

# Functional Plant Biology

## Contents

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### Special Issue: Optimising Photosynthesis for Environmental Fitness

<p><i>Foreword: Optimising photosynthesis for environmental fitness</i> <b>Suleyman I. Allakhverdiev</b></p>	<p>iii–vii</p>	<p>Photosynthesis plays an important role in maintaining life on our planet and its role increases with time due to the deterioration of the climate. Therefore, it is necessary to develop technologies for maintaining photosynthesis in unfavourable natural conditions. The technologies include conversion of some C3 crops grown in hot and arid climates into C4 plants and fast acclimation of photosynthetic apparatus to the environmental stresses. This paper examines a number of new ideas and technologies for optimising photosynthesis.</p>
<p>Regulation of the size of photosystem II light harvesting antenna represents a universal mechanism of higher plant acclimation to stress conditions <b>Maria M. Borisova-Mubarakshina, Daria V. Vetoshkina, Ilya A. Naydov, Natalia N. Rudenko, Elena M. Zhurikova, Nikolai V. Balashov, Lyudmila K. Ignatova, Tatyana P. Fedorchuk and Boris N. Ivanov</b></p>	<p>959–969</p>	<p>We investigated changes in the size of photosynthetic light harvesting antenna of PSII in higher plants under drought and salinity conditions before the appearance of obvious signs of damage caused by these factors, i.e. under mild stress conditions. Based on the obtained data we propose that the acclimatory decrease in the size of PSII antenna that was earlier known as the adjustment mechanism of plants to excess light conditions represents one of the universal mechanisms of acclimation of higher plants to stress factors.</p>
<p>Biochemical properties and ultrastructure of mesophyll and bundle sheath thylakoids from maize (<i>Zea mays</i>) chloroplasts <b>Nahida K. Aliyeva, Durna R. Aliyeva, Saftar Y. Suleymanov, Fuad H. Rzayev, Eldar K. Gasimov and Irada M. Huseynova</b></p>	<p>970–976</p>	<p>The maize chloroplasts are an appropriate model to study the relationship between the structure and function of thylakoid membranes of C4 plants. We have examined biochemical, functional and structural characterisation of the granal and agranal chloroplasts of maize and these chloroplasts have been found to differ in their biochemical and structural organisation. The obtained results significantly contribute to the understanding of the relations between differential membrane structure and function in thylakoids of mesophyll and bundle sheath chloroplasts of maize plants.</p>
<p>Effects of interstocks on growth and photosynthetic characteristics in ‘Yuanxiaochun’ <i>Citrus</i> seedlings <b>Tie Wang, Bo Xiong, Liping Tan, Youting Yang, Yue Zhang, Mengmeng Ma, Yinghuan Xu, Ling Liao, Guochao Sun, Dong Liang, Hui Xia, Xiaoi Zhang, Zhihui Wang and Jun Wang</b></p>	<p>977–987</p>	<p>We performed a comparative analysis with interstocks on the growth, development and photosynthetic characteristics related to physiological characteristics. In the plants grafted onto ‘Harumi’ and ‘Tarocco’ interstocks, more light energy was used for photochemical electron transfer, but the photosynthetic electron transfer rate was low, and most of the light energy was consumed through the heat dissipation pathway. The compatibility between rootstock and scion of top grafting is the limiting factor for the development of late ripening citrus industry.</p>

*Cover illustration:* A tentative scheme of H<sub>2</sub>O<sub>2</sub> production in chloroplasts and a possible signal transduction pathway for the downregulation of *lhcb* genes, leading to the acclimatory reduction of the photosystem II antenna size under stress conditions. Fd, ferredoxin; PS II, photosystem II; PS I photosystem I; PQ, PQ<sup>-</sup>, PQH<sub>2</sub>, plastoquinone, plastoquinone, plastoquinone, plastoquinone respectively; Pc, plastocyanin; SOD, superoxide dismutase; FNR, ferredoxin-NADP<sup>+</sup> reductase; WOC, water-oxidizing complex. Image by Maria M. Borisova-Mubarakshina and Ilya A. Naydov.

$\beta$ -1,3-glucan effect on the photosynthetic apparatus and oxidative stress parameters of tomato leaves under fusarium wilt  
**Liudmila Kabashnikova, Larisa Abramchik, Irina Domanskaya, Galina Savchenko and Sviatoslav Shpileuski**

988–997

Stimulation and control of a plant's immune system is a modern high-tech direction of increasing plant resistance to diseases. The aim of this work was to analyse the effect of  $\beta$ -1,3-glucan on the photosynthetic activity and oxidative stress parameters in tomato leaves upon infection with the fungal pathogen *Fusarium oxysporum* sp., causing fusarium wilt of tomato plants. Results allowed for a clearer understanding of some mechanisms for the development of tomato fusarium wilt, as well as the protective role of  $\beta$ -1,3-glucan during plant infection.

Diurnal changes of the ascorbate-glutathione cycle components in wheat genotypes exposed to drought  
**Durna R. Aliyeva, Lala M. Aydinli, Ismayil S. Zulfugarov and Irada M. Huseynova**

998–1006

Drought changed the balance between reactive oxygen species and the antioxidant defence system  $H_2O_2$  accumulated more in leaves of the sensitive genotypes compared with tolerant genotypes. Components of the AsA-GSH cycle play an important role in the detoxification of  $H_2O_2$  under drought. Determination of the activities of antioxidant enzymes in stressed plants is considered as one of the effective methods of screening for plant tolerance.

Photosynthetic performance of silver fir (*Abies alba*) of different origins under suboptimal growing conditions  
**Alena Konôpková, Eva Pšidová, Daniel Kurjak, Srdan Stojnić, Peter Petrik, Peter Fleischer Jr, Jana Kučerová, Marek Ježik, Anja Petek, Dušan Gömöry, Jaroslav Kmet', Roman Longauer and L'ubica Ditmarová**

1007–1018

Is there any difference in photosynthesis among trees of different origin growing at the same plot? We found out that provenances of silver fir originating from high altitudes showed the greatest photosynthetic performance and were less responsive to moderate heat and drought stress. The knowledge about the physiology of trees with different origins can be used in forestry improvement programs.