Occurrence and distribution of Big Bluestem (*Andropogon gerardii*) polyploids in tallgrass prairies: Ecological consequences of differences in genome size

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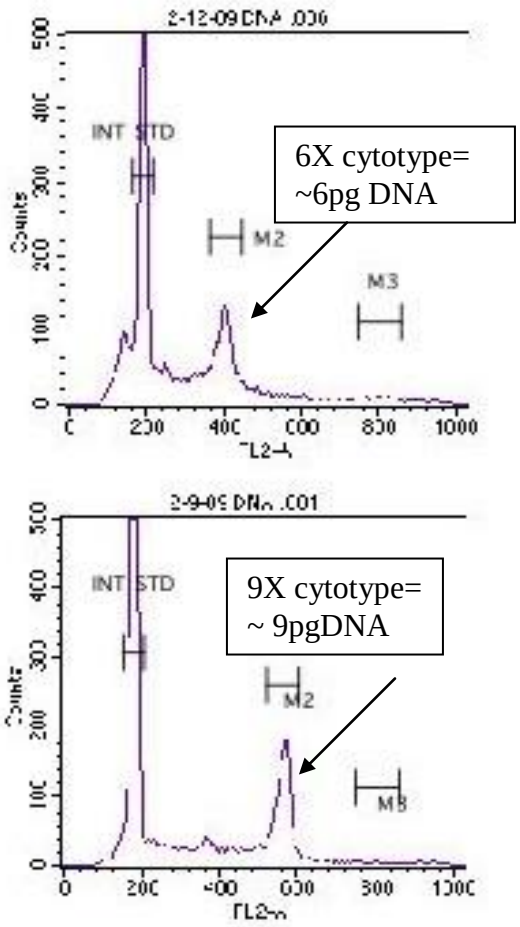
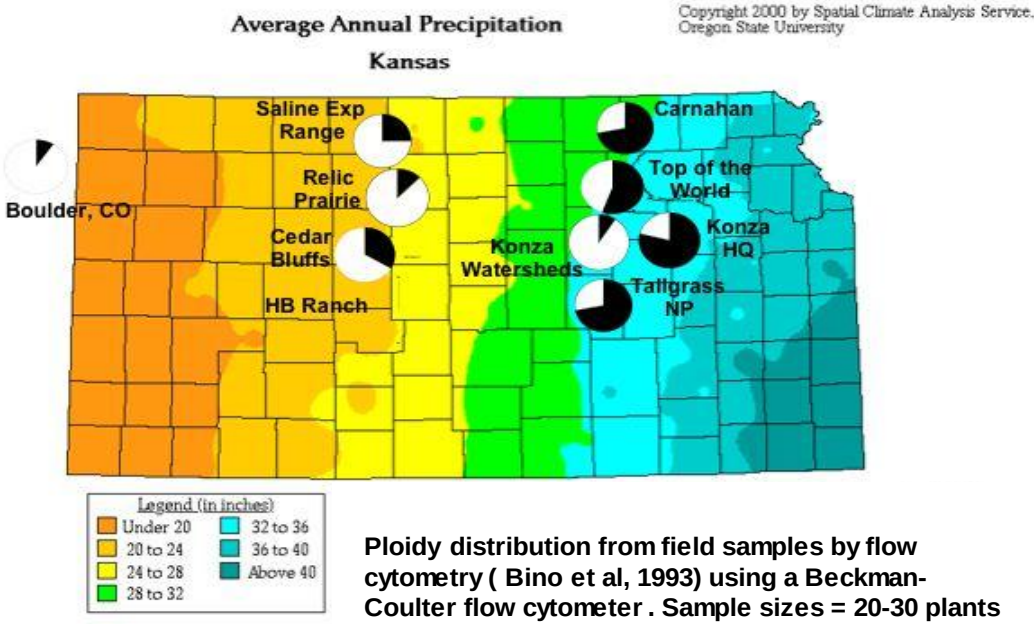
Background: Polyploidy is a very common occurrence in plants. About 70% of angiosperms have experienced recent or ancient whole genome duplication events (polyploidization). *Andropogon gerardii* (big bluestem), the ecologically dominant grass of the Great Plains, is an autopolyploid with a base chromosome number of 10 and occurs as mosaics of two major cytotypes—6X and 9X.

Goal: Determine the functional significance of genome size and ploidy variation for ecological differentiation in *Andropogon gerardii* and community composition and ecosystem function

Objectives: To understand the occurrence, distribution and abundance of 6 and 9X cytotypes and identify how and why the 9X forms and is maintained. Second, we plan to characterize if there is a morphological, physiological and genomic differentiation between 6X and 9X plants and the ecological consequences of differences in genome size in the dominant prairie grass big bluestem.



Preliminary data on the geographic distribution and occurrence of 6X and 9X cyotypes



Ploidy distribution from field samples by flow cytometry (Bino et al, 1993) using a Beckman-Coulter flow cytometer . Sample sizes = 20-30 plants per site. Black=9X, White=6X.
(Geographic locations approximate, not to scale)

Questions to be addressed:

- **Where, how and why and how frequent does the 9X cytotype forms? What are the ecological consequence of genome size variation?**

- **Why do the 6X and 9X occur as a mosaic in Kansas and Colorado, yet 6X dominates in the eastern part of the range of big bluestem? Does the stress of precipitation variability or increasing temperature westward contribute to the formation of the 9X cytotype?**

- **Can and do the 6X and 9X interbreed? If not, what factors contribute to their reproductive isolation when they remain growing together ont eh same site? ?**

- **How do they vary in their differences in gene expression? Do the cytotypes differ with respect to**

Approach and Experimental Design:

We will test these predictions by quantifying differences in morphology, physiology, reproductive fitness, and genetic differentiation at the level of gene expression in 6X and 9X plants under controlled conditions. We will determine and test these predictions using flow cytometry to determine ploidy calibrated with chromosome counts in root tip smears. We will also conduct parallel field experiments of common gardens of 6X and 9X cytotypes planted across the precipitation gradient of the Great Plains to examine the role of abiotic factors on the success of the different cytotypes in different precipitation regimes.

Significance

Ancient and recent polyploids in the plant kingdom are ubiquitous. Yet we know precious little about ecological differentiation in polyploids, the role of polyploidy in ecosystem function, and differences in gene expression.

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