Linking resource strategies to bud cold tolerance in the genus *Rhododendron*

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INTRODUCTION

The 900+ species of the genus *Rhododendron,* ranging from deciduous to evergreen, covering almost every possibility in between, are classified into several sections. Four of these sections, Pentanthera (deciduous), Tsutsusi (semi-evergreen), Rhododendron (semi-evergreen to evergreen), and Ponticum (evergreen), vary across many measurable traits.

Using data from twenty-six species, we hoped to study the plant economics spectrum in regards to resource allocation, carbon and nutrient concentration, and water content within each specimen. With leaf and floral tissue exhibiting similar patterns while studying plant fitness, it is likely these tissues will have similar carbon to nitrogen proportions within a species, but will differ largely across sections. Do short-lived plants have wasteful spending habits while longer-lived plants conserve their resources?

METHODS

Using Rhododendron floral and leaf tissue of twenty-six species collected from The Holden Arboretum in Kirtland, Ohio and The Rhododendron Species Botanical Garden in Seattle, Washington, common traits were measured and compared.

METHODS

These physiological traits include:

- Proportion of male flower parts (dry male wt(g)/total dry single flower wt(g))
- Proportion of female flower parts (dry female wt(g)/total dry single flower wt(g))
- Proportion of corolla (dry corolla wt(g)/total dry single flower wt(g))
- Proportion of sepals (dry sepals wt(g)/total dry single flower wt(g))
- Flower C:N
- BudTmin (minimum cold tolerance from the American Rhododendron Society plant database)
- Bloom time (American Rhododendron Society plant database)
- Flowers per inflorescence
- Leaf size
- Inflorescence length (cm)
- Flower water content (fresh flower wt(g)- dry flower wt(g))
- Specific leaf area (m²/kg)

RESULTS

Dependent Variable					
Independent Variable	Flower Water Content	Flower C:N	Corolla Proportion	Specific Leaf Area	Inflorescence Length
Bud Cold Hardiness	0.10	**<0.01*** **	0.82	**<0.01*** **	**<0.01** **
Section	**<0.01*** **	**<0.01*** **	**0.01** **	**<0.01*** **	**<0.01*** **
Bloom Time	**0.05***	**0.04***	0.08	0.92	**<0.01** **
Bud Cold Hardiness x Section	**<0.01*** **	**<0.01** **	**<0.01*** **	**<0.01** **	**<0.01*** **
Bud Cold Hardiness x Bloom Time	0.12	0.21	0.60	0.51	**0.02***
Section x Bloom Time	0.19	0.74	**0.04***	0.15	0.06
Bud Cold Hardiness x Section x Bloom Time	0.56	0.93	0.11	0.81	**<0.01*** **

Table 1. P-values from ANOVA test of all variables.. Significance indicated above by bold values. Asterisks indicate strength of significance with *** signifying the strongest relationship. BudTmin by Section consistently shows a strong relationship with all the the measured traits.

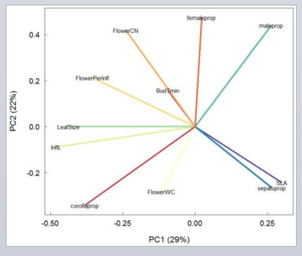

Figure 1. Comparison of traits over all sections

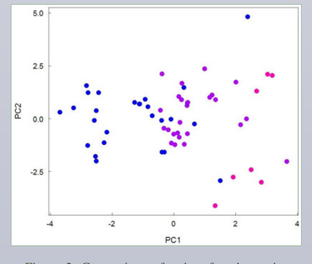

Figure 2. Comparison of traits of each species and corresponding section

RESULTS

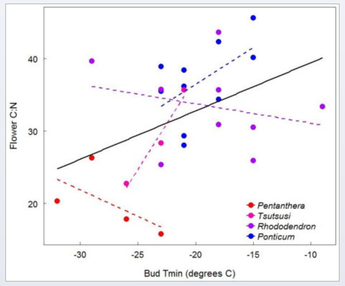

Figure 3. Relating minimum bud cold tolerance to proportion of carbon to nitrogen in floral tissue.

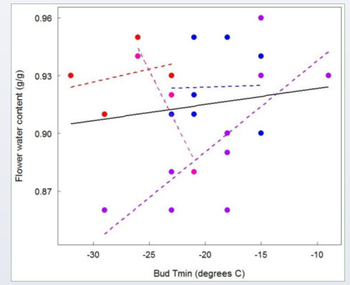

Figure 4. Comparison of floral water content of each species and series to minimum bud cold tolerance.

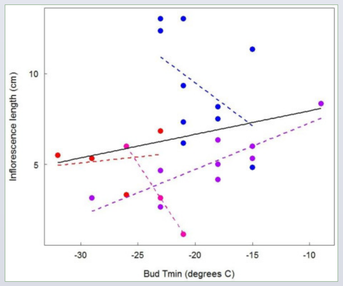

Figure 5. Variations of inflorescence length across series at the minimum bud cold tolerance.

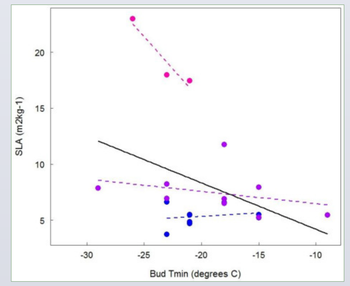

Figure 6. Linking specific leaf area to minimum bud cold tolerance across the four series. No SLA information for Pentanthera due to lack of leaf tissue at time of collection.

CONCLUSION

- Minimum bud cold tolerance is very closely related within each section. This result is expected due to the environmental conditions that species within a section have in common.
- Floral tissue with higher floral water content has a lower C:N, meaning less nutrients are conserved. This pattern is repeated across each series. This indicates the nutrient water cost of plant economics.
- Linking the trends we see in floral tissue to leaf tissue indicates that long-lived plants have a higher carbon to nitrogen ratio than short-lived species. This confirms their conservative leaf strategy.
- Plants with a short-lived leaf strategy, like the deciduous Pentanthera, have very little nutrient concentration while maintaining a high floral water content.

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