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A single nucleotide deletion in J encoding *GmELF3* confers long juvenility and is associated with adaption of tropic soybean

Hai Nian, College of Agriculture, South China Agricultural University, Guangzhou, China

Wild soybean is a typical short-day plant. The discovery and introduction of the long juvenile trait into soybean varieties in the 1970s fundamentally changed global soybean production in a way that has had an enormous influence on commodity markets. This trait delays flowering and thereby ensures sufficient vegetative growth prior to the developmental transition to reproductive growth. The existence of a J/j locus controlling the long juvenile trait in tropic soybean was proposed through genetic studies nearly 40 years ago. However, the gene or quantitative trait locus (QTL) responsible for J has not been reported.We constructed a RIL population by crossing the conventional juvenile variety Zhonghuang 24 (Huang-Huai-Hai Rivers Valley ('HHH') / North China) and the long juvenile variety Huaxia 3 (South China), which consistently had the longest flowering times in our experiments in Guangzhou. High-depth, whole-genome re-sequencing of the parents of the RILs, Zhonghuang 24 and Huaxia 3 was performed to increase SNP density. Linkage analysis with this map led to the long juvenile traits to the *GmELF*3 gene. In the long juvenile variety "Huaxia 3", the GmELF3 gene is missing a base, resulting in gene sequence shift and the encoded protein inactivation, which delayed flowering. Furthermore, "Huaxia No.3" showed the early flowering traits when the *GmELF*3 gene from "Zhonghuang 24" was transferred to it, which further proved that *GmELF*3 mutation led to the generation of long-term traits. Our identification of *GmELF3* as the causal gene for the economically- and historically-important long juvenile trait will likely enable significant, rapid progress in soybean breeding programs. Further, our insights about *J* promise to facilitate the investigation and identification of various interacting biomolecules in the signaling pathways associated to the long juvenile trait in soybean in particular, and perhaps to photoperiodism in plants generally.