

# Functional Plant Biology

## Contents

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| <p><i>In vivo</i> epidermal UV-A absorbance is induced by sunlight and protects <i>Soldanella alpina</i> leaves from photoinhibition<br/><b>Constance Laureau, Sylvie Meyer, Xavier Baudin, Christophe Huignard and Peter Streb</b></p>  | 599–608 | <p>High intensities of UV radiation and visible light are important stress factors affecting plants' photosynthetic performance, particularly in the mountains. Protection from this stress is provided by UV-absorbing pigments in the epidermis of <i>Soldanella alpina</i> leaves and is induced by visible light. This UV shielding protects leaves from photodamage in their natural environment.</p>   |
| <p>Photosynthetic characteristics and light energy conversions under different light environments in five tree species occupying dominant status at different stages of subtropical forest succession<br/><b>Qiang Zhang, Tai-Jie Zhang, Wah Soon Chow, Xin Xie, Yuan-Jun Chen and Chang-Lian Peng</b></p> | 609–619 | <p>How light drives the development of forest ecosystems is still not fully understood. The aim of this study is to reveal the mechanism driving subtropical forest succession along a light gradient. Our results indicate that photosynthetic capacity decreases along the successional axis and that late-successional species have more responsive energy dissipation capability to compensate for their inferior photosynthetic capacity.</p>   |
| <p>Dynamic carbon allocation into source and sink tissues determine within-plant differences in carbon isotope ratios<br/><b>Frederik Wegener, Wolfram Beyschlag and Christiane Werner</b></p>   | 620–629 | <p>Plant organs of C<sub>3</sub> plants differ in their C isotopic signature (<math>\delta^{13}\text{C}</math>) but the underlying mechanisms are still unclear. We induced different allocation strategies and found that the spatial <math>\delta^{13}\text{C}</math> variation within plants was strongly influenced by the life stage of the leaves. These results are important, as foliar <math>\delta^{13}\text{C}</math> is used in many fields of plant science (e.g. for estimating photosynthetic isotope fractionation).</p> |
| <p>The role of oxidative stress in determining the level of viability of black poplar (<i>Populus nigra</i>) seeds stored at different temperatures<br/><b>Ewa Marzena Kalemba, Jan Suszka and Ewelina Ratajczak</b></p>   | 630–642 | <p>Black poplar (<i>Populus nigra</i> L.) is one of the most threatened tree species in Europe and they produce seeds characterised by short longevity. Oxidative stress increases during seed storage and injures seed tissues resulting in a loss of viability, particularly at temperatures higher than <math>-10^\circ\text{C}</math>. Successful storage of seeds might be prolonged when specific low temperature is applied that minimises oxidative stress effects.</p>  |
| <p>Crosstalk among nitric oxide, calcium and reactive oxygen species during triterpenoid biosynthesis in <i>Betula platyphylla</i><br/><b>Fansuo Zeng, Kun Liu, Sida Li and Yaguang Zhan</b></p>   | 643–654 | <p>Crosstalk among NO, reactive oxygen species (ROS) and Ca<sup>2+</sup> in tree species was not clear. The study showed that NO plays important roles in the synthesis and accumulation of triterpenoids in birch by regulating the intracellular ROS and Ca<sup>2+</sup> signalling pathway. These results provide the theoretical basis and the technical support required for the use of triterpenoid biotechnology.</p>   |

*Cover illustration:* Scheme of the IBTREE model describing the effect of climatic variables on tree growth and allocation (see Schippers *et al.* pp. 697–709). Abbreviations: LAI, leaf area index ( $\text{m}^2 \text{ leaf m}^{-2} \text{ ground surface}$ ); W, weight of different organs (kg dry matter per tree); Photo., photosynthesis; Temp., temperature; Respiration\* indicates the loss of reserves due to assimilate shortage when photosynthesis is smaller than the respiration;  $W_{\text{sapw.}}$ , biomass of living sapwood;  $W_{\text{res.}}$ , biomass of reserves;  $W_{\text{heartw.}}$ , mass of dead heartwood. Image by Peter Schippers.

<p>Assessment of drought tolerance and its potential yield penalty in potato  <b>Heike Sprenger, Katharina Rudack, Christian Schudoma, Arne Neumann, Sylvia Seddig, Rolf Peters, Ellen Zuther, Joachim Kopka, Dirk K. Hinch, Dirk Walther and Karin Köhl</b></p>	<p>655–667</p>	<p>Reduced water availability for agriculture make potato a desirable crop due to its high calorie production per unit of water; however, the crop is sensitive to drought. A research project detected drought-tolerant cultivars among those bred for temperate climate. These cultivars will be used to identify marker-based strategies for the efficient breeding of drought-tolerant potatoes to reduce yield loss due to water shortage.</p>
<p>The decline in xylem flow to mango fruit at the end of its development is related to the appearance of embolism in the fruit pedicel  <b>Thibault Nordey, Mathieu Léchaudel and Michel Génard</b></p>	<p>668–675</p>	<p>Fruit water balance changes during the late growth stage in part due to xylem flow decrease. Our measurements on mango revealed that the decline in xylem flow was related to the decrease in the hydraulic conductivity of xylem vessels due to embolism. The xylem decrease in the later growth stage could affect fruit growth and fruit mineral composition.</p>
<p>Genetic suppression of plant development and chloroplast biogenesis via the Snowy Cotyledon 3 and Phytochrome B pathways  <b>Diep Ganguly, Peter Crisp, Klaus Harter, Barry J. Pogson and Verónica Albrecht-Borth</b></p>	<p>676–686</p>	<p>In this study, we used genetic approaches and transcriptome profiling to unravel the complex interaction of different developmental pathways required for chloroplast development in plants. The recently described <i>snowy cotyledon 3 (sco3)</i> Arabidopsis thaliana mutant as well as the well characterised <i>Phytochrome B (phyB)</i> mutant revealed a complex suppressive or additive genetically linked regulation of chloroplast development, flowering time and transcription regulation in the double mutant <i>sco3-phyB</i>.</p>
<p>Heterogeneity of photosynthesis within leaves is associated with alteration of leaf structural features and leaf N content per leaf area in rice  <b>Dongliang Xiong, Tingting Yu, Xi Liu, Yong Li, Shaobing Peng and Jianliang Huang</b></p>	<p>687–696</p>	<p>Leaf photosynthesis, as a most important functional trait, is usually represented by point measurements, based on a hypothesis of photosynthetic rate is uniform within leaves. In this paper, we investigated the heterogeneity of photosynthesis within leaves in two rice cultivars. The results indicated that CO<sub>2</sub> diffusion conductance as well as leaf nitrogen, Rubisco, and chlorophyll contents increased from base to apex; consequently, photosynthesis increased along leaves. The findings could provide knowledge complement in rice photosynthesis.</p>
<p>Sapwood allocation in tropical trees: a test of hypotheses  <b>Peter Schippers, Mart Vlam, Pieter A. Zuidema and Frank Sterck</b></p>	<p>697–709</p>	<p>Carbon allocation in tropical trees is a key process in determining the carbon sequestration of the forest. By combining a tree growth model and tree ring records we discovered that allocation with low priority to sapwood was the best candidate explaining our results. This new allocation assumption may greatly influence predicted carbon sequestration of tropical forests under climatic change.</p>