

Characterization of a Cotton Fiber Gene Promoter

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Cotton fibers are unicellular trichomes derived from outer integument cells of the ovule. Our previously study showed that cotton R2R3 MYB transcript factor *GaMYB2* could complement the *Arabidopsis* trichome mutant of *glabra1* (*gl1*), suggesting that cotton fiber initiation and *Arabidopsis* leaf trichome share similar molecular mechanisms of regulation. We then isolated the *GaMYB2* promoter and analyzed its activity in cotton (*Gossypium hirsutum*), tobacco (*Nicotiana tabacum*) and *Arabidopsis* plants. A 2062 bp upstream fragment of *GaMYB2* was fused to the glucuronidase (*GUS*) reporter gene. Histochemical staining revealed that in transgenic cotton plants, *GaMYB2* promoter exhibited activities predominantly in the ovule of 0 DPA and in the developing fiber cells (such as those of 9 DPA), and to a lesser extent in trichomes of other aerial organs, including leaf, stem, and bract. Similar to cotton *RDL1* promoter reported previously, the *GaMYB2* promoter was specific to trichomes in transgenic *Arabidopsis* plants. Different from *Arabidopsis* which has unicellular non-glandular trichomes, tobacco has both glandular and non-glandular multicellular trichomes. Interestingly, in tobacco *GaMYB2* promoter directed *GUS* gene expression exclusively in head cells of the multicellular glandular trichome. This promoter provides a tool not only for engineering of glandular trichome-based metabolism but also for dissecting regulatory mechanisms of glandular trichome development. To localize the regulatory regions important for trichome expression of the *GaMYB2* promoter, successive 5-deletions were performed. We found that a 360 bp fragment upstream to the translation initiation codon was sufficient for driving gene expression in *Arabidopsis* trichomes and tobacco glandular trichomes. A putative *cis* element, T/G-box, located at -233 to -214, was identified. Yeast one-hybrid assay showed that *Arabidopsis* bHLH protein *GL3*, also a trichome regulator, had a binding activity to the T/G-box motif. Over expression of *GL3* enhanced the *GaMYB2* promoter activity. These results suggest that the cotton bHLH protein(s) homologous to *GL3* may play a role in transactivating *GaMYB2* expression in cotton trichomes, particularly in cotton fibers.

Key words: promoter; cotton fiber; trichome; glandular trichomes; MYB