Life history and physiology of iteroparous reproduction in *Neoregelia tigrina* (Bromeliaceae)

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Virtual OBE Day
Colorado College
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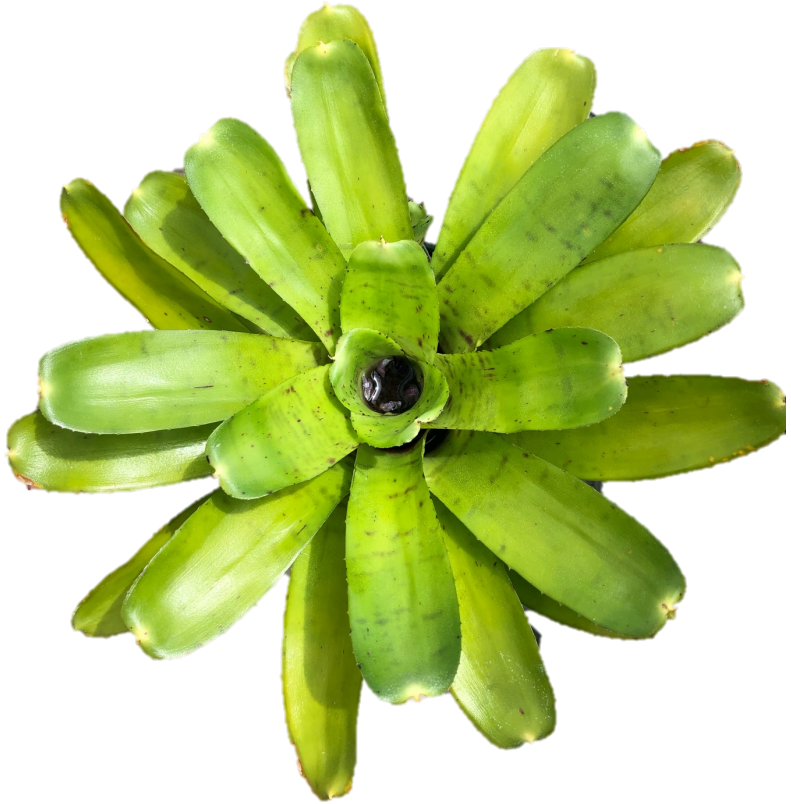
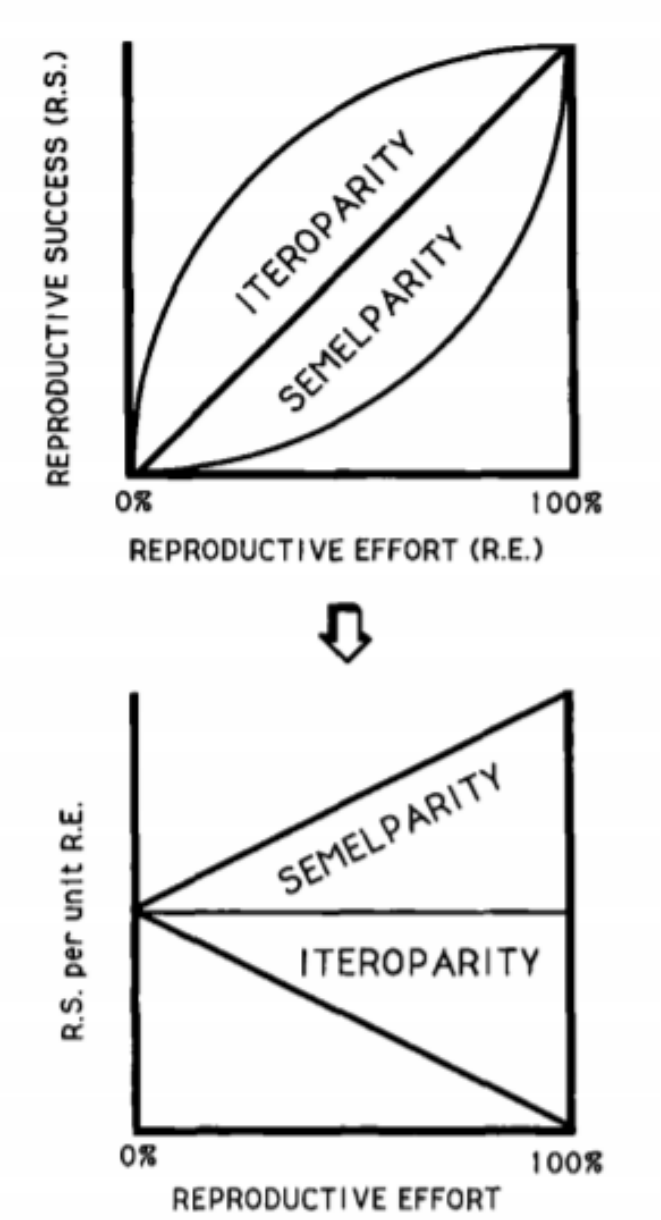


