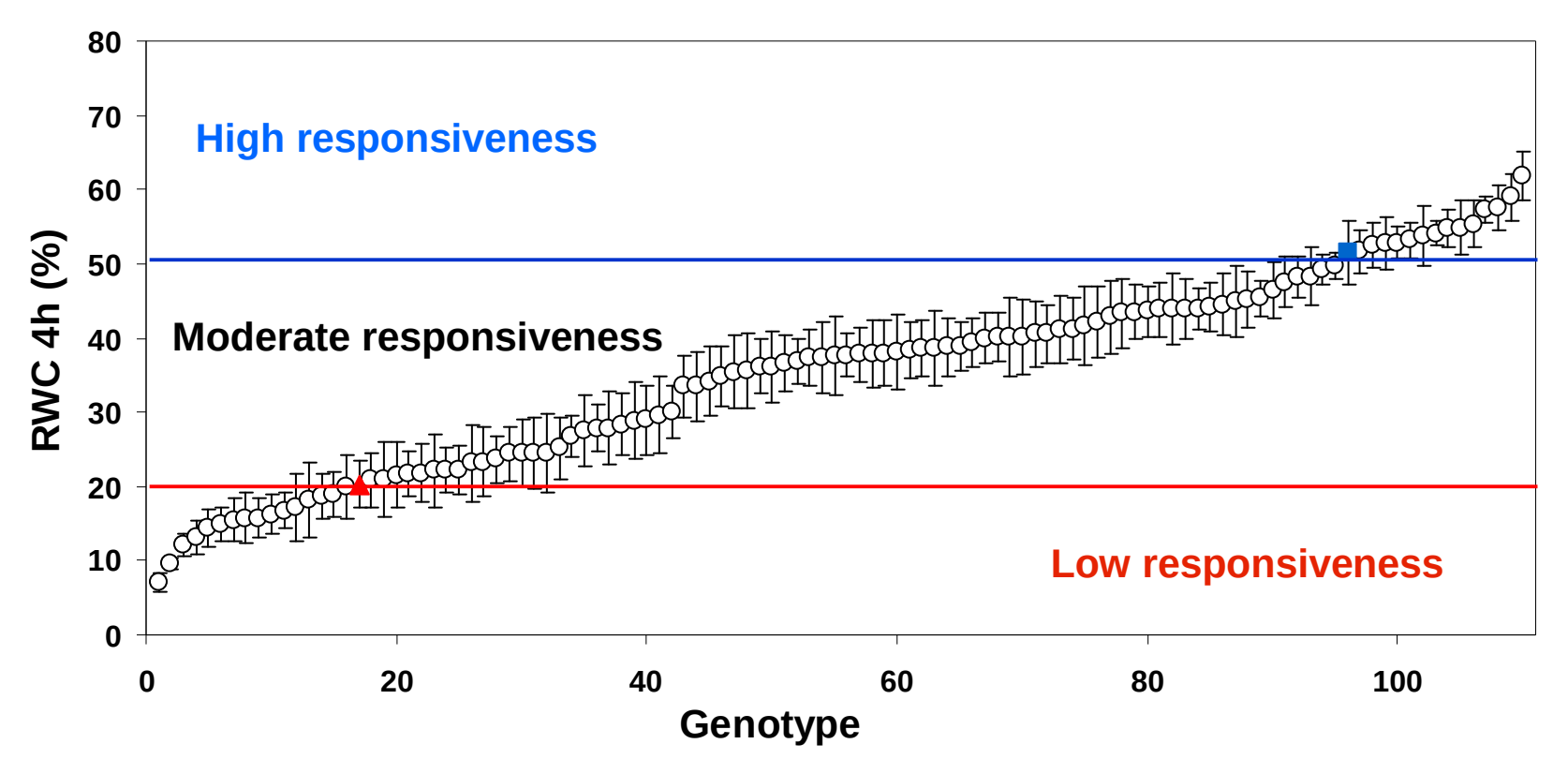
M&M: Cut rose population screening – cont.

$$RWC = \frac{\text{Fresh Weig ht} - \text{Dry Weight}}{\text{Saturated Fresh Weig ht} - \text{Dry Weight}} * 100$$

Expt.1: Population screening



- Large genotypic variation in response to leaf desiccation
- RWC 4h desiccation ranged 7-62% (parents: 20, 51% RWC)

