Curvature development in vegetative *Leucospermum* ‘Soleil’ and ‘Succession II’ shoots in response to gravity and a consistent force

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Introduction

Value of *Leucospermum* cut flowers = quality of the shoot

1. High-quality inflorescence
2. Long and straight shoot

Commercial *Leucospermum* cultivars are hybrids/selections of species

1. Floriferous, spreading shrubs
2. Bear inflorescences on stems that are curved and/or relatively short

Packhouse waste

- No/poor records are kept
- Significant

Introduction

Three main environmental factors that affect the occurrence and extent of shoot curvatures

1. Light
2. Gravity
3. Physical forces such as wind

Introduction

Epinasty

- shoot bending with increased growth on the upper surface of the shoot
- result from a **stress** response
- involves interaction between auxin and **ethylene**

Persistent, strong breezes

- typically associated with the Western Cape region (early summer)
- coincides with a period of active growth in *Leucospermum* shoots,
- prior to the lignification of the distal, terminal end

Gravity

Introduction

Techniques have been developed to increase shoot straightness and length

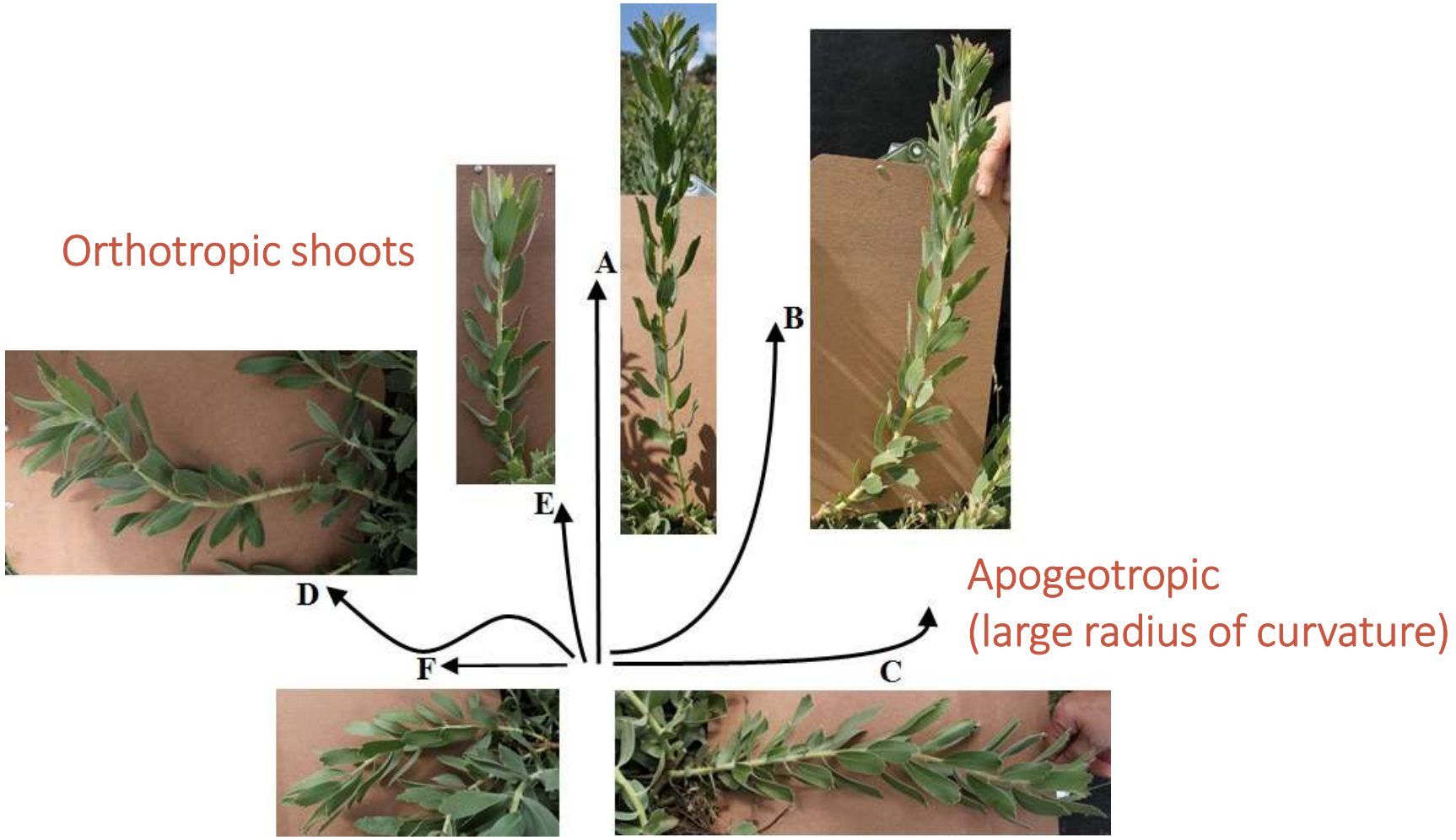
