論 文 の 内 容 の 要 旨

応用生命化学
専攻
平成２３年度博士課程　入学
氏　　名　　姜　　凱
指導教員名　　浅見　忠男

論文題目 Physiological and molecular biological studies of PYR/PYL/RCAR ABA receptors in *Arabidopsis*
（シロイヌナズナ ABA 受容体 PYR/PYL/RCAR の
生理学的および分子生物学的研究）

Introduction

ABA is a plant hormone and regulates both plant growth and plant responses to stresses. Uncovering the mechanisms of ABA in these actions will facilitate the regulation of plant growth and alleviation of plant damages caused by various stresses, which then direct the increase in crop production and plant resistance against stresses.

The metabolisms of ABA including its biosynthesis and catabolism have been well studied since its discovery. Although many ABA related factors, such as PP2Cs, SnRK2s, transcription factors and responsive genes were identified successively, the ABA signaling pathway was still incomplete since the loss of information about how ABA was sensed and transmitted. The discovery of ABA soluble receptors RCAR/PYR/PYL was a hallmark in ABA

signaling studies since it coordinated the various factors that were found before and established a canonical pathway from ABA perception and transduction to ABA response in plant physiology (Figure 1).

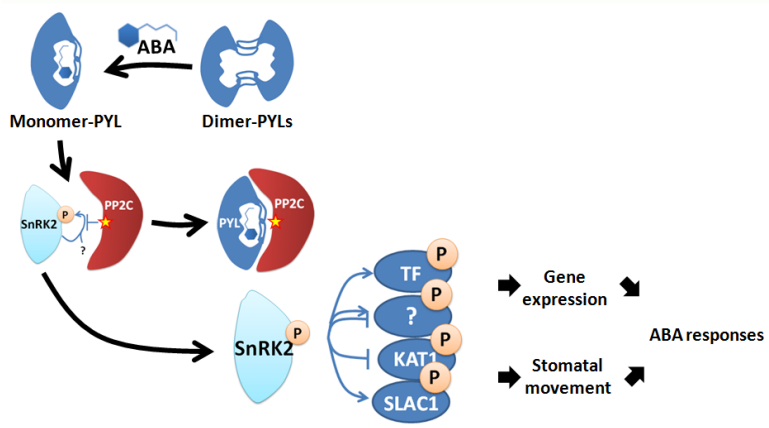

Figure 1 ABA signaling pathway

There are 14 members in *PYL* family in *Arabidopsis*. They show various spatio-temperal expression levels and redundant physiological roles with each other. The mechanisms of PYLs in regulating the ABA signaling pathway and the functions of PYLs in plant growth and development are still to be studied.

Observation of the phenotypes of *PYL* over-expression lines in response to different conditions

The *PYL* over-expression (*PYL*-OE) lines of *Arabidopsis* were constructed and the physiological responses of these over-expression lines to ABA and/or other reagent under various conditions were investigated. I confirmed recent published results that PYLs play redundant and distinct roles in regulating the seed germination, root elongation, seedling establishment. By analyzing the over-expression lines of *PYL1*, *PYL2* and *PYL4*, I found that these receptors played redundant roles in inhibiting seed germination. However, over-expression lines of *PYL3*, *PYL6*, *PYL11* and *PYL13* showed no increase in or even decrease in the sensitivity to ABA, which indicated that these PYLs could be not involved in regulating the seed germination. Over-expression lines of *PYL1*, *PYL2*, *PYL5* and *PYL7* showed increasing sensitivity to ABA

during seedling development. The root of *PYL2*, *PYL5* and *PYL7* over-expression lines were much more suppressed by ABA compared to that of control line. In addition, I first found that PYL6 functions as negative regulator in hypocotyl elongation under a specific light treatment (JK1 treatment) (Figure 2) and this suppression of hypocotyl by *PYL6* over-expression was restored by GA treatment (Figure 2), indicating that the regulation of hypocotyl elongation during a specific photomorphogenesis progress via PYL6 may be related to GA signaling to some extent.