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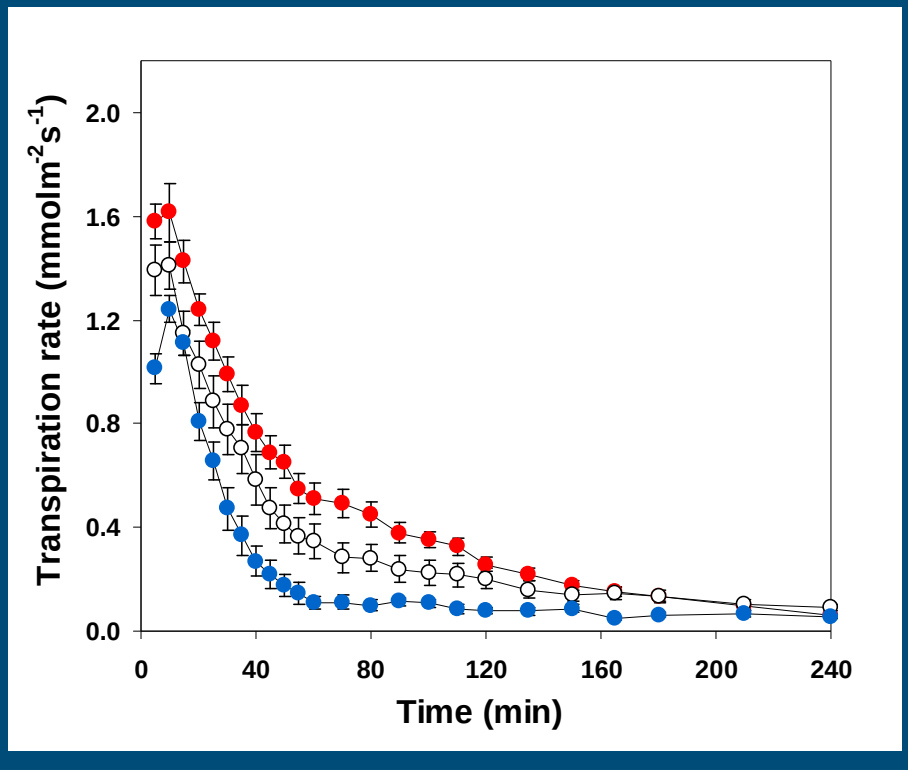
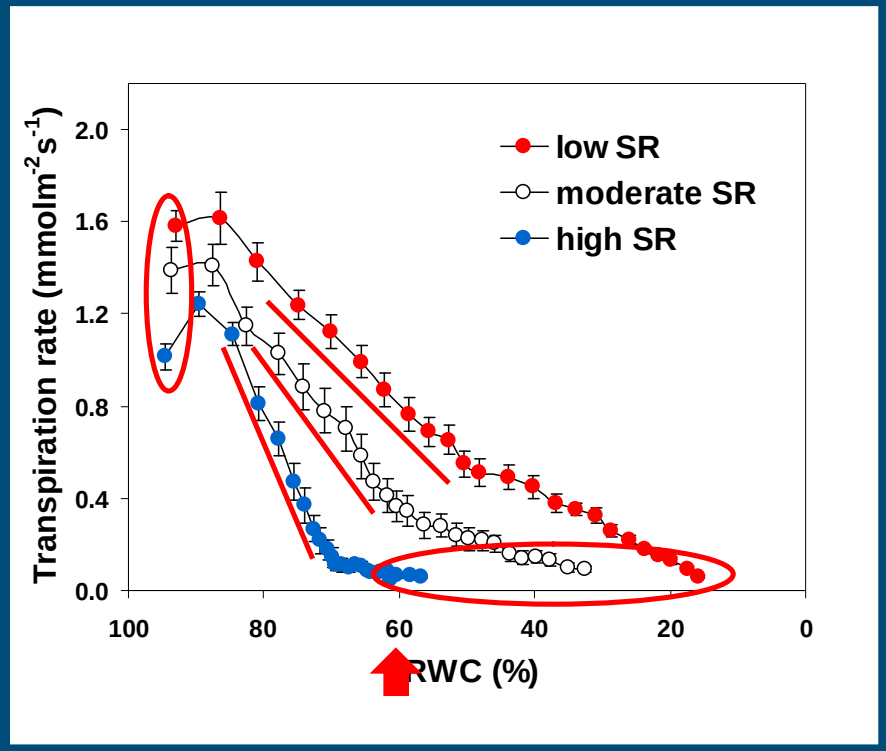
Expt.2: Variation in the stomatal responsiveness (SR)