- most of which involve pruning

Shoot behaviour of various cultivars with different growth habits

1. exposed to physical stress conditions
2. associated stem mechanics

has not been studied in *Leucospermum*

Introduction



Introduction

'Soleil' (*L. glabrum* × *L. cordifolium*),

- fourth most exported cultivar grown in SA
- exhibit spreading growth behaviour
- decumbent shoots often develop in lower half of the plant
- S-shaped shoot curvatures are evident later

'Succession II' (*L. lineare* × *L. cordifolium*)

- shoots display nearly no curvature
- is known for its distinctive upright growth habit
- orthotropic shoots

Aim of this study

Provide a deeper understanding of the occurrence of curvatures in *Leucospermum*

Shoot curvature responses

Evaluate the effect of gravity on shoot curvature

in the presence or absence of natural light

- 16 vertically-orientated, actively growing shoots were harvested
- *Leucospermum* ‘Succession II’ and ‘Soleil’
- shoots were recut to a standard length of ca. 28 cm
- placed at an angle of approximately 45° in 2 L beakers
- each filled with 500 ml tap water

Shoot curvature responses

Shoot curvature responses

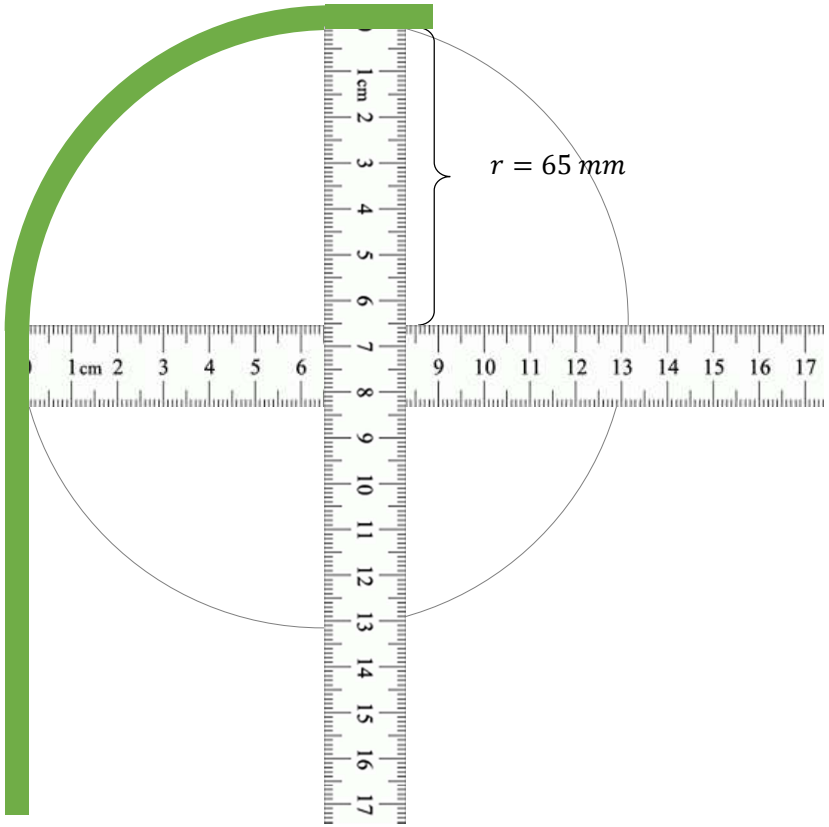
Eight shoots per cultivar (n=8) were placed in

