

Populus CEN/TFL1 regulates first onset of flowering, axillary meristem identity and dormancy release in Populus

ABSTRACT

Members of the CENTRORADIALIS (CEN)/TERMINAL FLOWER 1 (TFL1) subfamily control shoot meristem identity, and loss-of-function mutations in both monopodial and sympodial herbaceous plants result in dramatic changes in plant architecture. We studied the degree of conservation between herbaceous and woody perennial plants in shoot system regulation by overexpression and RNA interference (RNAi)-mediated suppression of poplar orthologs of CEN, and the related gene MOTHER OF FT AND TFL 1 (MFT). Field study of transgenic poplars (*Populus* spp.) for over 6 years showed that downregulation of PopCEN1 and its close paralog, PopCEN2, accelerated the onset of mature tree characteristics, including age of first flowering, number of inflorescences and proportion of short shoots. Surprisingly, terminal vegetative meristems remained indeterminate in PopCEN1-RNAi trees, suggesting the possibility that florigen signals are transported to axillary meristems rather than the shoot apex. However, the axillary inflorescences (catkins) of PopCEN1-RNAi trees contained fewer flowers than did wild-type catkins, suggesting a possible role in maintaining the indeterminacy of the inflorescence apex. Expression of PopCEN1 was significantly correlated with delayed spring bud flush in multiple years, and in controlled environment experiments, 35S::PopCEN1 and RNAi transgenics required different chilling times to release dormancy. Considered together, these results indicate that PopCEN1/PopCEN2 help to integrate shoot developmental transitions that recur during each seasonal cycle with the age-related changes that occur over years of growth.

Keyword: TERMINAL FLOWER 1; *Populus*; Flowering; Dormancy; Branching; Axillary meristem