- Representative genotypes from each group (12 & 2 parents)
- Leaf desiccation (n = 12 per genotype)
- Transpiration rate during 4 hours (gravimetrically)





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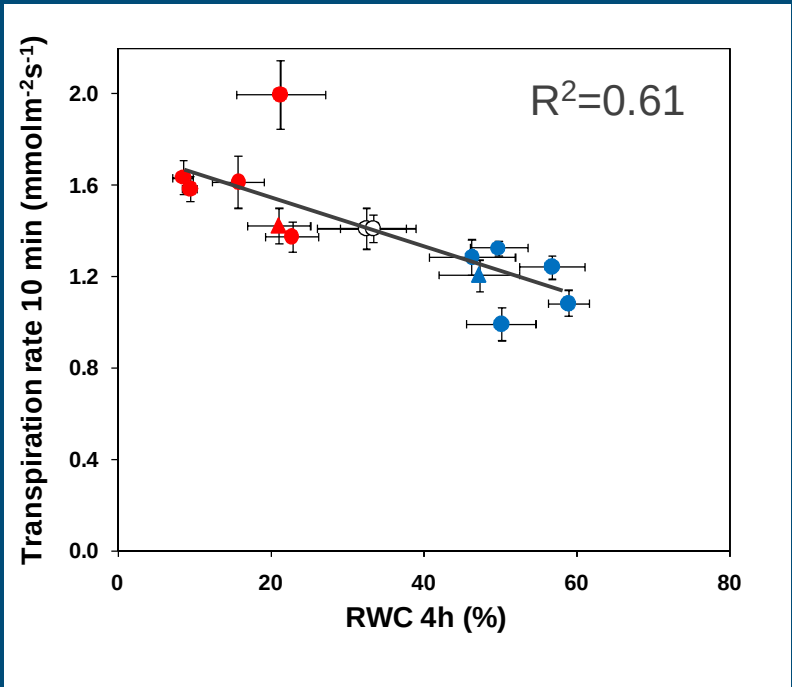
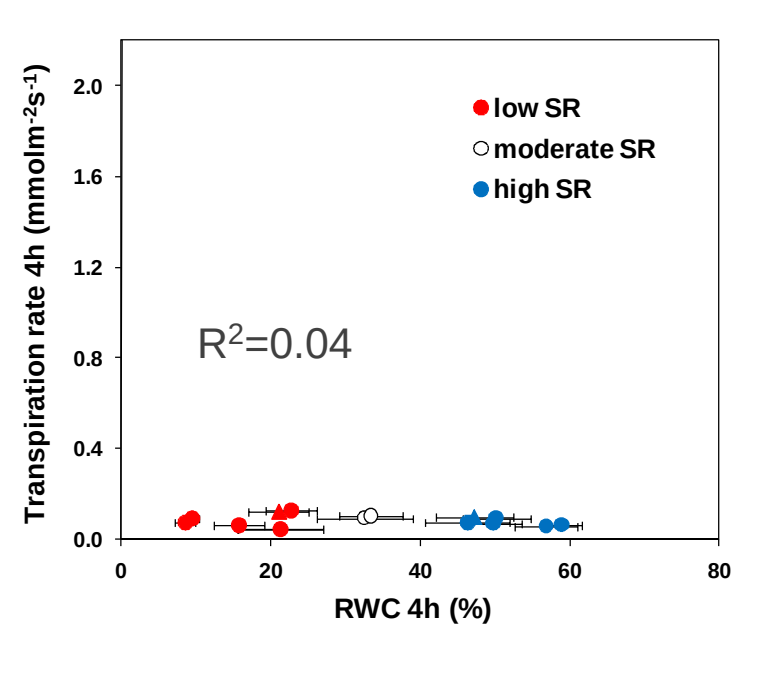
Variation in the stomatal responsiveness (SR) – cont.





