Connecting epidermal differentiation and cuticle wax biosynthesis

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The plant aerial epidermis constitutes a dynamic interface with the environment, where trichomes and the cuticle act as complementary protective barriers. Increasing evidence suggests that these structures are coordinated through shared regulatory networks rather than acting independently.

Building on this framework, we focus on the R2R3-MYB transcription factor NtODORANT1-like (NtODO1), which is expressed in early epidermal tissues and is proposed to act at the onset of epidermal specialization. Reverse genetic analyses demonstrate that NtODO1 modulates the development of long-stalked glandular trichomes, supporting its role as an upstream regulator of epidermal cell fate.

To resolve its molecular function, we implemented a DAP-seq strategy to map direct NtODO1 targets. Strikingly, NtODO1 binds and activates *KCS5*, a gene encoding a core enzyme of very-long-chain fatty acid elongation required for wax biosynthesis. This finding provides direct molecular evidence linking a trichome regulatory factor to cuticle lipid production. In parallel, additional targets associated with trichome development further support a dual regulatory role.

Together, these results place NtODO1 at the center of a transcriptional module that couples epidermal differentiation with cuticle assembly. We propose that NtODO1 coordinates surface specialization by simultaneously promoting trichome formation and activating wax biosynthetic pathways via *KCS5*.

This work advances our understanding of epidermal coordination and highlights key regulatory nodes that could be leveraged to enhance plant resilience to environmental stress.