Physiological Understanding of Heat and Light Tolerance in *Begonia* ×*semperflorens-cultorum*

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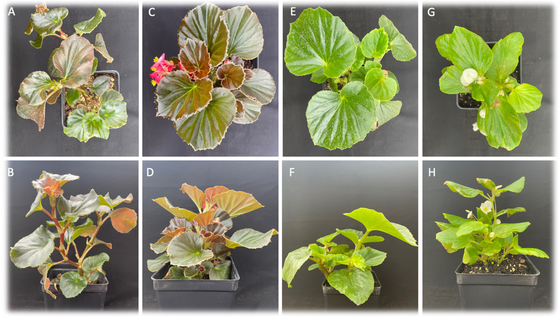
Purpose of Study

1. To characterize the physiological response of wax begonia varieties to heat and light stress.

2. Determine if there is any variation in the response that leads to enhanced thermotolerance and light tolerance.

Design

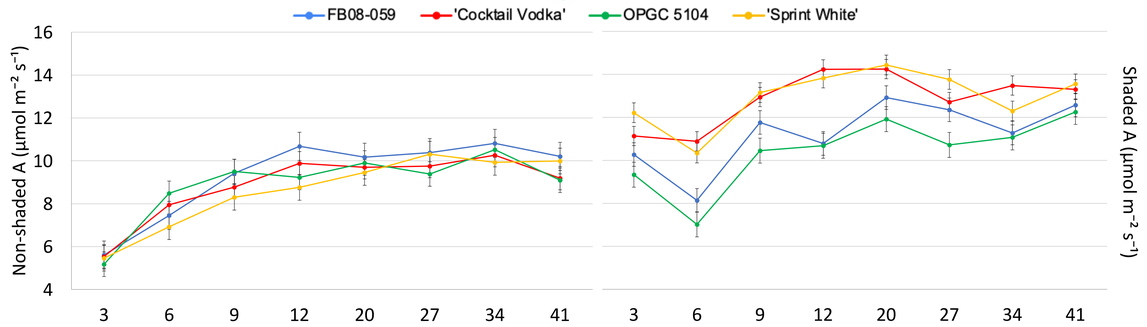
- Two Treatments
  - Non-shaded: 2100µmol m^{-2} s^{-1}, 35/22.5 ºC
  - Shaded: 750 µmol m^{-2} s^{-1}, 30/22.5 ºC
- Randomized block design with each treatment consisting of three blocks with four repetitions (n=12 per genotype). Study ran for 41 days.
- Ion leakage was measured using an OrionStar A215 conductivity meter. Gas exchange measurements were taken with a LICOR-6800.



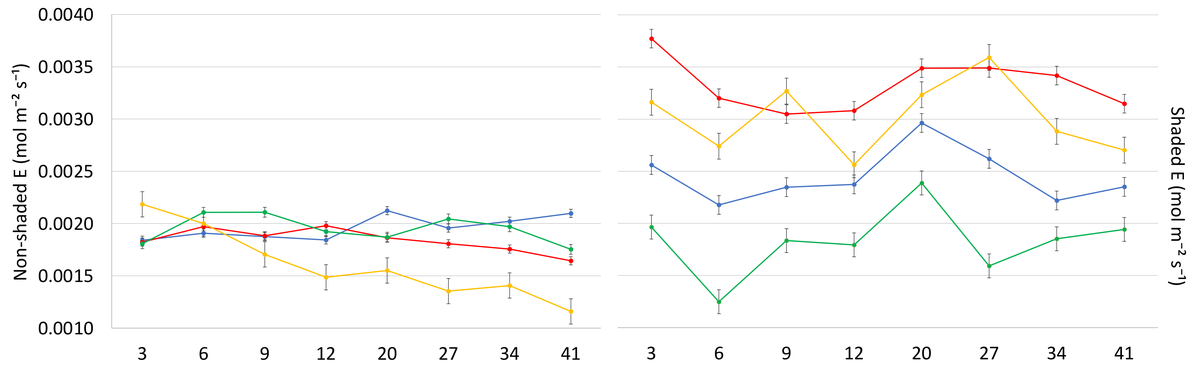
Genotypes

- A,B - FB08-059
  Purportedly heat tolerant genotype. Considered a bronze leaf type wax begonia. Selected from a F_2 population of a cross between *Begonia semperflorens* 'Kaylen' and *Begonia cucullata*.
- C,D - OPGC 5104
  Semperflorens-type begonia collected from Hawaii and distributed by the OPGC (Ohio). Green leaf type found in nature.
- E,F - 'Cocktail Vodka'
  Commercial bronze leaf genotype. Compact growth habit with red flowers.
- G,H - 'Sprint White'
  Commercial green leaf genotype with white flowers.

