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Sota Fujii and Kinya Toriyama

Graduate School of Agric. Sci., Tohoku Univ., Sendai, Japan

Cytoplasmic male sterility (CMS) is a maternally inherited trait which is utilized for commercial F_1 hybrid rice breeding program. CMS is caused by the incompatibility between nucleus and mitochondria, and CMS has been an excellent model for understanding the intracellular genomic barrier.

We have been studying on three rice CMS strains derived from independent origin. Here we présent our recent approaches for understanding the total nature of CW-type CMS. CW-type CMS have been derived from *Oryza rufipogon* Griff., W1 strain. The mature pollen of CW-type CMS line (W1-A) appears to be normal compared to the recurrent parent (Taichung 65) or the fertility restorer line (W1-R). To screen the genetic components involved in the evolvement of CMS in W1-A, we have performed the 22k microarray and compared the mRNA transcriptomic status between W1-A and Taichung 65. Fifty-eight genes were ectopically up-regulated in W1-A, and 82 were down-regulated. Further analysis by quantitative RT-PCR have revealed that such W1-A specific gene expression was only observed in mature anthers but not in vegetative cells, indicating the presence of anther-specific mitochondrial retrograde regulation of nuclear gene expression. We also identified that the gene expression patterns in W1-R mature anthers resembles to that of Taichung 65, meaning that pollen fertility is restored in W1-R at molecular level. To find out the fertility restorer component in W1-R, we have raised BC_1F_1 individuals derived from two constitutive backcrosses of Taichung 65 into W1-R, and revealed that the fertility restoration is controlled by a single gene. The single fertility restorer gene was designated as *Rf17,* and we have carried out the molecular mapping in order to clone the *Rf17* gene. By determining the genotype of 96 BC_1F_1 individuals, we have found markers linked to *Rf17* on chromosome 4. At current status, we have screened approximately 4,000 BC_1F_1 and 3,000 F_2 individuals, and identified *Rf17* in 77 kb region. Since the expression levels of genes down-regulated in W1-A mature anthers were restored in BC_1F_1 plants carrying the *Rf17* locus, we concluded that *Rf17* is the genetic component that normalizes these gene expressions in W1-R. We will discuss about how CMS occurs in rice CW-CMS, and mitochondrial involvement in reproductive organ development.