- *Initial transpiration rate* (10min) is only slightly related to stomatal responsiveness
- *Final transpiration rate* (4h) is an irrelevant trait, since it corresponds to very different leaf hydration levels (RWC)

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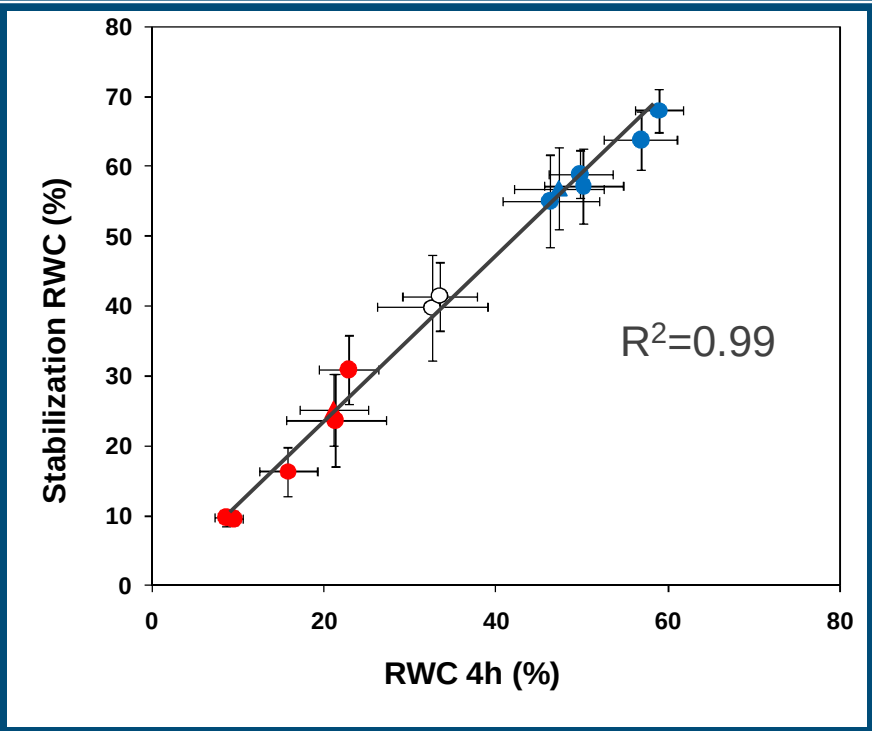
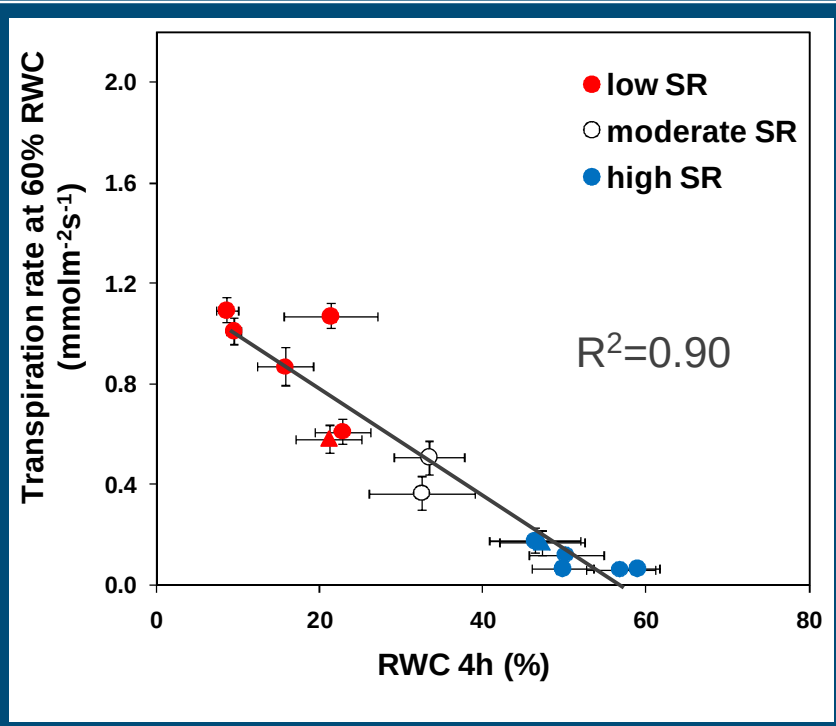
Variation in the stomatal responsiveness (SR) – cont.





