Biochemical Genetic Mechanism and QTLs of Early Maturing without Yield Loss in Short-season Upland Cotton (*Gossypium hirsutum* L.)

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The short season cotton (SSC) was important Upland plant ecotype (*Gossypium hirsutum* L.). The growth of SSC was very short that is 105 ~ 110 days (after planting). SSC could increase plant index and farmer incomes on the same soil in one year. However, there was a contradiction between the early maturing and high-yield potential of SSC varieties that restrict SSC development. The SSC varieties often exhibited premature senescence. Biochemical breeding could be one such solution to this problem. The objective of this study was to investigate the genetic basis of biochemical traits associated with the antioxidant system and phytohormones, and to locate QTLs of biochemical traits, which could use in the SSC breeding. Six cultivars from two types of SSC were selected, type A cultivars are those that senescence prematurely, including Zhongmiansuo 10, Zhong 652585, and Yuzao 28; type B cultivars are those that mature early without premature senescence, including Liao 4086, Zhong 061723, and Yu 1201; The 6 × 6 diallel crossing design was used. Yield, earliness, fiber, and biochemical characters of the SSC were studied to explain the mechanism of the biochemical inheritance. Seed yield, lint yield, lint percentage, boll weight, and boll number exhibited significant dominant effects and dominant by environmental effects. The additive by additive epistasis, and environmental effects also were significant. Date of the first square and the position of the first fruiting branch exhibited significant dominance effects and dominant environment effects. The additive by additive epistasis effects also were significant. Date of first flower and date of first boll opening exhibited significant additive effects and dominance effects. Epistatic environment effects also were significant. Chlorophyll content exhibited significant additive by additive epistasis, additive environmental effects, and dominant environmental effects. CAT and POD exhibited significant dominant effects and dominant environment effects. SOD had significant epistatic environment effects and dominant environment effects. The additive effects also were significant. MDA had significant epistatic environmental effects, dominant effects, and dominant environment effects. A molecular genetic map of the SSC (*G. hirsutum*) was constructed. The biochemical characters at the different stage were located on different linkage groups. Using SSR, SRAP, TRAP primer combinations, we identified polymorphism between Zhongmiansuo 10 and Liao 4086. Sixteen QTLs for the biochemical traits were detected in F_2 and $F_{2:3}$. The SSC cultivars without premature senescence have early mature, high yield, and good quality, and they were recommended for planting. QTLs of biochemical traits could be used as molecule markers in the SSC breeding.