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Ecological Drivers of Local Adaptation in White Clover: Herbivores or Winter Temperatures?

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Ecological Drivers of Local Adaptation in White Clover: Herbivores or Winter Temperatures?

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Trifolium repens (white clover) is a widespread species that displays local climatic adaptation related to cyanogenesis (the production of cyanide upon tissue damage). Cyanogenesis is polymorphic in white clover, with cyanogenic and acyanogenic individuals present in populations, and higher frequencies of cyanogenic plants are found in warmer climates. While this clinal pattern has been documented worldwide across latitudinal and altitudinal gradients for over 60 years, the exact ecological factors that drive the evolution of cyanogenesis clines remain unresolved. Leveraging reciprocal common gardens that are currently growing in Duluth, MN, St. Louis, MO, and Gainesville, FL, this project was conducted to test two hypotheses that might explain the low frequency of cyanogenic plants in cold climates: the autotoxicity hypothesis (cyanogenic plants might harm themselves when tissue is ruptured due to low winter temperatures) and the energetic trade-off hypothesis (when herbivore abundance is low, chemical defense is too energetically-costly to be favored). To test these hypotheses, we measured leaf herbivore damage and a variety of fitness traits, including floral production and vegetative surface area at crucial points in the growing season at all three sites. Our preliminary conclusions suggest differences in rates of herbivory between the sites, including variation between cyanotypes within each site. Analyses are ongoing and will include digital picture analysis to quantify vegetative tissue area before and after the winter seasons in Duluth and St. Louis to test for autotoxicity.