IN BRIEF

PUCHI and Floral Meristem Identity

During development of multicellular organisms, cell fate is determined by a multitude of internal and external signals. In flowering plants, root and shoot meristems at the growing tips respond to these signals and are responsible for producing all the cells and tissues of the mature organism, including the lateral root and shoot meristems that lead to branching of both the aerial and subterranean portions of the plant. How the action of these meristems is regulated spatially and temporally to result in a plant’s unique architecture continues to be a fascinating and challenging study in development (Poethig, 2003; Prusinkiewicz, et al., 2007).

Previous work in Arabidopsis identified a gene, PUCHI, that is required for normal lateral root morphogenesis (Hirota et al., 2007). puchi mutants show altered cell division in lateral root primordia and ectopic cell proliferation at the base of lateral meristems. PUCHI encodes a putative transcription factor of the APETALA2/ethylene-responsive element binding protein family, and expression analysis suggested that it acts downstream of auxin to modulate cell division patterns early in lateral root primordium development.

Now, Karim et al. (pages 1360–1372) show a different role for PUCHI in the aerial portion of the plant during the transition from vegetative to reproductive growth. During this transition in Arabidopsis, the primary inflorescence produces lateral meristems that develop either into flowers or secondary inflorescences. An important difference between Arabidopsis flowers and secondary inflorescences is the absence of a subtending bract beneath flowers. Mutations in PUCHI cause an increase in the number of secondary inflorescences and result in production of a subtending bract beneath mutant flowers. They also produce ectopic secondary inflorescences, suggesting a partial conversion of flowers into branches in the mutant.

Closer microscopy analysis of ectopic structures at the base of puchi flowers suggested a rudimentary bract and a pair of stipules (see figure). An enhancer-trap marker previously shown to be expressed in stipules was also expressed in these structures, suggesting that PUCHI is responsible for the suppression of bract growth in flowers. Interestingly, in wild-type plants, PUCHI is expressed only in the adaxial side of the floral meristem.

Perhaps the role of PUCHI in determining the architecture of the Arabidopsis inflorescence is not unexpected, given its homology to maize BD1 and rice FZP, both of which affect floral meristem identity. However, several important differences among these genes are observed: PUCHI is expressed in the meristem itself, unlike BD1 and FZP; both bd1 and fzp mutants show ectopic meristem formation in the axil of glumes (no corresponding phenotype in puchi mutants); and puchi affects bract suppression, while bd1 and fzp do not. In summary, while these results provide valuable insight in understanding mechanisms regulating meristem function, they also underscore differences in function between orthologous genes in different species, reminding us to exercise caution in extrapolating gene function among species.

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