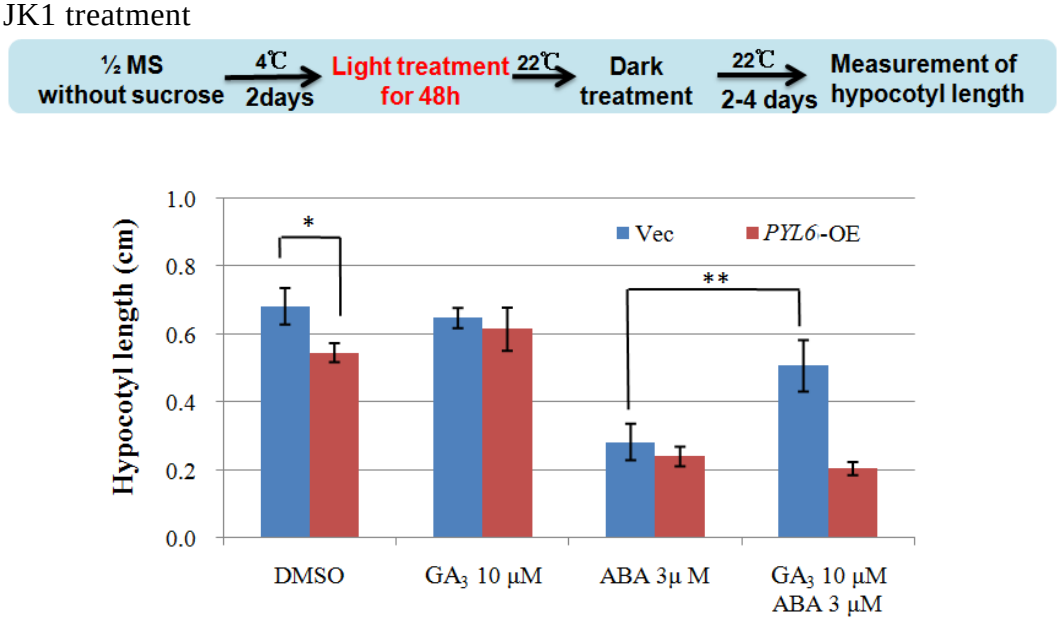

Figure 2 The hypocotyl growth under JK1 treatment with or without plant hormone treatments

In addition, mutation of *ABI5* dramatically increased the hypocotyl length compared to wild type, which indicates ABI5 plays important roles in regulating hypocotyl under JK1 treatment. The *ABI5* expression level is higher in *PYL6*-OE line than the control line.

Based on these results, I suggest that the inhibitory effect of PYL6 on hypocotyl growth is dependent on its up-regulation of *ABI5* transcription and its crosstalk with GA signaling pathway (Figure 3).

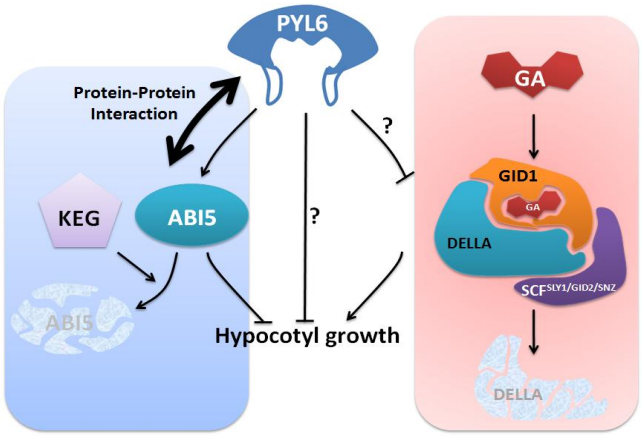

Figure 3 The possible inhibitory mechanisms of PYL6 on hypocotyl growth

Elucidation of the above questions will broaden the knowledge about the roles of ABA in plant and facilitate the utilization of ABA signaling in agricultural production and plant protection.