3rd National Congress on Physical Sciences, 29 Sep. – 2 Oct. 2016, Sofia
Section: Physics of Living and Soft Matter. Physics in Medicine

Alterations in Pigment Content and Photosynthetic Performance of *Arabidopsis thaliana* Plants under Combined Action of Low Temperature and High Light

M. Gerganova, **D. Stanoeva**, **A.V. Popova**, **M. Velitchkova**

Institute of Biophysics and Biomedical Engineering, Bulgarian Academy of Sciences, Acad. G. Bonchev str. Bl. 21, 1113 Sofia Bulgaria

Abstract. Photosynthesis is the unique process in the nature ensuring effective transformation of sun energy into chemical energy and evolving oxygen used by all living organisms. As a result of natural events and anthropological activities the environment is changing affecting negatively the photosynthetic processes and plants' growth and productivity. Understanding the mechanisms that underlie the plants' capability to cope with abiotic stress could provide knowledge for development of plant species resistant to adverse unfavorable environmental conditions. Low temperature is one of the stressors that negatively influence plants' growth, productivity and photosynthetic performance.

The long term effects of growth under low temperature in combination with high light illumination were studied on *Arabidopsis thaliana* plants. The response and acclimation of photosynthetic apparatus were evaluated by alterations of pigment content, chlorophyll fluorescence characteristics and oxygen evolution of whole detached leaves. Changes of carotenoids and chlorophylls content were evaluated after development for two and six days at 12/10°C and high light intensity (800 μmol.m^{-2}.s^{-1}). Growing at low temperature-high light for six days led to a considerable decrease of the total chlorophyll content, while the amount of total carotenoids was less affected. Oxygen evolution activity was inhibited by 20% and 27% on the 2nd and 6th day, respectively. By means of PAM fluorescence the parameters characterizing effectiveness and functionality of photosystem II were determined. The decrease of oxygen evolution estimated by Clark electrode corresponded with the reduction of ratio Fv/Fm, representing maximal quantum efficiency of Photosystem II. Non-photochemical quenching was also inhibited after low temperature – high light treatment. To check the ability of plants to restore their pigment content and functional activity the plants were allowed to recover at optimal conditions. Presented data throw light on the mechanisms underlying the acclimation process of photosynthetic apparatus to suboptimal growth temperature.

Acknowledgements: This work is supported by SNSF-Swiss and NES-Bulgaria under Research project IZEBZO-143169/1.