GhDET2, a Steroid 5alpha-reductase, Plays an Important Role in Cotton Fiber Cell Initiation and Elongation

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Cotton (*Gossypium hirsutum* L.) fibers, one of the most important natural raw materials for the textile industry, are highly elongated trichomes from epidermal cells of cotton ovules. Among the longest plant cells ever characterized, cotton fiber is an ideal system for studying plant cell elongation. Brassinosteroids (BRs), a class of steroidal phytohormone, play an important role in plant cell division and elongation. DET2, an Arabidopsis steroid 5alpha-reductase, is considered to catalyze a major rate-limiting in BR biosynthesis. To understand the role of BRs and the molecular base of cotton fiber growth and development, *GhDET2*, which putatively encodes a steroid 5alpha-reductase by sequence comparison, was cloned from developing fiber cells. In vitro assessment of *GhDET2* protein activity confirmed that *GhDET2* encodes a functional steroid 5a-redutase. Quantitative real-time PCR and northern blotting results indicated that high levels of *GhDET2* transcript were detected during the fiber initiation stage and the fiber rapid elongation stage. Through the cotton genetic transformation, antisense-mediated suppression of *GhDET2* inhibited both fiber initiation and fiber elongation. Similarly, treatment of finasteride on cultured ovules, which is a steroid 5alpha-reductase inhibitor, suppressed fiber elongation. Inhibition of fiber cell elongation by expression of antisense *GhDET2* or the finasteride treatment could be reversed by epibrassinolide, a biologically active BR. Furthermore, seed coat-specific expression of *GhDET2* increased fiber number and length. These results demonstrated that *GhDET2* and BRs play a crucial role in the initiation and elongation of cotton fiber cells, suggesting that modulation of BR biosynthesis factors may improve fiber quality or yield.