- *Speed of stomatal closure* is strongly related to stomatal responsiveness (RWC stabilization high > moderate > low)
- *Degree of stomatal closure* at certain leaf hydration level (RWC) is strongly related to stomatal responsiveness (high > moderate > low)

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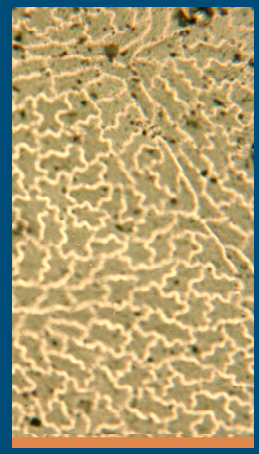
Expt. 3 – Variation in the cuticular transpiration

- 8 genotypes (4+4) & 2 parents
- n = 12 per genotype



Hypostomatous leaves

- Sealing lower leaf surface with wax and polyethylene sheet
- Desiccation in test room (RH: 50±3 %, T: 21°C, 2,5 µmol m^{-2} s^{-1})

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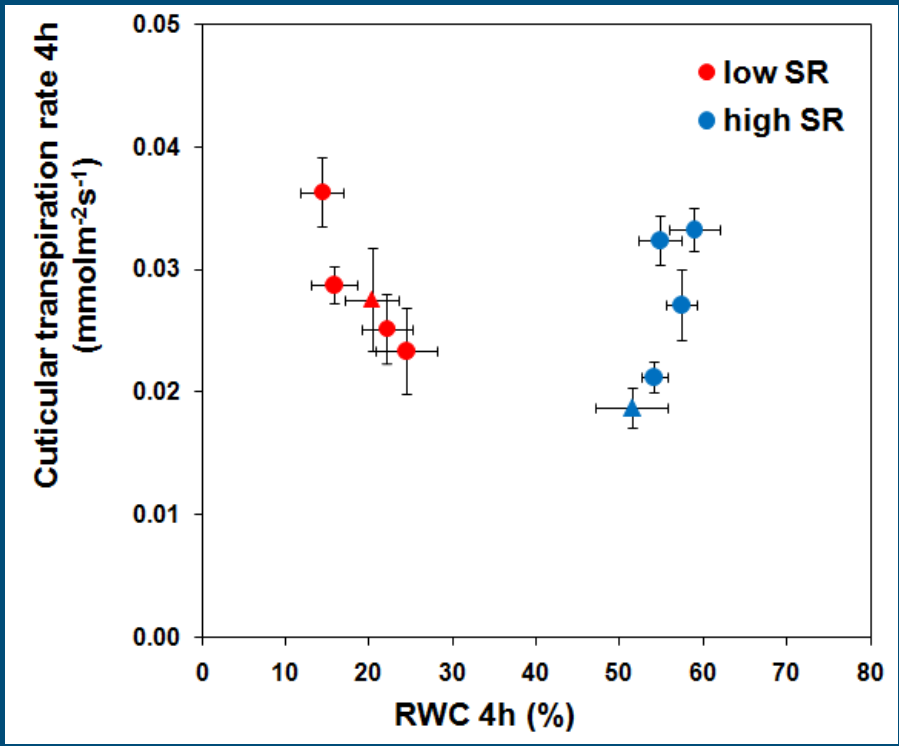
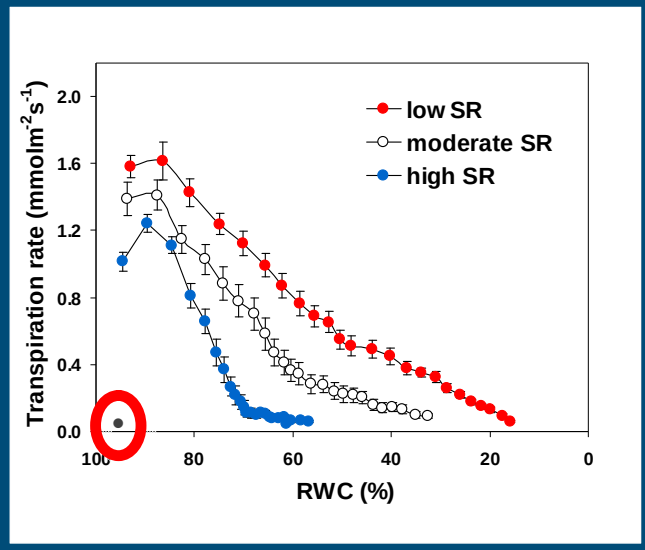
Cuticular permeability (G): no screening value





- Similar range of G in contrasting genotypes
- Cuticular contribution to total water loss is minimal

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Expt. 3 – Vase-life evaluation

- 6 genotypes (3+3)
- n = 8 stems/genotype (normalized length & leaf area)
- Harvest at stage 2 (VBN, 2001)

