

**GENETIC VARIATION AND HERITABILITY FOR ACCLIMATION TRAITS AMONG COTTON
GENOTYPES UNDER WATER-DEFICIT STRESS**

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Abstract

Cotton is sensitive to high temperature and drought stresses. Cotton thermosensitivity is related with the photosynthetic process of leaves. Photosystem II (PSII) thermostability acclimates to exposure to heat and drought. However, differences among genotypes and early reproductive development response to drought are not known. Effects of water-deficit stress during squaring and genotypes characteristics must be considered to select genes for future commercial varieties with improved acclimation to drought. The objective of this research was to investigate differences in PSII thermotolerance among cotton cultivars during early reproductive development under drought stress, as well as estimate the genetic variance and heritability coefficient in the evaluated traits. A completely randomized pot experiment with five replications was conducted in 2012 in a growth room at the Alheimer Laboratory – University of Arkansas in Fayetteville, Arkansas. Treatments consisted of four cotton (*Gossypium hirsutum* L.) cultivars, DP0912, Siokra L23, T1521, and Pima 32 (*Gossypium barbadense* L.), and two water regimes, well-watered and water-stressed. Stress was imposed in the stressed-treatment at pinhead square and plants were re-watered when stomatal conductance (g_s) reached approximately $10 \text{ mmol m}^{-2}\text{s}^{-1}$. Membrane leakage, g_s , and PSII quantum yield were taken the last day of the stress and one day after recovery from the fourth and third main-stem leaves, respectively. Genetic variances and heritability coefficients were estimated for the evaluated traits. Varietal significant differences ($p \leq 0.05$) in g_s and membrane leakage exist among cultivars under both water regimes. Verification of high temperature thresholds for PSII revealed cultivar differences in PSII thermostability. Results suggest that, even though Pima 32 had low g_s and membrane leakage, it appears to exhibit higher acclimation under drought. The heritability coefficients of the characteristics ranged from 75.67 to 98.01% suggesting that they are beneficial for selection. Additional research is needed to identify more indicators to select cotton cultivars with higher acclimation response to heat and drought stresses.