

Functional Plant Biology

Contents

Volume 34 Issue 12 2007

Preliminary development of a genetic strategy to prevent transgene escape by blocking effective pollen flow from transgenic plants

Davinder Pal Singh, Angelica M. Jermakow and Stephen M. Swain 1055–1060

The possibility of transgene escape from GM crops continues to be an issue of considerable debate. This paper describes a novel genetic strategy to prevent gene flow, from transgenic crops to non-transgenic crops or weedy relatives, via pollen, that does not prevent harvesting and sowing of seeds from the transgenic crop, in contrast to the much-criticised “terminator” technology. The work describes a technology with great potential to enable the safer and more controlled use of GM crops.

AtMCP1b, a chloroplast-localised metacaspase, is induced in vascular tissue after wounding or pathogen infection

Luis Castillo-Olamendi, Armando Bravo-García, Julio Morán, Mario Rocha-Sosa and Helena Porta 1061–1071

Castillo-Olamendi *et al.* studied the expression of a type I metacaspase (*AtMCP1b*) in response to a number of stimuli related to programmed cell death (PCD). They measured gene expression using RT–PCR and GUS expression driven by the native *AtMCP1b* promoter, and found a positive correlation between *AtMCP1b* expression with PCD processes, and tissue-specific expression of GUS and plastid localization of GFP *AtMCP1b* fusions. The results infer a role for the plastid organelles in PCD and, thus, in responses to pathogen-attack.

Seasonal photosynthesis and anthocyanin production in 10 broadleaf evergreen species

Nicole M. Hughes and William K. Smith 1072–1079

Where previous studies compare photosynthetic responses of red and green leaves, none focus their analysis purely on evergreen species. These authors find that species that synthesize photoprotective anthocyanin pigments correspond to those with diminished photosynthetic capacity during the winter, corresponding with a greater need for photoprotection. They present *in situ* data for leaves in different seasons, and use red and blue LED sources to measure photosynthetic response curves, thereby circumventing the effects of light-attenuation by anthocyanins. The study is an important contribution to our knowledge of anthocyanin physiology.

L-Ascorbic acid accumulation in fruit of *Ribes nigrum* occurs by *in situ* biosynthesis via the L-galactose pathway

Robert D. Hancock, Paul G. Walker, Simon D. A. Pont, Nicola Marquis, Sebastian Vivera, Sandra L. Gordon, Rex M. Brennan and Roberto Viola 1080–1091

Blackcurrants are an important horticultural crop, mainly for their high levels of vitamin C (L-ascorbic acid, Asc), therefore an understanding of the processes by which Asc accumulation occurs is of great value. The authors carried out a detailed analysis of Asc accumulation and turnover, and find that of the four putative pathways of Asc synthesis characterized in plants, synthesis in blackcurrants is directed by the Wheeler–Smirnoff option. This is the first time that vitamin C accumulation in sink tissues has been studied from a whole-plant system perspective.

Cover illustration: Sugarcane crop in tropical Queensland, Australia. Sugarcane is increasingly considered for production of energy and biomaterials, and efficient use of nitrogen fertiliser is required for sustainability (see Robinson *et al.* pp. 1122–1129). Photo by Alex Whan.

In vivo assessing flavonols in white grape berries (*Vitis vinifera* L. cv. Pinot Blanc) of different degrees of ripeness using chlorophyll fluorescence imaging
Sándor Lenk, Claus Buschmann and Erhard E. Pfündel 1092–1104

This work uses novel imaging techniques to assess flavonols and chlorophylls at different degrees of ripeness in grapes. Decomposition of chlorophylls, synthesis of *ortho*-dihydroxy flavonoids and optical phenomena resulting in reflectance variations are differently affected by ripening and locally-acting factors. The data suggest that metabolic clusters can operate independently in berry skin. These techniques are very promising for the study of local variability of tissue structure and chemical composition.

The first application of terephthalate fluorescence for highly selective detection of hydroxyl radicals in thylakoid membranes
Iva Šnyrychová and Éva Hideg 1105–1111

This paper is the first of a pair on the subject, and evaluates the use of a new fluorescent probe, a hydroxyl radical sensor that allows hydroxyl radicals in thylakoid membranes to be measured. The novel aspect lies in the use of hydroxyterephthalate for the fluorescent detection of the radical. This probe aids mechanistic investigation of oxidative stress, particularly with difficult-to-assay and escaping species.

Hydroxyl radicals are not the protagonists of UV-B-induced damage in isolated thylakoid membranes
Iva Šnyrychová, Péter B. Kós and Éva Hideg 1112–1121

The second paper investigates the origin of hydroxyl radicals in UV-B-treated thylakoids. Following much speculation on the possible role and origin of the radicals produced in such samples, the authors use the terephthalate method to follow the production of hydroxyl radicals during UV-B treatment. They hypothesise on the biochemistry of hydroxyl radical production under UV-B stress, refining earlier hypotheses in that hydroxyl radicals appear to be products of UV-induced electron transport and their production alone does not lead to D1 protein degradation.

Sugarcane genotypes differ in internal nitrogen use efficiency
Nicole Robinson, Andrew Fletcher, Alex Whan, Christa Critchley, Nicolaus von Wirén, Prakash Lakshmanan and Susanne Schmidt 1122–1129

With increasing international focus on sustainable resource use in agricultural systems and increasing N use efficiency through crop improvement, this study looks at an important crop: sugarcane. This biomass-based crop is of considerable interest, being grown in areas sensitive to N pollution. This study is the first to characterise the extent of variation in biomass production and internal N use efficiency in a large number of genotypes. The authors discuss the implications for breeding more N use-efficient cultivars.

Boron uptake by the root cortex symplast of tomato and pea plants: evidence for low-boron-induced active transport
Jasna Savic, Miroslav Nikolic, Slaven Prodanovic and Volker Römheld 1130–1136

Adding to evidence of active B efflux under deficiency conditions from xylem parenchyma cells into xylem vessels, this paper gives clear evidence of the existence of an active transport system in the root cortex. This is the first time that such detail has been presented of radial B transport in higher plant roots under B deficiency. The active transport mechanism appears to be either degraded or not expressed at adequate or high B levels, suggesting that B loading into xylem is a separate process to B uptake into the cortex.

Canopy development and hydraulic function in *Eucalyptus tereticornis* grown in drought in CO₂-enriched atmospheres
Brian J. Atwell, Martin L. Henery, Gordon S. Rogers, Saman P. Seneweera, Marie Treadwell and Jann P. Conroy 1137–1149

Considerable uncertainty surrounds the responses of trees to climate change, largely due to the time frames of experiments. This paper describes distinctive patterns of canopy development when young eucalypts were subjected to elevated CO₂ and drought, related to numbers and radial dimensions of xylem vessels. Main stem vessel dimensions showed a clear effect of drought on vessel size, where CO₂ had no effect. Coordination of development and hydraulics will be critical for survival of eucalypts under future climate change scenarios.