Life History Theory

- **Semelparity**
  - Single attempt at reproduction
- **Iteroparity**
  - Repeated attempts at reproduction
  - Asexual reproduction?
  - More axes to iteroparity…
- Physiology of life history strategy?



Semelparous Puya ramondii
photo credit: Leah Veldhuisen

Iteroparous Bilbergia brasiliensis

Young, 1990






Bromeliaceae

- Model system to study life history and ecophysiology
- 54 genera and over 3,500 species
- Convergent evolution of semelparity from iteroparous lineages
- Diversity of asexual reproduction
- Epiphytes & terrestrial

Neoregelia tigrina (Ruschi) Ruschi

- CAM epiphytic bromeliad
- Endemic to the Atlantic Rainforest of Southeastern Brazil
- Sunken inflorescence
- Stolon-attached ramets

Study population

- 45 mature similarly-aged individuals
- Purchased from Tropiflora Inc. June 2019
- Three developmental stages

Study population in Colorado College greenhouse, June 2019

Neoregelia tigrina developmental categories

Category 1: Pre-flowering with young, minimal ramets

Category 2: Flowering with young minimal ramets

Category 3: Flowering with large, stolon connected ramets

Experimental questions

1. Does functional trait variation exist with flowering?

2. Does functional trait variation exist with different stages of ramet growth?

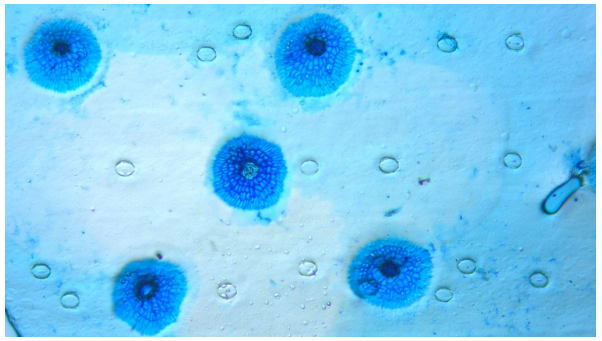
3. Is there evidence for potential tradeoffs between sexual and asexual reproduction in *N. tigrina*?

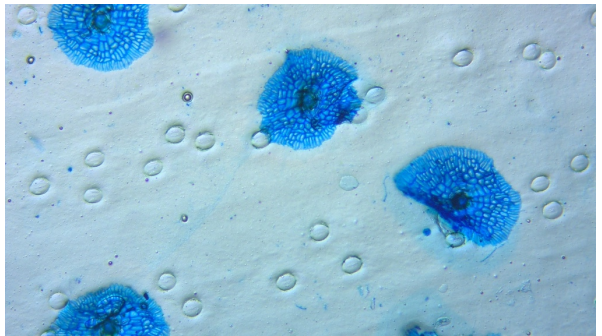
Methods

Functional traits measured:

- Photosystem efficiency
- Chlorophyll content index
- Stomatal density
- Leaf area
- Leaf mass
- SLA: Specific leaf area

  Leaf area / leaf mass (fresh)
- Longest leaf length
- Sucrose content (BRIX)