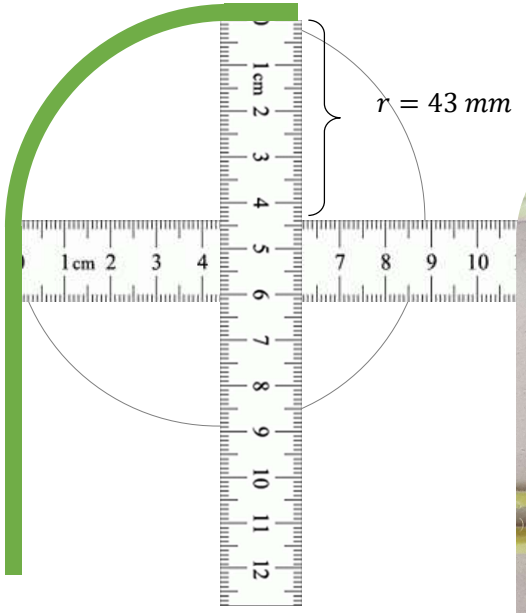
1. complete darkness
2. natural daylight

After 48 hours

1. shoots were removed from their respective environments
2. stems were defoliated
3. recording of the extent of the curvatures that had developed

Shoot curvature responses



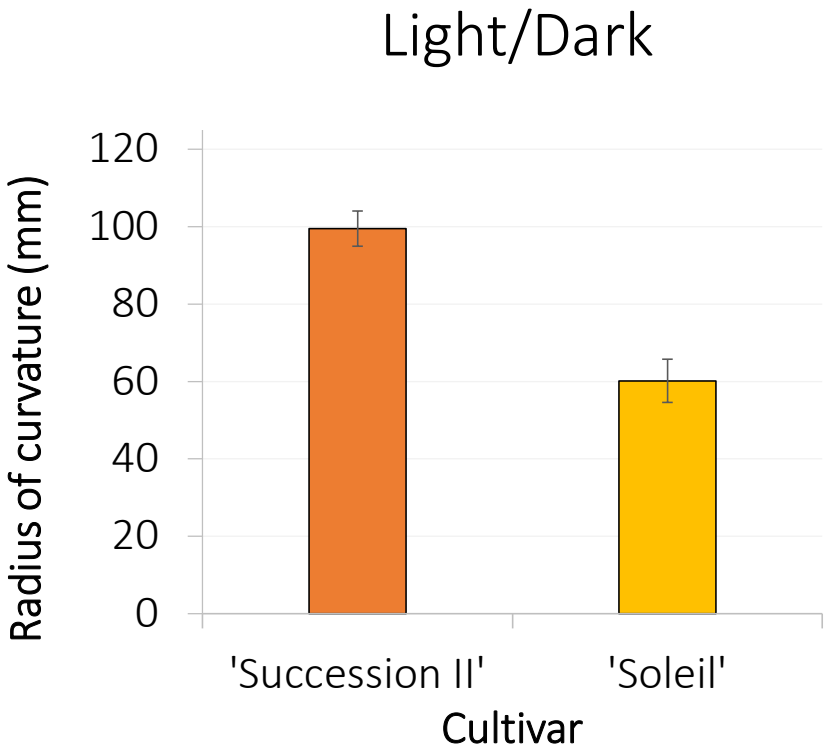


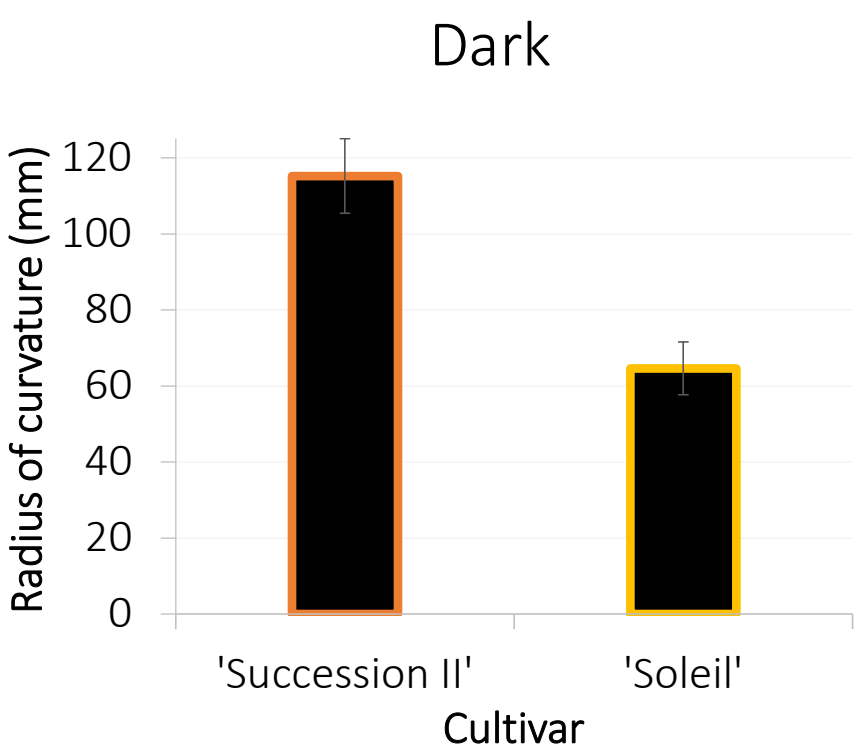
r = radius of circle/curve

= shoot

Shoot curvature responses

Shoot curvature responses





Bending of shoots by a load

