論文の内容の要旨

Molecular genetic studies on meristem regulation and lateral organ development in *Oryza sativa.*

（イネのメリステムと側生器官の発生に関する分子遺伝学的研究）

田中若奈

Plant development depends on the meristem, in which the stem cell is self-maintained and provides cells to form lateral organs. Thus, the regulation of meristem maintenance and its fate is essential for plant development. In addition, communication between the meristem and lateral organ is also important not only for proper development of lateral organs but also for the meristem function. However, little is known about genes involved in this communication.

In this thesis, I focused on a novel mutant, *tongari-boushi1* (*tob1*), which shows unique pleiotropic phenotypes in the spikelet, and revealed that *TOB1* has a critical function in both lateral organ development and meristem regulation. Next I revealed that *TOB1* is involved in transcriptional repression and that *TOB1*-related genes, *OsYABBY3* and *OsYABBY4*, play roles similar to that of *TOB1* in spikelet development. Lastly, I focused on five *FON1*-like

(*FOL*) genes and revealed their involvement in spikelet meristem regulation.

Functional analysis of *TOB1* gene involved in the communication between lateral organ and meristem.

Mutation in the rice gene *TONGARI-BOUSHI1* (*TOB1*) results in pleiotropic phenotypes in spikelets, such as the formation of a cone-shaped organ instead of the lemma or palea, the development of two florets in a spikelet, or premature termination of the floret meristem, in addition to reduced growth of the lemma or palea and elongation of the awn. These phenotypes seem to result from not only failure in growth of the lateral organs, but also defects in maintenance and organization of the meristem. For example, the cone-shaped organ develops as a ring-like primordium from an initial stage, suggesting that regulation of organ initiation in the meristem may be compromised.

I isolated the *TOB1* gene by positional cloning and revealed that this gene encodes a YABBY protein, which is closely related to *FILAMENTOUS FLOWER* (*FIL*) in *Arabidopsis*. *TOB1* is strongly expressed in the primordia of lateral organs, such as lemma and palea, without any patterns of polarization, but not expressed in the meristem per se. These finding suggests that *TOB1* may act non-cell autonomously to maintain proper meristem organization, and play an important role in the communication of lateral organs and the meristem to control proper development of the spikelet in rice.

The molecular function of TOB1 protein and phenotypic redundancy.

To get a better understanding of *TOB1* function in spikelet development, I make *TOB1-SRDX*

expressing plant to analyze *TOB1* function together with that of *OsYABBY3* and *OsYABBY4*, which are closely related to *TOB1*. *TOB1-SRDX* expressing plant exhibits phenotypes similar to that of *TOB1*-overexpressing plant, suggesting that TOB1 is involved in transcriptional repression. Consistent with this inference, TOB1 interact physically with OsSEU proteins, which are thought to act as adaptors in a repressor complex.

I also showed that *TOB1*-related *YABBY* genes, *OsYABBY3* and *OsYABBY4* have function similar to that of *TOB1* to control spikelet development and to probably regulate meristem maintenance and organization. Suppression of *OsSEU* genes in the *tob1* background resulted in an enhancement of the *tob1* phenotype, which is also observed when *OsYABBY3* or *OsYABBY4* expression is silenced in the *tob1* mutant. Therefore, these three *YABBY* genes may be involved in transcriptional repression and have a crucial roles in spikelet development and probably in meristem regulation.

Functional analysis of *FON1-LIKE* (*FOL*) genes that regulated the maintenance and the fate of the spikelet meristem

FON1 and *FON2* regulate the maintenance of the stem cell in rice. *FON1* encodes LRR-receptor kinase and thought to perceive FON2 CLE peptide. To understand more detailed mechanism of stem cell maintenance in rice, I focused on five *FON1-LIKE* (*FOL1-FOL5*) genes, which are closely related to *FON1*. These *FOL* genes seem to act redundantly because simultaneous suppression of two genes in wild type results in no abnormal phenotype. By contrast, when I suppress *FOL4* and *FOL5* in the *fon1-4* mutant background, an enhancement of *fon1-4* phenotype is observed. Therefore, *FOL4* and *FOL5* are likely to have an important role in

regulation of the maintenance of the stem cell and determinacy of the spikelet meristem, together with *FON1*. This inference is confirmed from the results that suppression of *FOL4* and *FOL5* in *fol1-1* mutant causes increase in the floral organ number like *fon1* mutant. In addition, it is also suggested that both *FON4* and *FON5* are involved in the regulation of meristem fate independently of *FON1*, because marked spikelet phenotypes such as formation of two florets in a spikelet or reversion of the spikelet into inflorescence are observed in *FOL4-FOL5*:RNA/*fon1-4* plant.