外 国 語 要 旨

学位論文題目（英 語） ：”Chemical biology research for brassinosteroid signaling factor BIL3 and BPG3”

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Brassinosteroids (BRs) are plant steroid hormones that regulate plant growth and development including chloroplast developement. To identify detail molecular mechanism of brassinosteroid signaling, we tried to screen mutants by using Brz, which is the specific inhibitor of brassinosteroid biosynthesis enzyme DWF4 P450 oxidase. Brz causes deetioation and dwarf phenotypes in the dark germination stage that are similar to the phenotypes of BR-deficient mutants. Trial to screen plant growth and chloroplast activating genes with BR by chemical genetics has been carried out recently. BR-deficiency caused by Brz activated the photosynthesis related gene expression and protein translations.

To analyze the molecular mechanism of BR-signaling that regulates chloroplast functions, we screened Brz-insensitive *bpg* (*Brz-insensitive-pale green*) mutants that showed reduced sensitivity to chlorophyll accumulation by Brz in the light. *Brz-insensitive-pale green 2* (*bpg2)* was previously reported as an *Arabidopsis* recessive mutant regulating chloroplast rRNA. In CHAPTER 1, a novel *bpg* mutant, *Brz-insensitive-pale green 3-1D (bpg3-1D)* is analyzed. *bpg3-1D* was screened from full-length cDNA overexpressor (FOX) lines, which showed pale green cotyledons and was insensitive to the Brz-induced promotion of greening in the light. Although *bpg2* is a recessive mutant, *bpg3-1D* is the first known dominant mutant of this type. *BPG3* encodes a novel chloroplast protein that was evolutionally conserved in bacteria, algae and higher plants. The expression analysis revealed that *BPG3* mRNA was increased by Brz-treatment, but was not affected by BR-treatment. The *bpg3-1D* plants showed lower parameters that suggested the condition of electron transport in total PSII. These results suggest that BPG3 should have a positive function in photosynthesis, although the overexpression of *BPG3* caused the pale-green phenotype and inhibition of the electron transport of PSII.

To analyze the molecular mechanism of BR-signaling that regulates plant growth functions, we screened Brz-insensitive *bil* (*Brz-insensitive-long hypocotyl*) mutants that showed longer hypocotyls than wild type with Brz in the dark. *brassinazole-resistance 1-1D (bzr1-1D)* and *Brz-insensitive long hypocotyl 1-1D (bil1-1D)* were isolated from EMS-mutation lines that showed longer hypocotyls than the wild-type with Brz in the dark. *bil1-1D* has the same mutation as *(bzr1-1D)*, which was independently screened by Brz, and identified as a positive regulator for BR-signaling. In the *bil1/bzr1* mutant, the mutation promoted stability of the BIL1/BZR1 protein, and the stabilized protein up-regulated BR-signaling that allowed insensitivity to Brz. In CHAPTER 2, a novel *bil* mutant, *Brz-insensitive-pale green3-1D (bil3-1D)* is analyzed. *bil3-1D* was screened from *Arabidopsis*

activation-tagging lines that showed longer hypocotyl with Brz at the germination stage, and a slender dwarf phenotype in the light. In the adult, compared with the wild strain, *bil3-1D* shows increased number of inflorescences, branches, and siliques. In the *bil3-1D* mutant, a BR biosynthetic gene *DWF4* expression was decreased compared with wild-type, indicating the BR stimulation with negative feedback. *BIL3* encodes a novel protein. GUS histochemical analysis revealed that *BIL3* expressed in SAM, young leaves, the vascular of leaves, the root tip, and whole root without elongation zone. These results suggest that *BIL*3 should have a positive function in BR-signaling and might involve in the development of vascular tissues and SAM.