

## IN THE *turf* MUTANT OF SUNFLOWER, A TRANSPOSON INSERTION IN A *CYCLOIDEA* GENE (*HaCYC2c*) CHANGES THE FLORAL SYMMETRY AND FERTILITY OF RAY FLOWERS

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Floral symmetry appears to be controlled by the same fundamental set of related genes in many distantly related taxa, suggesting a common genetic basis for the trait (Jabbour et al., 2009). *CYCLOIDEA* (*CYC*)-like genes have been reported to be involved in flower symmetry regulation in various plant species. *CYC* of *Antirrhinum* was the first gene isolated, and thereafter the most extensively studied (Jabbour et al., 2009). It belongs to the plant-specific gene family encoding TCP transcription factors, which share a conserved basic helix–loop–helix TCP domain (Martin-Trillo and Cubas, 2010). Recent studies investigating the role of *CYC* homologs in Brassicaceae, Leguminosae and Asteraceae flower development support independent recruitment of *CYC* in establishing bilateral symmetry within core eudicots (Preston and Hileman, 2009). The inflorescence of sunflower (*Helianthus annuus* L.) is heterogamous with zygomorphic ray flowers located in the outermost whorl of the head and actinomorphic disk flowers arrayed in arcs radiating from the center of the head. The ray flowers are sterile; disk flowers are hermaphrodite, carrying both male and female organs. The *tubular ray flower* (*turf*) mutant is characterized by a change from a zygomorphic corolla to a nearly actinomorphic tubular-like corolla of ray flowers that also achieves the ability to differentiate fertile stamens and ovules (Berti et al., 2005). The recessive *turf* mutation is found to be unstable, spontaneously reverting to a wild-type or nearly wild-type phenotype (Fambrini et al., 2007). Here, we demonstrate that the mutant phenotype is due to a transposon insertion in the class II TCP gene *CYCLOIDEA/TEOSINTE BRANCHED1* (*CYC/TB1*), *HaCYC2c* (Chapman et al., 2008). In heterozygous progenies, the mutant phenotype co-segregate with the transposon insertion. Perfect transposon excision, generates reversion of the mutant to wild type phenotype. By contrast, imperfect transposon excision can generate stable mutant types. It is likely that in ray flower, the *HaCYC2c* gene carries a dual role controlling the corolla symmetry and repressing genes involved in stamen and carpel development. New mutant phenotypes were also detected within the heterozygous reverted progenies, and a gene tagging approach could be employed to isolate the affected genes.

### REFERENCES

- Berti F. et al., 2005. Can. J. Bot. 83: 1065-1072.
- Chapman M.A. et al., 2008. Mol. Biol. Evol. 25:1260–1273.
- Fambrini M. et al., 2007. Plant Breed. 126: 548-550.
- Jabbour F. et al., 2009. C. R. Biologies 332: 219-231.
- Martin-Trillo M. and Cubas P., 2010. Trends Plant Sci. 15: 31-39.
- Preston J.C. and Hileman L.C., 2009. Trends Plant Sci. 14: 147-154.