**Genome-wide studies and expression profiling of *GhWRKY41* family genes in different tissues and stress conditions in cotton (*Gossypium hirsutum* AD1)**

The WRKY transcription factor (WRKY) gene family primarily functions as a defense mechanism against various stresses throughout the plant's life cycle. Prior studies have thoroughly examined specific WRKY gene groups across different plants. Nevertheless, there has not been a thorough investigation or expression profiling of the GhWRKY41 family in cotton (Gossypium hirsutum). In this study, an examination of the cotton genome identified 11 potential WRKY41 genes, which were categorized into nine sub-families (I-XI) based on a phylogenetic analysis. The gene structure and motifs within each sub-family were relatively consistent with three exons and two introns, except Gohir.A12G184600, which has 20 exons and 19 introns. The GhWRKY41 genes exhibited an uneven distribution, spanning eight of the 26 chromosomes in cotton. Expression profile analysis revealed differential expression levels of all 11 *GhWRKY41* family genes in different tissues at nine and four days post-anther (DPA) in ovule and fiber developmental stages, respectively. The majority of GhWRKY41 genes demonstrated tissue-specific expression patterns, affirming their vital contributions to cotton growth and development, independent of stress conditions. Additionally, gene duplication analysis indicated that WRKYs are duplicated in some chromosomes, with many others observed in redundant stages, suggesting their existence with undiscovered functions. The gene ontology (GO) analysis we conducted indicated that all members of the *GhWRKY* gene family were linked to the regulation of transcription, transcription factor activity, and sequence-specific DNA binding in both molecular function and biological process categories. Overall, this research enhances our understanding of the genetic mechanisms underlying cotton growth and development, with implications for stress response and the evolution of the *GhWRKY* gene family.