To mimic the effects of a constant load pressure as caused by wind/gravity on *Leucospermum* shoots

- completely randomised experiment
- known force was used to induce bending by applying a load
- weights (30 g) were tied to the tips of actively growing upright shoots
- bending the shoots by an angle of ± 90° for 18, 24, 48 or 72 hours (treatments)

Bending of shoots by a load

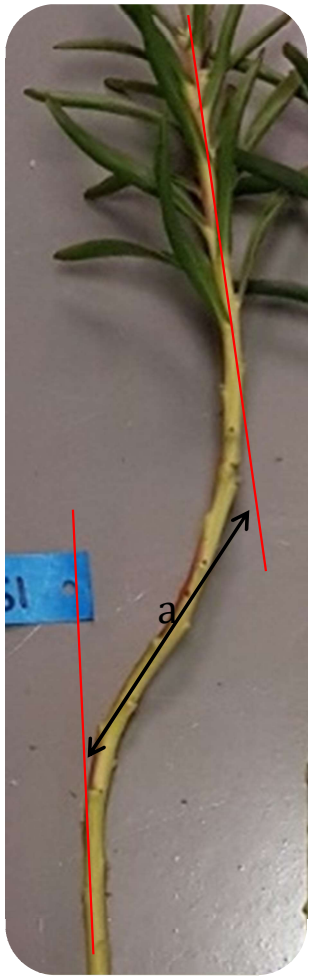
'Soleil'

Arnelia (Hopefield, SA)

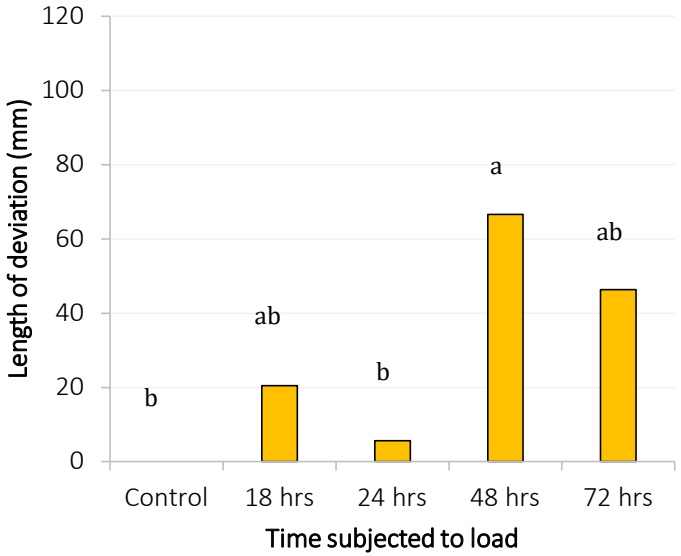
Pomona (Piket-Bo-Berg, SA)

