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Contents

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Natural variation in rice *starch synthase IIa* affects enzyme and starch properties

Takayuki Umemoto, Noriaki Aoki, Hongxuan Lin, Yasunori Nakamura, Naoyoshi Inouchi, Youichiro Sato, Masahiro Yano, Hideyuki Hirabayashi and Sachio Maruyama

671–684

Natural variation in rice *starch synthase IIa*, a candidate gene for alkali disintegration of grain, was characterised in near-isogenic lines. The variation causes loss of activity and starch association of the enzyme, which results in altered amylopectin structure. The authors discuss the importance of single nucleotide polymorphisms in *SSIa* for enzyme function and starch properties.

Regulation of sucrose-phosphate synthase in wheat (*Triticum aestivum*) leaves

Stephen J. Trevanion, C. Kate Castleden, Christine H. Foyer, Robert T. Furbank, W. Paul Quick and John E. Lunn

685–695

Long-term exposure of wheat leaves to higher light levels increased leaf sucrose-phosphate synthase (SPS) activity, but activation of pre-existing enzyme was a more common short-term response to high light. Sucrose accumulation did not inactivate SPS or inhibit sucrose synthesis, thus while the mechanisms linking the rates of sucrose synthesis and photosynthetic CO₂ fixation in wheat leaves were similar to those in starch-accumulating species, short-term feedback inhibition of sucrose synthesis by sucrose is lacking in wheat.

Effect of water stress on partitioning of ¹⁴C-labelled photosynthates in *Vitis vinifera*

Josefina Bota, Oleg Stasyk, Jaume Flexas and Hipólito Medrano

697–708

Previous studies of water stress effects on grapevine physiology have not addressed carbohydrate export from the assimilating leaves or assimilate partitioning among plant organs. The influence of fruits on export and distribution of photosynthate, and the impact of water stress were studied in grapevine. Distribution of photosynthates reflected sink size. Water stress reduced leaf water potential, photosynthesis and stomatal conductance, but did not affect ¹⁴C distribution.

Quantification of stress adaptation by laser-induced fluorescence spectroscopy of plants exposed to engine exhaust emission and drought

Narayanan Subhash, Changatharayil N. Mohanan, Rupananda J. Mallia and Vadekkeveetil Muralidharan

709–719

Petrol engine exhaust pollutants such as SO₂, NO₂ and suspended particulate matter affected photosynthetic activity of *Manihot utilissima*, *Colocasia antiquorum* and *Kaempferia galanga*. Changes in photosynthetic activity induced by pollution were investigated by laser-induced chlorophyll fluorescence induction kinetics. The applicability of the stress adaptation index in understanding the tolerance of plants to pollution stress is demonstrated, as well as the possibility of recovery of photosynthetic activity on removal of stress.

Cover illustration: Rice starch gelatinisation with 4 M urea. Grains of cv. Nipponbare (left) that lack *starch synthase IIa* activity in the endosperm have more short chains of amylopectin, and gelatinise readily (the blue colour is due to staining of the gelatinised starch with iodine). The grains of three near isogenic lines that have functional *SSIa* allele do not gelatinise. See Umemoto *et al.* pp. 671–684.

Analysis of wound-induced gene expression in *Nicotiana* species with contrasting alkaloid profiles

Steven J. Sinclair, Richard Johnson and John D. Hamill

721–729

Transcript levels of alkaloid biosynthesis genes were compared in three *Nicotiana* species after wounding of aerial tissues and correlated with changes in alkaloid content. In contrast to the 'model' response of *N. sylvestris*, *N. glauca* displayed an increase in transcript levels of several genes in wounded leaves preceeding increased anabasine production. In contrast, no increase in transcript or alkaloid levels was observed in roots or leaves of *N. alata* following wounding, though addition of the wound hormone methyljasmonate to cultured roots did stimulate alkaloid production.

The role of photochemical quenching and antioxidants in photoprotection of *Deschampsia antarctica*

Eduardo Pérez-Torres, Andrea García, Jorge Dinamarca, Miren Alberdi, Ana Gutiérrez, Manuel Gidekel, Alexander G. Ivanov, Norman P.A. Hüner, Luis J. Corcuera and León A. Bravo

731–741

Deschampsia antarctica is the only grass that grows in the maritime Antarctic. Low temperatures and episodes of high light are typical conditions during the growing season at this latitude. These authors report the effects of low temperature and high light on non-acclimated and cold-acclimated *D. antarctica*, monitoring PSII fluorescence and measuring variation in activities of superoxide dismutase, ascorbate peroxidase and glutathione reductase, as well as antioxidant and carotenoid contents.

Do mature shade leaves of tropical tree seedlings acclimate to high sunlight and UV radiation?

G. Heinrich Krause, Esther Grube, Olga Y. Koroleva, Carina Barth and Klaus Winter

743–756

Seedlings of four tropical forest tree species grown in deep shade were exposed daily to direct solar radiation, to test the capability of mature shade leaves to acclimate to full solar visible and UV radiation. PSI activity exhibited a response to full sunlight that is characteristic of sun-leaves and rates of net photosynthetic CO₂ assimilation were increased. The leaves exhibited remarkable physiological acclimation towards sun leaf characteristics.

Corrigendum to:

Leaf water use efficiency differs between *Eucalyptus* seedlings from contrasting rainfall environments

Matthew J. Searson, Dane S. Thomas, Kelvin D. Montagu and Jann P. Conroy [Vol. 31, No. 5 (2004) pp. 441–450] 757

Corrigendum to:

The relative limitation of photosynthesis by mesophyll conductance in co-occurring species in a temperate rainforest dominated by the conifer *Dacrydium cupressinum*

Evan H. De Lucia, David Whitehead and Michael J. Clearwater [Vol. 30, No. 12 (2003), pp. 1197–1204] 759