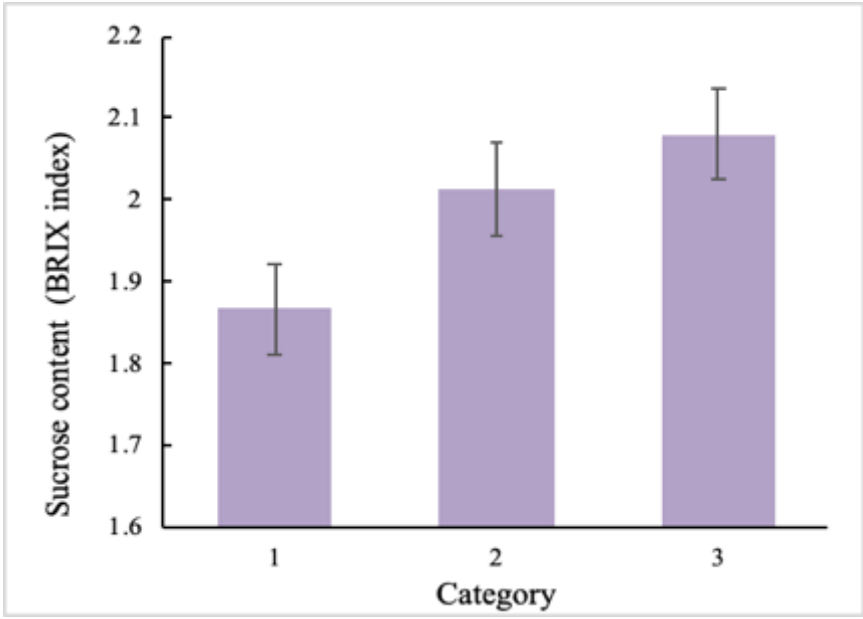


Variation with Flowering

Category 1 to Category 2:

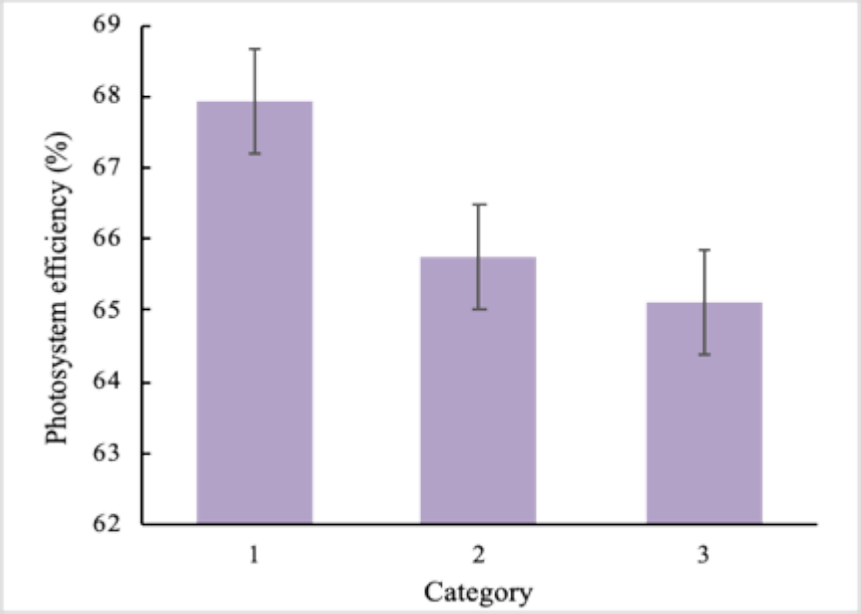
- Higher sucrose
- Lower photosystem efficiency
- No significant change in chlorophyll content