'Succession'

Pomona (Piket-Bo-Berg, SA)

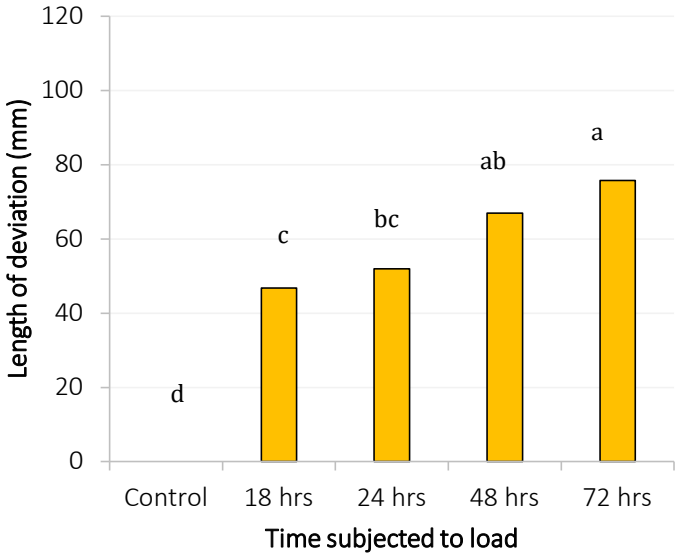


Bending of shoots by a load



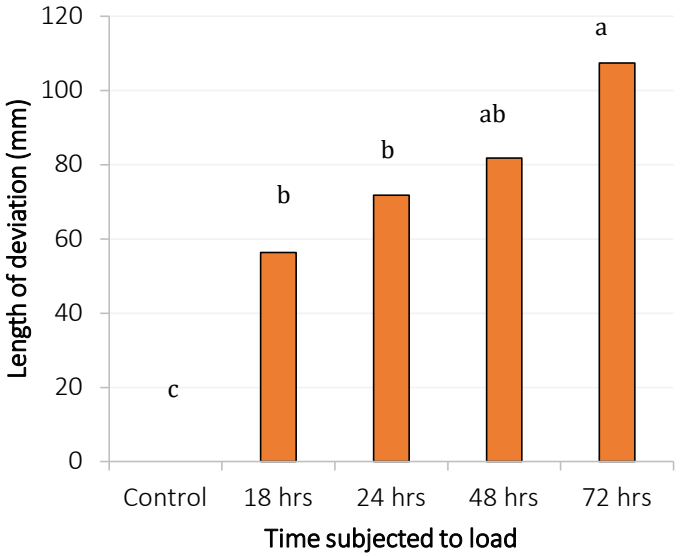
‘Soleil’ – Arnelia

P=0.040



‘Soleil’ – Pomona

P<0.0001



‘Succession’ – Pomona

P<0.0001

Discussion

- Curve formation takes place during active vegetative shoot growth
  - prior to stem lignification
  - as the stem matures, any growth deviation such as bending, will become fixed following lignification
- Several factors that may contribute to curvature formation
  - negative gravitropism
  - phototropism
  - a tension wood-type response to wind
    - leaf size and weight
    - shoot diameter and weight
    - lignification
  - genetic propensity for forming curved shoots

Conclusions

- The reactions of shoots to light and gravity, and to stressors (load) differed distinctly between ‘Succession II’ and ‘Soleil’
- ‘Succession II’ growth habit appear to be stronger negative gravitropic
  - shoots showed a lower reaction to gravity
  - producing a greater radii of curvature
  - due to the position and degree of lignification of stems
- Smaller leaves that are characteristic of ‘Succession II’, are proposed as possible traits that would promote straight stem growth
- Future studies on curvature development of *Leucospermum* shoots should consider plant age and shoot thinning procedures as experimental variables

Thank you

ARNELIA

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