- Standard solution
  (0.7mM $CaCl_2$, 1.5mM $NaHCO_3$, 5µM $CuSO_4$)
- RH: 50 %, T: 20°C, 10-12 µmol $m^{-2}s^{-1}$ (12h/d)
- End of vase life according to VBN criteria (2001)

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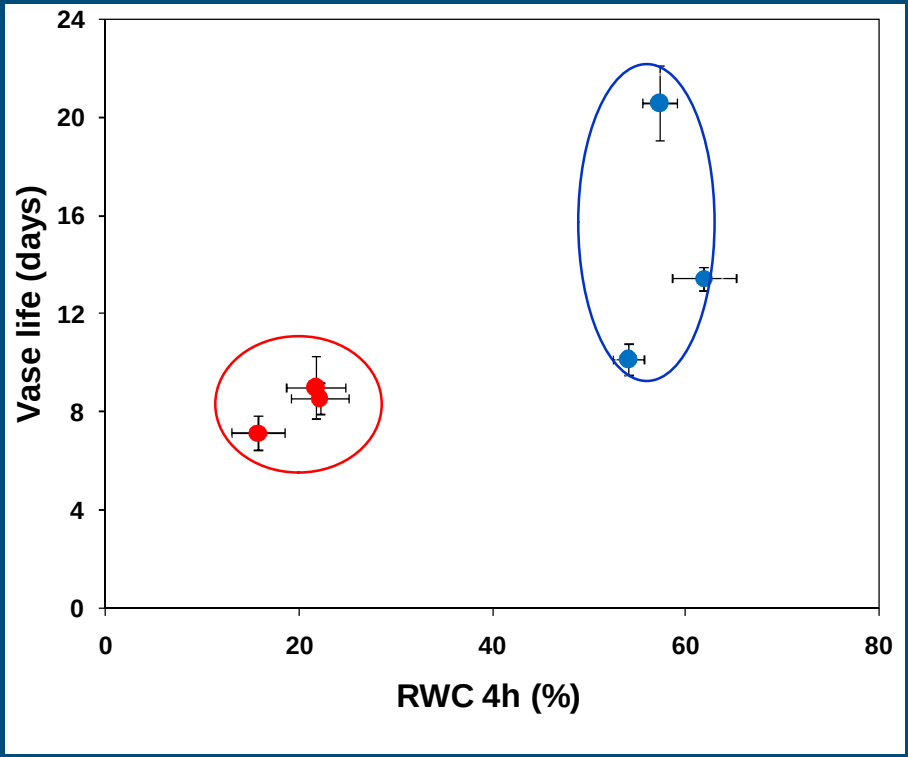
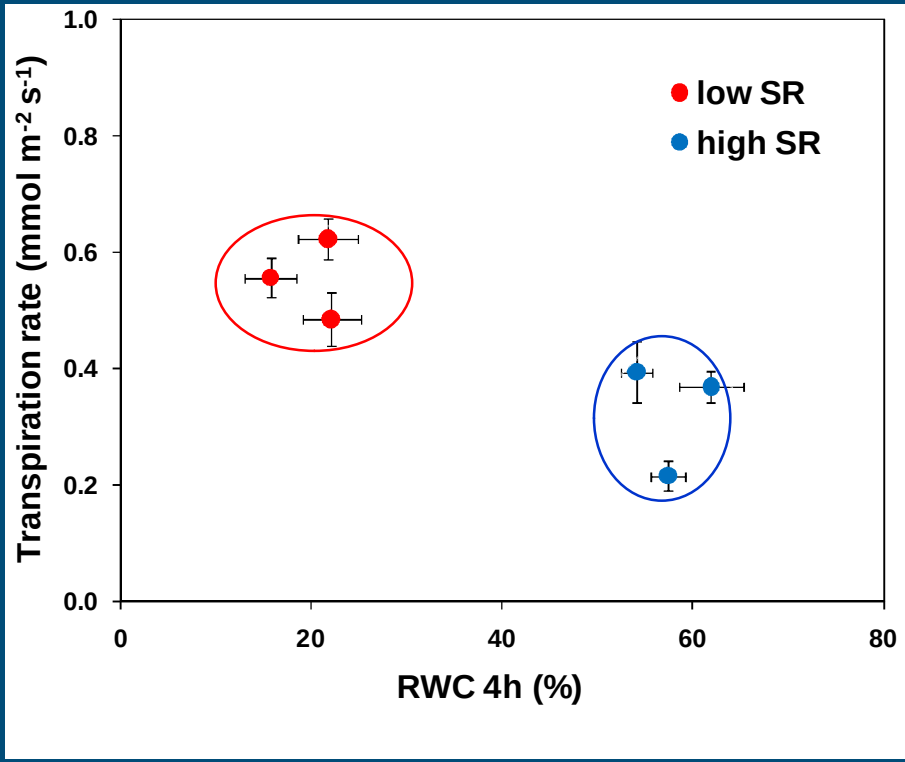
Importance of stomatal responsiveness on vase life