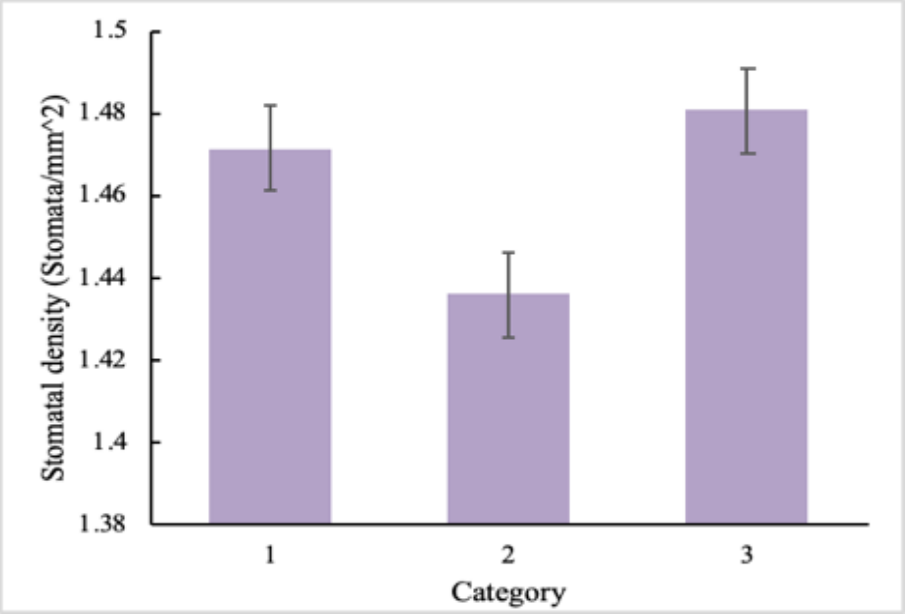
Shift in primary productivity strategy with flowering



- Lower stomatal density

Water conservation with flowering





Variation with ramet growth

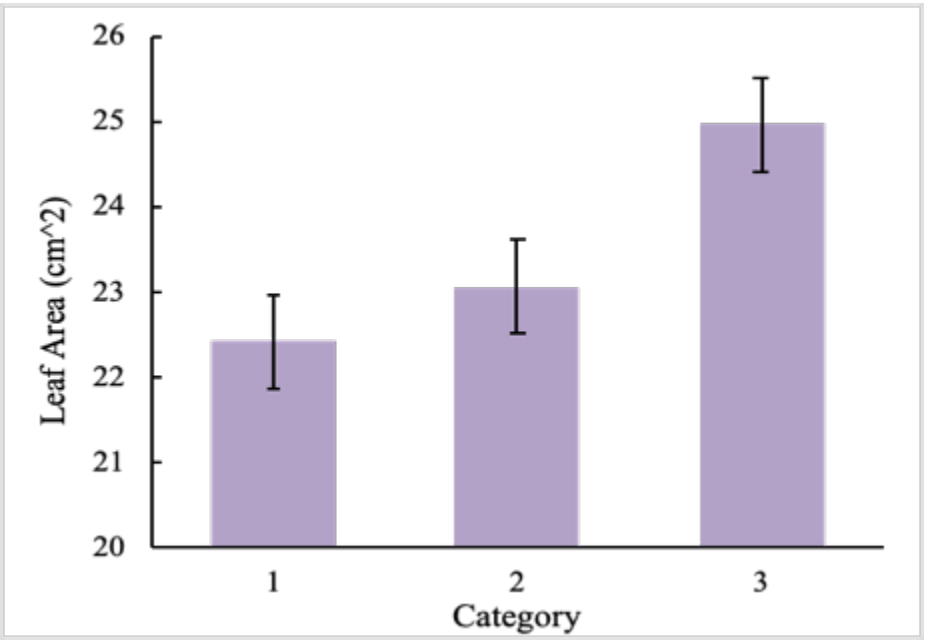
Categories 2 to Category 3:

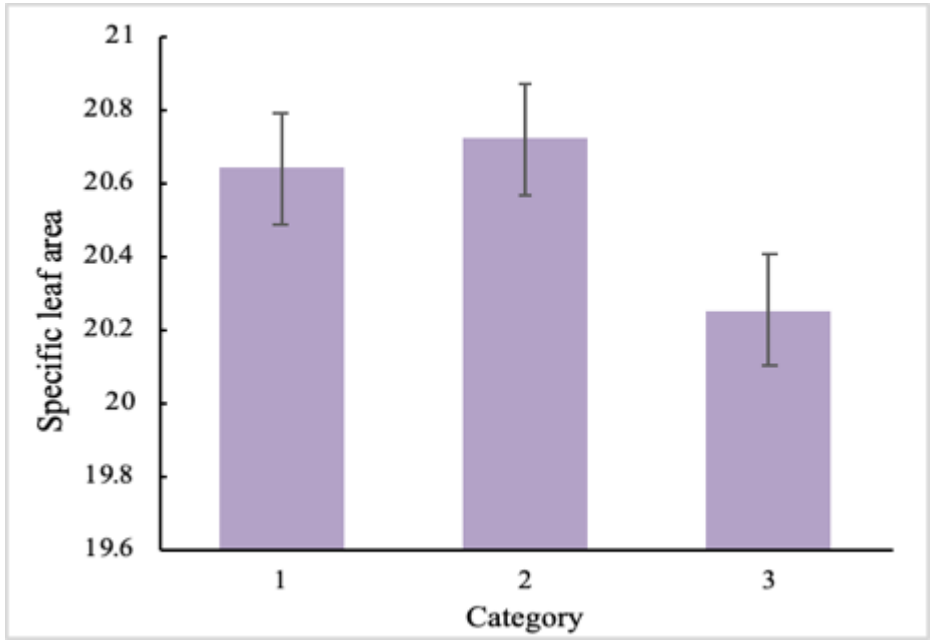
- Higher leaf area & higher stomatal density:

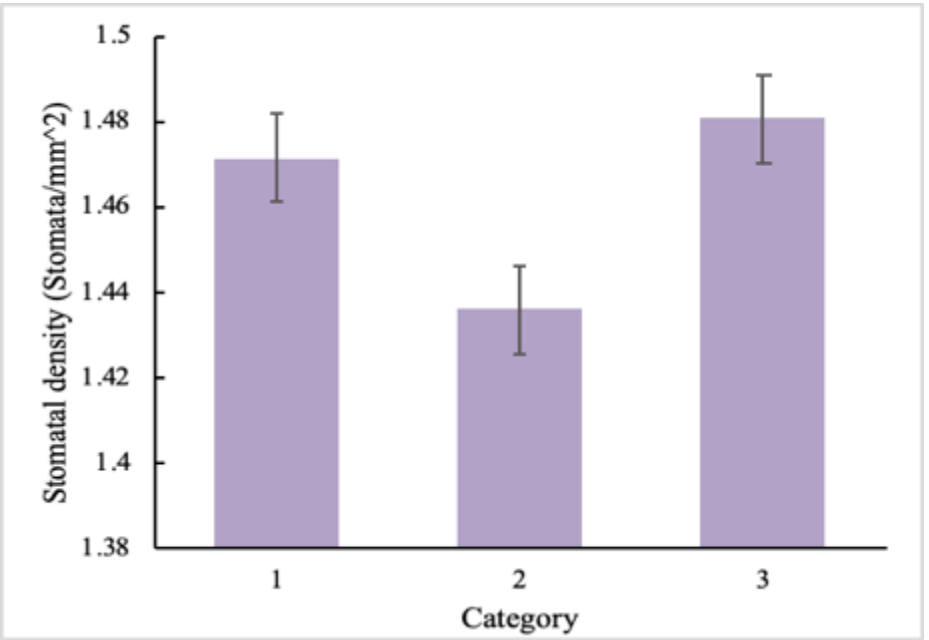
  <u>Increased gas exchange potential</u>

- Lower SLA:

  <u>Water conservation strategy</u>







Experimental questions

1. Does functional trait variation exist with flowering?

   Yes - lower PE, stomatal density and higher sucrose

2. Does functional trait variation exist with different stages of ramet growth?

   Yes – higher leaf area and stomatal density, lower SLA

Is there evidence for potential tradeoffs between sexual and asexual reproduction in *N. tigrina*?

Life history stage *does* significantly affect functional traits in *Neoregelia tigrina* but… is there evidence for tradeoffs between asexual and sexual reproduction?

- Sucrose levels increase across development
- Longest leaf length (LLL) not significantly associated with developmental stage
  -LLL associated with biomass in most bromeliads

More robust fitness estimate needed to fully evaluate tradeoffs

In optimal conditions – no distinct tradeoffs

- May depend on nutrient levels, water stress or light conditions

Conclusion

- Life history stage can influence plastic physiological resource acquisition strategies in bromeliads
- Asexual reproduction can be a critical parameter of plant growth and reproduction
- Iteroparity is a complex space with many levels of variation in Bromeliaceae, which may contribute to the evolution of semelparity from iteroparous linages

N. tigrina may represent an extreme end of this life history evolution continuum

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