

Functional Plant Biology

Contents

Volume 36 Issue 1 2009

Temporal variation in $\delta^{13}\text{C}$, wood density and microfibril angle
in variously irrigated *Eucalyptus nitens*

David M. Drew, E. Detlef Schulze

and Geoffrey M. Downes

1–10

By measuring radial variation in wood properties at high resolution in *Eucalyptus nitens*, it was found that sharp increases in $\delta^{13}\text{C}$ frequently occurred when drought stress was relieved. Microfibril angle (MFA) showed concomitant temporal variation with $\delta^{13}\text{C}$. These findings have implications for using MFA and $\delta^{13}\text{C}$ as tools in dendroclimatology.

Estimating fine root longevity in a temperate Norway spruce
forest using three independent methods

Dirk Gaul, Dietrich Hertel and Christoph Leuschner

11–19

Fine root longevity of Norway spruce was estimated comparing radiocarbon (^{14}C), sequential coring and minirhizotron analyses. Root age differed markedly among different root diameter classes and soil depths. Moreover, root longevity varied between <1 and >5 years, depending on the chosen method, indicating lasting uncertainty in the estimation of fine root turnover.

Sun-shade patterns of leaf carotenoid composition in 86 species
of neotropical forest plants

Shizue Matsubara, G. Heinrich Krause, Jorge Aranda,

Aurelio Virgo, Kim G. Beisel, Peter Jahns

and Klaus Winter

20–36

A survey of photosynthetic pigments in leaves of neotropical vascular plants, including 86 species from 64 families, was conducted to study sun-shade patterns in carotenoid biosynthesis and occurrence of α -carotene and lutein epoxide. The results revealed a common photoacclimatory shift in the balance between the two branches of the carotenoid biosynthetic pathway as well as a wide distribution of α -carotene and lutein epoxide among many different plant taxa.

Effects of low temperature stress on excitation energy
partitioning and photoprotection in *Zea mays*

Leonid V. Savitch, Alexander G. Ivanov,

Loreta Gudynaite-Savitch, Norman P. A. Huner

and John Simmonds

37–49

The regulation of energy partitioning upon exposure to environmental stress is critical to plant productivity and survival. In cold-stressed maize leaves, excess energy is dissipated thermally through a pathway other than traditional antenna quenching. Thermoluminescence measurements indicate that PSII reaction centre quenching may contribute significantly to this alternative photoprotective pathway.

Environmental stress and genetics influence night-time leaf
conductance in the C_4 grass *Distichlis spicata*

Mairgareth A. Christman, Jeremy J. James,

Rebecca E. Drenovsky and James H. Richards

50–55

The effect of salinity on night time leaf conductance was investigated in six genotypes of saltgrass with variable salt tolerance. The results indicate night time leaf conductance is influenced by genetic and environmental factors, and we provide evidence of separate regulation of daytime and night time leaf conductance in response to salinity stress.

Cover illustration: Arbuscular mycorrhizal phenotypes in a reduced mycorrhizal colonisation (*rmc*) mutant of tomato with *Glomus intraradices* (left) and *Scutellospora calospora* (right).

New Feature: More details on root mycorrhizal colonisation can be seen in movie format in the accessory publication available from the online version of *Functional Plant Biology* (see Manjarrez *et al.* pp. 86–96).

Self-organisation at the whole-plant level: a modelling study
Zongjian Yang and David J. Midmore 56–65

Vascular plants have a modular structure. The development of a plant is most likely to rely on distributed control mechanisms. This modelling study suggests that morphological dynamics and phenotypic adjustment at the whole-plant level can be understood as the sum of all modular responses to their local environments. Oriented vascular differentiation specified by polar auxin transport plays a central role in the adjustment of resource allocation and growth partitioning in response to environmental changes.

ABA mediation of shoot cytokinin oxidase activity: assessing its impacts on cytokinin status and biomass allocation of nutrient-deprived durum wheat
Lidia B. Vysotskaya, Alla V. Korobova, Stanislav Y. Veselov, Ian C. Dodd and Guzel R. Kudoyarova 66–72

Nutrient deprivation alters biomass allocation and the concentrations of several plant hormones. The role of ABA in nutrient deprivation-mediated decreases in cytokinin concentrations was addressed by adding ABA or fluridone to the nutrient solution of well-fertilised plants or nutrient-deprived plants, respectively. Shoot ABA concentration and cytokinin oxidase activity were negatively correlated in all treatments, suggesting that shoot ABA status can regulate shoot cytokinin concentration via altering cytokinin metabolism.

Zm401p10, encoded by an anther-specific gene with short open reading frames, is essential for tapetum degeneration and anther development in maize
Dongxue Wang, Chengxia Li, Qian Zhao, Linna Zhao, Meizhen Wang, Dengyun Zhu, Guangming Ao and Jingjuan Yu 73–85

We characterised a maize anther-specific gene, *Zm401*, which contains short open reading frames (sORFs). The longest ORF encodes a small nucleic protein *Zm401p10*. *Zm401p10* overexpression retarded tapetal degeneration and caused microspore abnormalities. A microarray analysis identified 278 downregulated and 150 upregulated genes in transgenic anthers.

Different arbuscular mycorrhizal fungi induce differences in cellular responses and fungal activity in a mycorrhiza-defective mutant of tomato (*rmc*)
Maria Manjarrez, Meredith Wallwork, Sally E. Smith, F. Andrew Smith and Sandy Dickson 86–96

A well known mycorrhiza-defective tomato mutant (*rmc*) was used to investigate the cellular responses associated with arbuscular mycorrhizal colonisation. *rmc* and its wild-type parent showed similar initial stages of fungal development, although at least three potential blockages: at the epidermis, exodermis and cortex needs to be overcome to form a functional symbiosis in *rmc*.