- Low stomatal responsiveness (SR)
  - Shorter vase-life (8 days ± 0.5 / 15 days ± 3.1)
  - limited by the high water loss rates

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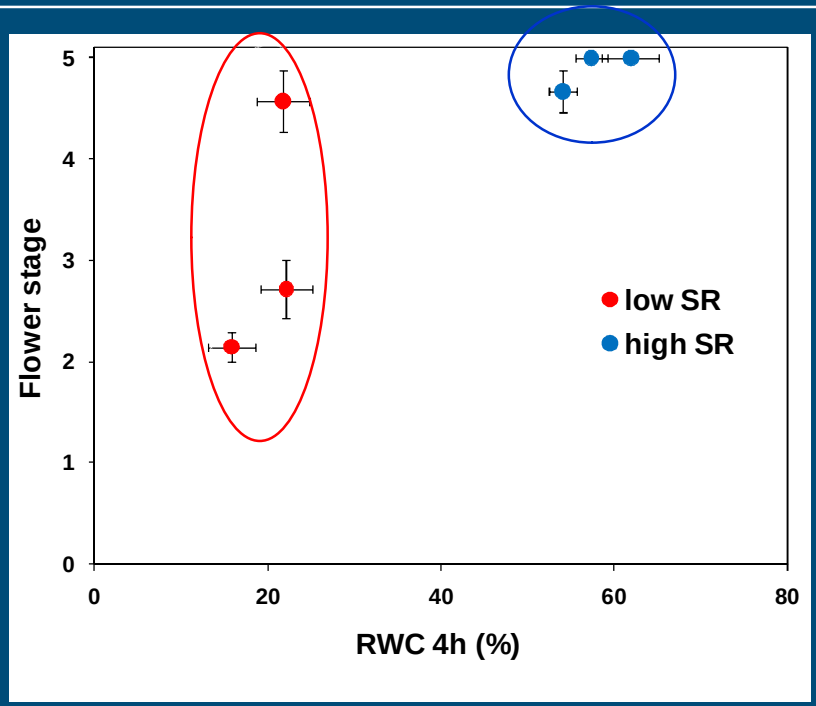
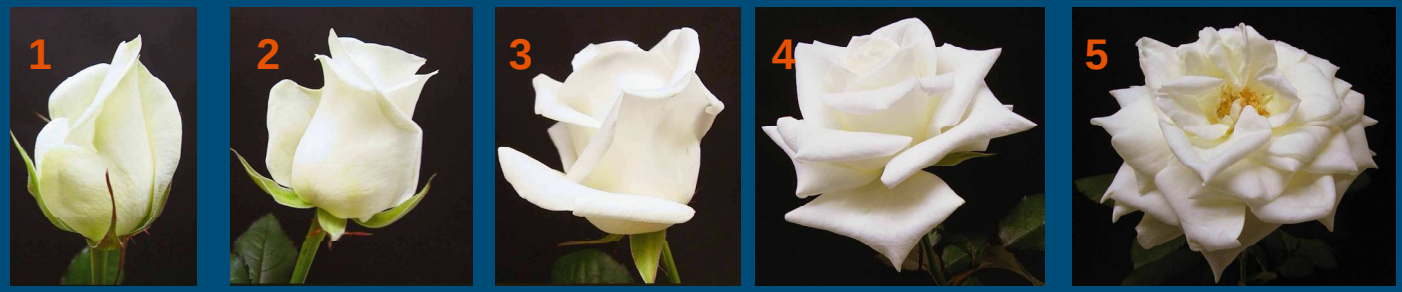
Stomatal responsiveness & Flower opening





- Low stomatal responsiveness ➔ hampered flower opening (end vase life without reaching stage 5)

