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

Suboptimal Growth Temperature and Light Intensity Effects on Photosystem II Activity and Oxygen Evolution of Tomato (*Solanum lycopersicum*)

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Abstract.

As a result of human activities and natural events the Earth's climate changed and lead to alteration of conditions at which the plants developed and survive. Among unfavorable factors the extreme temperatures influence directly the photosynthesis affecting the balance between photophysical reactions and biochemical processes. To cope with adverse stress environment plants are developed different protective systems and mechanisms. In the chloroplast, the response to stress factors action involves inter thylakoid structural alterations, reorganization of main pigment-protein complexes and changes of the content and stoichiometry of photosystem I and photosystem II and their antenna complexes. Tomato is known as temperate climate culture and low temperature express negative impact on its functions and effectiveness of photosynthetic processes. In present work the capability of tomato plants to acclimate to suboptimal temperature depending on the presence of high light intensity was studied. Data obtained showed that growing the plants at low temperature (12–10°C) and high light for 6 days led to a decrease of the ratio chlorophyll a/b in comparison with control plants indicating a relative decrease of participation of chlorophyll $b$molecules in energy supply of photosystem II. The overall performance of photosystem II was estimated using the rate of oxygen evolution in the presence of an exogenous electron acceptor and flash oxygen yields without added artificial electron acceptor. Under low growth temperature and high light conditions, these parameters were significantly reduced compared to values observed under control conditions, indicating that these conditions exhibit deleterious effect on photosystem II photochemical activity. The response and acclimation to unfavorable conditions includes alterations of pigment-protein complexes organization and interaction with the aim to balance the excitation of both photosystems. The changes of energy supply of both photosystems were evaluated by analysis of 77K chlorophyll emission and excitation spectra of isolated membranes. The decrease of the ratio E470/E436 under low temperature and high light could be explained by a decrease of antenna complex of photosystem II. The

analysis of the basic photosynthetic processes revealed that all parameters are influenced by the low growth temperature in presence of high light intensity.

Acknowledgements: This work was supported by Bulgarian-Swiss Research program under Research project IZEBZO-143169/1.