Identification of LATE BLOOMER 2 as a CDF homolog reveals conserved and divergent features of the photoperiod response mechanism in pea

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soybean SDP
doğan legumes

• fundamental flowering mechanisms
• links to other traits
• comparative biology and evolution
• domestication and adaptation
• germplasm characterization

conservation and divergence in fundamental flowering control mechanisms

the Arabidopsis mechanism

conserved components in pea photoperiod response

Arabidopsis

pea

legume CO-like genes

Wong et al. (2014) Frontiers Plant Sci
late2-1D affects expression of FT genes

late2-1D - a gain-of-function mutation affecting a repressor of FTb2

late2-1D has no obvious photomorphogenic or rhythmic defects

late2-1D - a gain-of-function mutation affecting a repressor of FTb2

a new late-flowering photoperiod-insensitive mutant

a CYCLING DOF FACTOR gene as candidate for LATE2
late2-1D has a mutation in a conserved FKF1-binding domain of PsCDFc1

H-terminal deletion impairs LD induction of tuber formation

K251L prevents complex formation and LD induction of flowering

\( \text{R450W mutation in CDFc1 delays flowering in Arabidopsis} \)

\( \text{R450W mutation in CDFc1 impairs physical interaction with FKF1} \)

\( \text{• yeast two-hybrid assay} \)

\( \text{• shows mutation is functionally significant} \)

\( \text{• affects CO and FT expression} \)

\( \text{• implies constitutively high levels of LATE2 protein} \)

\( \text{• no consistent differences for any other CDL gene} \)

\( \text{• or in any other photoperiod response mutants} \)

\( \text{COLa rhythm is unaffected in late1 and late2 mutants} \)
other direct transcriptional activators of FT

- CBF1-5 (bHLH TF, bound and activated by CBF2 under blue light)
- PIF4 (bHLH TF, mediates temperature effects)
- CO
- PIF1
- other CCT-domain proteins?
- other B-box proteins?

regulatory targets of LATE1/LATE2?

- RNaseq on leaf tissue
- 3-week old plants
- grown under continuous light

Could LATE2 be a direct repressor of FT?

- transient assay in tobacco
- initially using MFTb1 promoter

Conclusions

- CDF/FKF/GI module conserved, but not CO target
- CO function evolved recently in Brassicaceae, convergent in other taxa
- CDF/FKF/GI module could act directly at FTb promoter
- need alternative explanation for effects of PHY and clock

Ongoing...

- protein-level regulation
- FTb2 regulators
- FTb2 targets
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