Conclusions

- Large variation present in the gene pool for stomatal responsiveness → many possibilities for breeding for better control of water loss

- Key traits: speed & degree of stomatal closure (i.e. stomatal physiology)
- Cuticular permeability is not a relevant trait

Conclusions

- RWC after 4h of leaf desiccation proved to be a quick and relible screening method suitable for large-scale screening of rose genotypes for stomatal responses to water stress

- Genotypes with lower RWC at 4h desiccation (i.e. lower stomatal responsiveness):
  - Shorter vase life
  - flower opening is hampered

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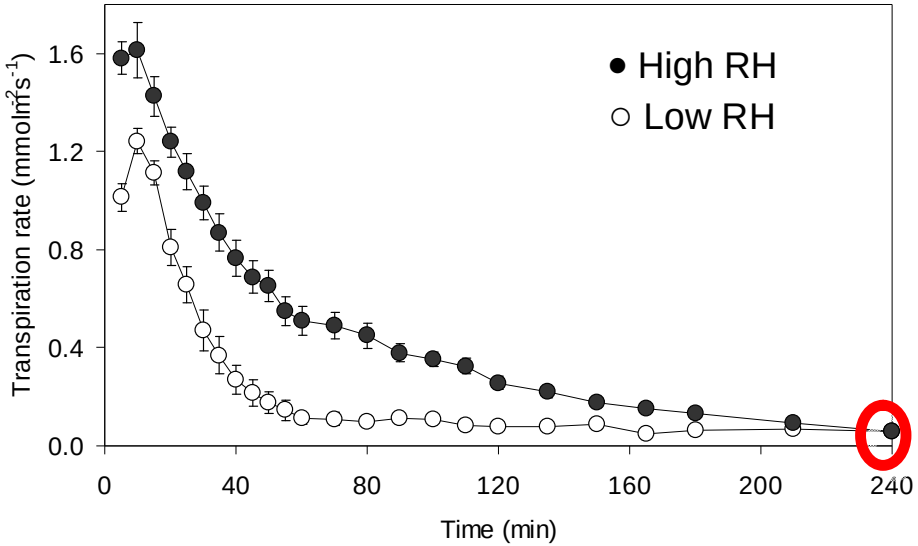
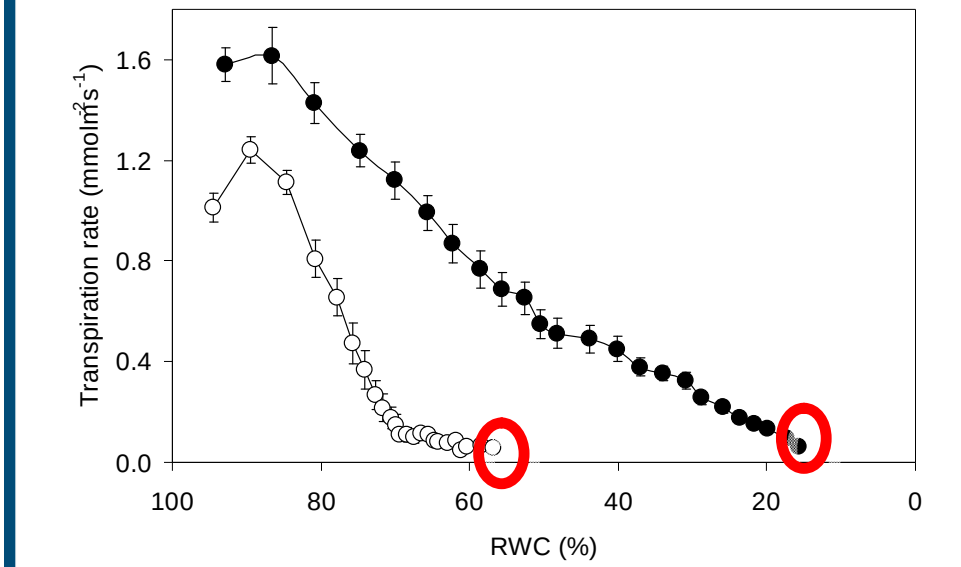
Muito obrigada!!!
Thank you for your attention!

Why relative water content (RWC) after 4h desiccation?

- Previous work has shown that RWC is a good indicator of the control of water loss





$$RWC = \frac{\text{Fresh Weig ht} - \text{Dry Weight}}{\text{Saturated Fresh Weig ht} - \text{Dry Weight}} * 100$$

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