

Functional Plant Biology

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Editorial: The year 2009, and plans for 2010

Rana Munns

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Expression profiling and proteomic analysis of isolated photosynthetic cells of the non-Kranz C₄ species *Bienertia sinuspersici*

Joonho Park, Thomas W. Okita and Gerald E. Edwards

1–13

Bienertia sinuspersici (Chenopodiaceae) is a C₄ plant without Kranz anatomy. It possesses a novel mechanism of performing C₄ photosynthesis in which individual photosynthetic cells have two types of chloroplasts. In this paper, transcript profiling and proteomics were performed on isolated chlorenchyma cells. The photosynthetic genes and proteins identified, and the phylogenetic comparison of C₄ pathway gene homologues with public data bases, provide evidence for function of NAD-malic enzyme type C₄ photosynthesis.

The influence of the hemiparasitic angiosperm *Cassytha pubescens* on photosynthesis of its host *Cytisus scoparius*

Hao Shen, Jane N. Prider, José M. Facelli and Jennifer R. Watling

14–21

A native parasitic plant, *Cassytha pubescens*, infects and kills the invasive weed *Cytisus scoparius*. This paper shows that the parasite restricts host photosynthesis by inducing stomatal closure, thus making *C. scoparius* more susceptible to photodamage. The combined loss of C uptake and increased sensitivity to light, probably contribute to the death of these hosts.

Reduced neutral invertase activity in the culm tissues of transgenic sugarcane plants results in a decreased in respiration and sucrose cycling and an increase in the sucrose to hexose ratio

Debra Rossouw, Jens Kossmann, Frederik Coenraad Botha and Jan-Hendrik Groenewald

22–31

Reduced neutral invertase (NI) activity in genetically modified sugarcane culm tissues correlated with an increase in sucrose levels and a decrease in hexose levels, sucrose cycling and the total respiration rate. The role of NI in directing carbon towards respiratory processes is demonstrated and, for the first time, data is present that support the use of cell cultures as a model system for carbohydrate metabolism in sugarcane internodes.

Correlative changes in proteases and protease inhibitors during mobilisation of protein from potato (*Solanum tuberosum*) seed tubers

Sarah M. Weeda, G. N. Mohan Kumar and N. Richard Knowles

32–42

Potato tubers contain many protease inhibitors whose functions in regulating protein content remain unclear. As vegetative propagules, tubers mobilise protein nitrogen to support early plant growth. This study demonstrates that loss of selected cysteine and serine protease inhibitors are highly correlated with increases in protease activity, suggesting a role for protease inhibitors in the mobilisation of protein nitrogen to developing plants.

Cover illustration: Bienertia sinuspersici has an unusual structural form of C₄ photosynthesis, which occurs in individual photosynthetic cells with two types of chloroplasts. The confocal microscopy image of a live cell shows membranes (green, DiOC₆-3 stain), the nucleus (blue, Hoechst 33342 stain), chloroplasts (red, autofluorescence). The scheme illustrates capture of atmospheric CO₂ in the C₄ pathway and donation of CO₂ from C₄ acids to the C₃ cycle (see Park *et al.* pp. 1–13).

<p>Promotion of shoot development and tuberisation in potato by expression of a chimaeric cytokinin synthesis gene at normal and elevated CO₂ levels Guo-Qing Tao, D. Stuart Letham, Jean W. H. Yong, Kerong Zhang, Peter C. L. John, Owen Schwartz, S. Chin Wong and Graham D. Farquhar</p>	43–54	<p>Expressing the P_{CHS-ipt} gene in potato elevated cytokinin levels, increased catalysis of the cell cycle, and altered shoot development. This also reduced the N content of tubers at both normal [CO₂] and elevated [CO₂]. While elevated [CO₂] increased tuber weight, expression of this gene had the opposite effect probably as a result of diversion of nutrients to the shoot promoted by the elevated foliar cytokinin level.</p>
<p>Ammonium tolerance and the regulation of two cytosolic glutamine synthetases in the roots of sorghum Redouane El Omari, Marina Rueda-López, Concepción Avila, Remedios Crespillo, Mohamed Nhiri and Francisco M. Cánovas</p>	55–63	<p>Ammonium but not nitrate differentially regulated two distinct isoforms of cytosolic glutamine synthetase in the roots of Sorghum-sudangrass hybrids. The concerted action of these enzymes, at high levels of ammonium supply, contribute to glutamine biosynthesis for plant growth and may represent an efficient system of ammonium detoxification.</p>
<p>The cotton dehydration-responsive element binding protein GhDBP1 contains an EAR-motif and is involved in the defense response of <i>Arabidopsis</i> to salinity stress Chun-Juan Dong, Bo Huang and Jin-Yuan Liu</p>	64–73	<p>Cotton dehydration-responsive element binding protein 1 (GhDBP1) is an active transcriptional repressor with an EAR-motif at its C-terminus. The results of this study suggest that transcriptional repression of gene expression by EAR-motif-containing repressor proteins plays a key role in modulating plant defense and stress responses, and provide another molecular event of negative regulation of gene expression in plants.</p>
<p>Biochemical factors conferring shoot tolerance to oxidative stress in rice grown in low zinc soil Michael Frei, Yunxia Wang, Abdelbagi M. Ismail and Matthias Wissuwa</p>	74–84	<p>Zinc deficiency is among the major soil micronutrient disorders in agricultural production and causes reduced growth, oxidative stress, and yield losses in crops. This study examines biochemical factors associated with tolerance to oxidative stress under zinc deficiency in a tolerant breeding line of rice by comparing it to its intolerant parent. High ascorbic acid level is identified as a factor most likely associated with tolerance.</p>