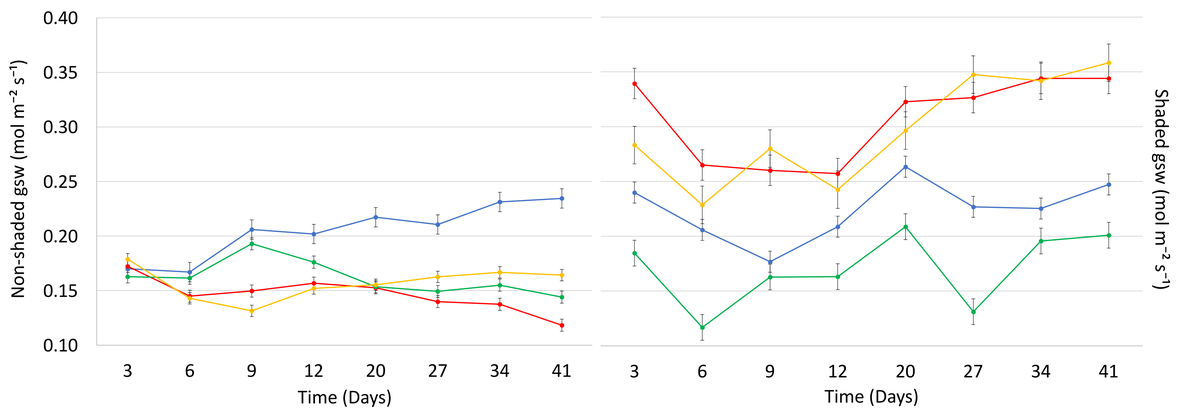
Gas Exchange Parameters



Carbon Assimilation The interaction between genotype x light was nonsignificant for carbon assimilation (*P*=0.1772). For the non-shaded plants, response in photosynthesis was nonsignificant among genotypes, remaining steady at 9-10 µmol m^{-2} s^{-1} for much of the experiment. When shaded, commercial genotypes had noticeably higher carbon assimilation by day 12 than noncommercial genotypes; and at 41 days 'Sprint White' assimilated 1.1 times more carbon than OPGC 5104.



Transpiration The interaction between genotype x light was significant for transpiration (*P*=0.0025), implying a varying response among the genotypes to the treatment. Transpiration of non-shaded genotypes was nonsignificant.

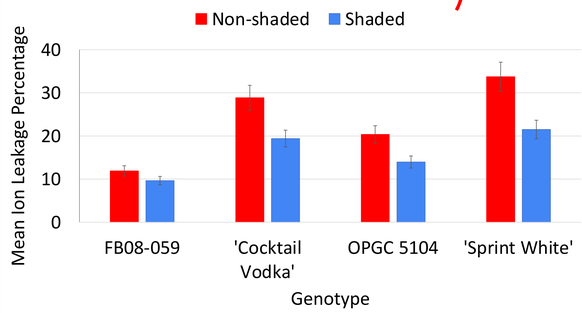


Stomatal Conductance Under the shaded conditions, stomatal conductance was similarly high among the commercial genotypes ('Sprint White and 'Cocktail Vodka'), being 43% greater than the OPGC 5104 genotype (green, noncommercial). Stomatal conductance of FB08-059 (red, noncommercial genotype) in the non-shaded treatment was 1.64 times greater compared to all other genotypes. The interaction between genotype x light was significant for stomatal conductance (*P*=0.0006).

How do we know these morphological traits enhance tolerance?

Less K+ Leakage = Less Stress!

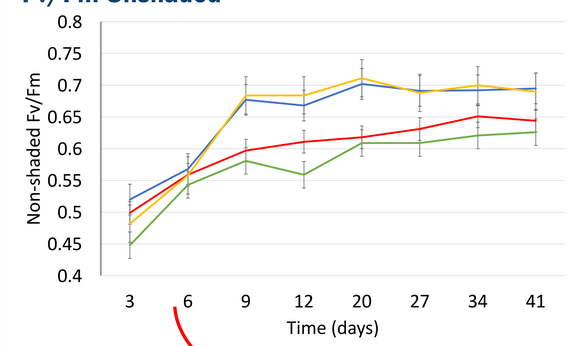
Ion Leakage



- K+ leakage is a common parameter that quantifies the K+ ions that leak out of cells due to damage to the cellular membrane. FB08-059 displayed significantly lower levels of leakage in both the shaded and unshaded treatments (2-way ANOVA, Tukey's HSD, p≤0.05).

- Fv/Fm is another parameter used to measure stress. A Fv/Fm between 0.75-0.8 implies a plant is functioning at optimal performance. There is no significant difference in Fv/Fm among four varieties under the shaded treatment (2-way ANOVA). Under direct sunlight and heat, the effect of these stressors on Fv/Fm is much more prominent, resulting in a very low Fv/Fm at Day 3 of the treatment. However, the Fv/Fm in unshaded FB08-059 and OPGC 5104 plants gradually recovered to a level comparable to the shaded plants after twenty days.

Fv/Fm Unshaded



Higher Fv/Fm = Less Stress!

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