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research highlights

SOYBEAN GENETICS

Adapting to the tropics

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Soybean, a short-day species originally domesticated from temperate regions, displays early flowering and yield reduction when cultivated in tropical areas. To overcome this problem, a long-juvenile (LJ) trait of delayed flowering has been used to expand soybean cultivation to low-latitude regions. A major locus, *J*, situated on soybean chromosome 4, was found to account for this LJ trait in previous studies. However, the molecular basis of *J* and how it works have remained unknown. Now, Sijia Lu, at the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, and colleagues have identified the causal gene and mutations at the *J* locus, providing a clear mechanism for how it shapes low-latitude adaptation.

Using quantitative trait locus mapping and positional cloning, the researchers managed to narrow down the *J* locus to an orthologue of the *Arabidopsis* flowering-time gene, *EARLY FLOWERING 3* (*ELF3*). Transgenic experiments validated its function in controlling flowering time and showed that its loss-of-function variants, which are present in LJ varieties, resulted in late flowering and enhanced yield under short-day conditions.

J protein repressed the legume-specific flowering repressor *E1* by binding to the *E1* promoter and suppressing its transcription. Previous studies have already shown that soybean *E1* is regulated by two upstream positive regulators (*E3* and *E4*) and that *E1* represses the expression of two downstream *FLOWERING LOCUS T* (*FT*) genes (*FT2a* and *FT5a*). Now, in the present study, the researchers have found that *J* expression can be repressed by *E3* and *E4*, so the *J* gene mediates the control of *E1* by *E3* and *E4* and influences photoperiod-regulated flowering by ultimately modulating the expression of *FT* genes.

The researchers identified eight loss-of-function *J* alleles across global soybean germplasm. All present in accessions from low-latitude regions, these alleles arose independently and have been utilized across continents to facilitate soybean cultivation in tropic regions.

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