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Title:	Growth Regulating Factors control the Expression of Homeodomain Glabrous 12 in leaf epidermis to promote cell differentiation in Arabidopsis thaliana
Authors:	Kumar, Harish
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Abstract:	<p>Abstract Despite the important role played by leaf in photosynthesis our understating about how they attain a particular shape and size is still poor. Gene regulatory networks underlying the control of leaf shape and size needs to be elucidated not only to unravel the mechanism of development but also to enhance the production of food and energy by increasing the overall biomass of the plant. Here, I report a regulatory network involving HOMEODOMAINGLABROUS12 (HDG12), a member of homeodomain leucine zipper IV transcription factor family, and GROWTH REGULATORY FACTOR 1, 2, 3 (GRF1, 2, 3). GRFs promote the timely transition of cells from proliferation to differentiation by activating the expression of HDG12 in leaf epidermis. My results show that HDG12 inhibits cell proliferation but promotes an increase in size of the pavement cells in developing leaf to coordinate the final shape and size. In the yeast-1-hybrid and yeast-2-hybrid assays, novel protein-DNA and protein-protein interactions of HDG12 suggest the possible pathways by which it can restricts the organ growth. Inducible ectopic expression of HDG12 specifies multiple layers of epidermis in the leaf tissue and switches the fate of palisade parenchyma cells into stomatal guard cells, suggesting that HDG12 is involved both in cell size and cell fate specification events in Arabidopsis thaliana leaf. To identify the downstream targets of HDG12, I used an inducible overexpression system and carried out RNAseq experiments. Gene ontology analysis revealed that early responsive genes were related to photosynthesis and response to environment while late responsive genes were associated to defense responses. A pair of natural long noncoding RNA gene and its antisense protein coding gene required for cell wall integrity was found as the putative target of HDG12 in my transcriptomic data analysis. In summary, I have established that cell differentiation in the leaf epidermal layer is promoted by GRFs through positive regulation of HDG12. Apart from cell differentiation, HDG12 alone is sufficient to promote cell fate specification in the inner tissue layers of leaf.</p>
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