論文の内容の要旨

FE regulates florigen-mediated flowering through multi-layered functions in *Arabidopsis thaliana*

（シロイヌナズナのフロリゲンを介した花成制御における FE の多層的な役割）

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The proper timing of flowering is essential for reproductive success. In a facultative long-day plant, *Arabidopsis thaliana*, *FLOWERING LOCUS T* (*FT*) encodes the mobile hormone florigen, and plays a pivotal role in modulating the optimal timing of flowering. FT is synthesized in leaf phloem companion cells and transported from leaves to the shoot apical meristem (SAM) via phloem tissue to initiate flowering.

Since *FT* is the most important gene for flowering, multi-layered regulation mechanisms are needed to proper regulation of florigen activity. Under inductive long-day conditions, the abundance of *FT* mRNA shows unique diurnal expression pattern. CONSTANS (CO) plays an important role in the temporal regulation of *FT*. CO interacts with NUCLEAR FACTOR-Y (NF-Y), and CO/NF-Y complex binds to the *FT* promoter region to activate *FT* expression. Over the *FT* locus, a transcriptionally

repressive histone modification, trimethylated Lys residues at position 27 of histone 3 (H3K27me3) is widely enriched. This transcriptionally repressive chromatin status is regulated by polycomb group proteins. After translation, FT is transported to the SAM through interaction with florigen transporters, such as SODIUM POTASSIUM ROOT DEFECTIVE 1 (NaKR1) and FT-INTERACTING PROTEIN 1 (FTIP1).

The mechanisms of temporal transcriptional regulation and setting the repressive chromatin status have been revealed to a large extent. However, mechanisms of phloem-specific spatial transcriptional regulation and setting active chromatin status remain unclear. In addition, there is room to elucidate the molecular mechanism that coordinates FT protein synthesis and transport for opportune flowering.

In this thesis, I focused on the phloem-specific Myb-related transcription factor, FE. In order to clarify molecular functions of FE in the florigen-mediated flowering, I performed experiment from three different points of view. Firstly, in transcriptional regulation, FE directly binds to the *FT* promoter together with CO/NF-Y to activate *FT*. Simultaneous induction of FE and CO strongly activates *FT* transcription not only in phloem tissue but also in some other tissues. Secondly, in chromatin remodeling, FE mediates removal of H3K27me3 with RELATIVE OF EARLY FLOWERING 6 (REF6) to set active chromatin state at the *FT* locus. And finally, in protein transport regulation, FE activates *NaKR1* and *FTIP1* for effective transport in CO-independent manners.

Given that the results of transcriptional regulation and chromatin remodeling, I suggest that FE and REF6 provide capability of accepting transcription factors for the

FT locus through chromatin remodeling, and then FE recruits CO to induce *FT* expression in phloem tissue. From protein transport analysis, I suggest that FT protein synthesis and transport are governed by FE in CO-dependent/independent manners. Taken together, my results suggest that FE regulates the florigen mediated-flowering through multi-layered functions.