LHCII Proteins Phosphorylation Changes Involved in the Dark-Chilling Response in Plant Species with Different Chilling Tolerance

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Abstract : Under constantly fluctuating environmental conditions, the thylakoid membrane protein network evolved the ability to dynamically respond to changing biotic and abiotic factors. One of the most important protective mechanism is rearrangement of the chlorophyll-protein (CP) complexes, induced by protein phosphorylation. In a temperate climate, low temperature is one of the abiotic stresses that heavily affect plant growth and productivity. The aim of this study was to determine the role of LHCII antenna complex phosphorylation in the dark-chilling response. The study included an experimental model based on dark-chilling at 4 °C of detached chilling sensitive (CS) runner bean (Phaseolus coccineus L.) and chilling tolerant (CT) garden pea (Pisum sativum L.) leaves. This model is well described in the literature as used for the analysis of chilling impact without any additional effects caused by light. We examined changes in thylakoid membrane protein phosphorylation, interactions between phosphorylated LHCII (P-LHCII) and CP complexes, and their impact on the dynamics of photosystem II (PSII) under dark-chilling conditions. Our results showed that the dark-chilling treatment of CS bean leaves induced a substantial increase of phosphorylation of LHCII proteins, as well as changes in CP complexes composition and their interaction with P-LHCII. The PSII photochemical efficiency measurements showed that in bean, PSII is overloaded with light energy, which is not compensated by CP complexes rearrangements. On the contrary, no significant changes in PSII photochemical efficiency, phosphorylation pattern and CP complexes interactions were observed in CT pea. In conclusion, our results indicate that different responses of the LHCII phosphorylation to chilling stress take place in CT and CS plants, and that kinetics of LHCII phosphorylation and interactions of P-LHCII with photosynthetic complexes may be crucial to chilling stress response. Acknowledgments: presented work was financed by the National Science Centre, Poland grant No.: 2016/23/D/NZ3/01276

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