博士論文 (要約)

Analysis of the transcriptional regulation of Arabidopsis *PIF* family genes in response to abiotic stresses

(環境ストレス応答におけるシロイヌナズナ *PIF* 遺伝子の転写制御機構の解析)

応用生命化学専攻　植物分子生理学研究室

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指導教員　篠崎　和子

Chapter 1. Introduction

Drought is known as one of the most severe stress conditions that strongly affect the plant growth and productivity. Recent studies indicated that the reduction of plant growth under drought condition is result of adaptation to the stress. Expression of many genes is up-regulated or down-regulated during drought stress condition, and some of these genes were reported to be involved in regulation of plant growth.

As light is an essential environmental factor for growth and development, plants have various kinds of photoreceptors. Phytochromes are representative photoreceptors that are sensitive to red and far-red light. In Arabidopsis, a red light receptor phytochrome B (phyB) can be raised as a well-characterized member of phytochromes known to control photomorphogenesis such as inhibition of hypocotyl elongation and expansion of cotyledon under red light condition by managing the light-signaling network. Members of the PIF (Phytochrome Interacting Factor) family of bHLH transcription factors function in the light-responsive development of chlorophyll, shade avoidance and phytomorphogenesis.

A rice PIF-like gene, *OsPIL1* was identified by microarray analyses as one of the stress-responsive transcription factor genes that were down-regulated by drought stress. The level of the *OsPIL1* mRNA in rice seedlings grown under non-stressed condition with light/dark cycles oscillates in a circadian manner with peaks in the middle of the light period. The expression of *OsPIL1* during the light period is repressed under drought and low-temperature conditions. OsPIL1 regulates expression of downstream cell wall-related genes and is involved in height of rice plants by changing the internode cell size. However, a mechanism of down-regulation of *OsPIL1* expression under stress condition is not clearly identified yet.

This study aimed to elucidate the mechanism of down-regulation of PIF/PIL family genes under stress conditions in plants by using the most homologous *PIF*/*PIL* genes of *OsPIL1* in Arabidopsis. Down-regulation of the Arabidopsis *PIF* genes was confirmed and their promoter regions were analyzed using transgenic Arabidopsis plants to identify *cis*-acting elements that regulate the expression of the genes under both circadian and drought conditions. The DNA-binding proteins that interact with the identified *cis*-acting elements were tried to isolate using a yeast one-hybrid screening system.

Chapter 2

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