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Abstract of Ph.D. thesis entitled: The physiological and molecular basis of cytokinins action in delaying the leaf senescence in *Hordeum vulgare* L.

Cytokinins (CKs) are a group of hormones involved in the regulation of plant growth and development. From an economic point of view, the crucial is the ability of CKs to delay the onset of leaf senescence which influences the quality and quantity of the crop yield. The study presents a detailed analysis of CK influence on dark-induced senescence (DIS) of the first true leaf of three barley (*Hordeum vulgare* L.) cultivars: Bursztyn, Carina and Lomerit, which differ with ontogenesis, the onset, and scheme of the leaf senescence. The present study aimed to identify the physiological and molecular basis of anti-senescing action of tested CKs in analyzed barley cultivars. To this end, the abundance of the photosynthetic pigments, the activity of II (PSII) and I (PSI) photosystem, changes in photosystems composition, the rate of CO_2 assimilation and other gas exchange parameters, the content of photosynthetic proteins and the senescence-specific marker SAG12, the importance of cytosolic pathway of CKs synthesis in leaf aging and CK-related action of phospholipase D, nitrogen monoxide and extracellular invertase, as well as the effectiveness of antioxidant defense and oxidative stress intensity were analysed.

The study proved that analyzed CK effectively slowed down the progress of senescence of barley leaves restricting the accumulation of SAG12 protein. Application of CKs during DIS allowed to reduce the typical symptoms of leaf senescence, such as the loss of chlorophyll and of photosynthetic proteins (especially the antennae proteins of PSI and PSII), thus maintained an undisturbed quantum performance of PSII with a reduced involvement of non-photochemical quenching of absorbed energy, and with a lower level of stress-related PsbS protein. It was also documented that leaves incubated with CK during DIS maintained a control-like level of PGRL1 and NdhS protein engaged in cyclic electron transport around PSI. At the same time, the efficiency of CK to sustain the assimilation rate of CO_2 was minor and limited by reduced stomatal conductance, damped efficiency of CO_2 acceptor regeneration and lowered rate of Rubisco carboxylation. It has been showed that different anti-senescing efficiencies of CKs most likely result from the cultivar-specific pathway of CK synthesis, the different metabolic activities, and antioxidant capacities. The work allowed to identify the Bursztyn cultivar as a functional *stay-green* phenotype, although the observed delay of leaf senescence during DIS in Bursztyn was not directly related to higher photosynthetic efficiency of the cultivar under control conditions.

30.08.2019, Julia Niewiadomska

30.08.2019 Ernest Skowron