UNIVERSITY OF GOTHENBURG

FACULTY OF SCIENCE
DEPARTMENT OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES

Light-regulated Development in *Arabidopsis*

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Akademisk avhandling för filosofie doktorsexamen i Naturvetenskap med inriktning Biologi, som med tillstånd från Naturvetenskapliga fakulteten kommer att offentligt försvaras Tisdag den 21 October 2014 kl. 10.00 i Hörsalen, Institutionen för biologi och miljövetenskap, Carl Skottsbergs gata 22B, Göteborg.

Examinator: Professor Cornelia Spetea Wiklund, Institutionen för biologi och miljövetenskap, Göteborgs Universitet

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ISBN 978-91-85529-71-1

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ABSTRACT

Many external and internal factors affect multiple developmental processes in plants. Light is one of the essential factors that regulates various aspects of plant growth and development throughout their life cycle. Through combination of genetic and biochemical assays, this doctoral work elucidated the role of B-box protein 21 (BBX21) in the crosstalk between light and abscisic acid (ABA) network, and identified two novel CONSTITUTIVE PHOTOMORPHOGENIC 1 (COP1) regulators which are responsible for modulation of COP1 abundance and/or activity.

In the model plant *Arabidopsis thaliana*, light is sensed by various photoreceptors and promotes photomorphogenesis. A subset of BBX proteins, including BBX4, BBX20, BBX21and BBX22, play positive roles in the light signaling pathway. Plant hormones are also involved in photomorphogenesis, and several regulators functioning in the light signaling participate in the hormone pathways as well. To increase the knowledge of BBX proteins in the crosstalk between light and hormones, in **Paper I** the role of BBX21 in response to light and ABA was investigated. *Arabidopsis* mutants for *BBX21* gene are hyposensitive to light, in **Paper I** they were found to be hypersensitive to ABA. BBX21 physically interacted and formed heterodimers with ELONGATED HYPOCOTYL 5 (HY5) or ABA INSENSITIVE 5 (ABI5), thereby interfering with HY5 or ABI5 binding to the *ABI5* promoter to activate *ABI5* or *ABI5*-regulated genes expression.

COP1 is a key repressor of plant photomorphogenesis. In the dark, COP1 targets many downstream substrates for ubiquitination and promotes their degradation via the 26S proteasome system to repress photomorphogenesis. To explore candidate genes responsible for regulation of COP1, in **Paper II** and **III** we performed a genetic screen for suppressors of *cop1*. Two novel COP1 regulators were identified and characterized, namely COP1 SUPPRESSOR 1 (CSU1) and CSU2. Either *csu1* or *csu2* alone completely suppressed constitutive photomorphogenic phenotype of *cop1-6* in the dark.

CSU1, which is a Ring-finger E3 ubiquitin ligase, co-localized with COP1 in nuclear speckles, and negatively regulated the abundance of COP1 in the dark. CSU1 was able to ubiquitinate COP1 *in vitro* and was found to be responsible for the COP1 ubiquitination *in vivo*. Thus, CSU1 acts as an E3 ubiquitin ligase to maintain the COP1 homeostasis in the dark-grown seedlings **(Paper II)**.

CSU2 encoding a coiled-coil protein, physically interacted and co-localized with COP1 in the nuclear speckles through their coiled-coil domains. CSU2-COP1 association resulted in the repression of the E3 ubiquitin ligase activity of COP1 towards HY5 **(Paper III)**.

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