Differences in growth, heat and drought tolerance among advanced-generation hybrids and coastal Douglas fir families.

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INTRODUCTION

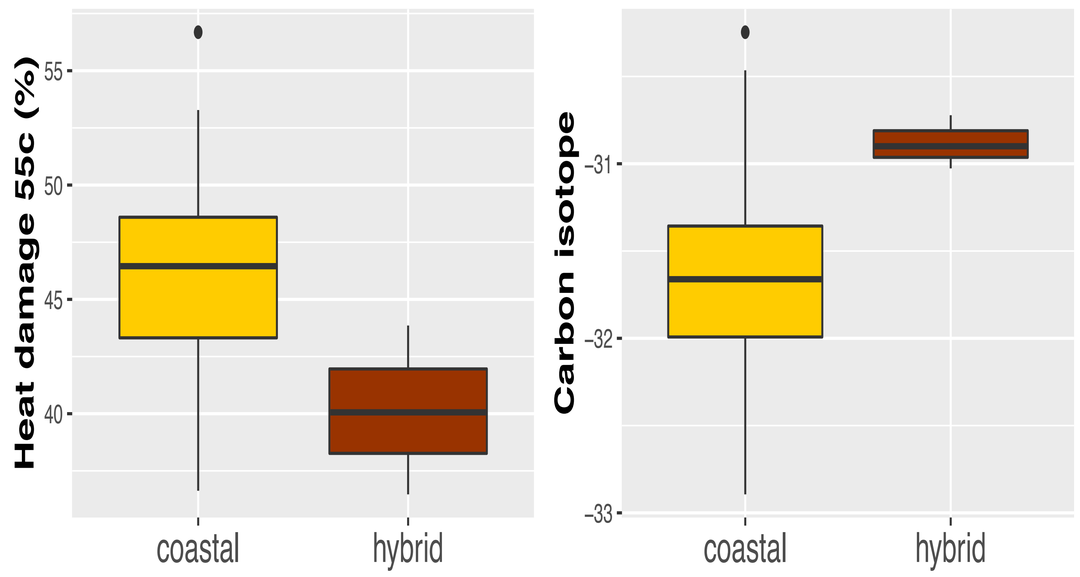
- Current and future global warming are causing an increase in the severity and duration of drought and heat events resulting in reduced growth and increased mortality of forest trees. This study aims to identify differences in drought and heat tolerance among hybrids and coastal Douglas fir; and identify genes, gene families and pathways responsible for heat and drought response in the species.

METHODS

1. A greenhouse common garden study was used to grow 115 Douglas fir families (>22 seedlings/family) for 3 years. Seedlings were either coastal or advanced-generation hybrid varieties.
2. 12 traits were measured including height (2 years old), carbon isotope discrimination (C13, N, C:N), and electrolyte leakage (8 temperatures from 35-65C)
3. Genotypes were obtained with a 14,980 SNP array and univariate and multivariate genome-wide association tests in GEMMA and TASSEL were performed among traits and genotypes.

RESULTS

- We found an increase in water use efficiency and photosynthetic capacity in advanced-generation hybrids, suggesting lower stomatal conductance in comparison to coastal Douglas fir.
- Hybrids were also more heat tolerant than coastal Douglas fir families when exposed to 50 and 55 Celsius.
- 35 new significant associations among 6 traits and 31 genes were reported.
- F-box proteins, transcription factor VOZ1 and a member of the inositol phosphate metabolism were found as candidate genes in response to heat stress.



CONCLUSIONS

- The results of this study suggest advanced-generation hybrids might better tolerate warming conditions and heat events, which might be of consideration when selecting trees for reforestation in a changing climate.

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