

# Functional Plant Biology

## Contents

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Increasing leaf export and grain import capacities in maize plants under water stress

**Jacques Trouverie and Jean-Louis Prioul**      209–218

Leaf and grain responses to drought stress suggest the existence of a compensatory mechanism at both phloem source and sink ends, which tends to increase export/import efficiency. Differential regulation of a vacuolar invertase in source and sink tissues may be understood as one component of this compensation process, consistent with the Münch pressure-flow hypothesis.

Effects of water availability, nitrogen supply and atmospheric CO<sub>2</sub> concentrations on plant nitrogen natural abundance values

**William D. Stock and John R. Evans**      219–228

This paper investigates the effects of CO<sub>2</sub>, water supply and nutrient availability on plant N natural abundance values. The authors show that decreasing  $\delta^{15}\text{N}$  in elevated CO<sub>2</sub> mimics reported declines along increasing rainfall gradients. They suggest that, of all the soil and plant-driven fractionation processes, the one most likely to explain this common pattern is leaf N allocation.

Dynamics of the energy flow through photosystem II under changing light conditions: a model approach

**Albert Porcar-Castell, Jaana Bäck, Eija Juurola and Pertti Hari**      229–239

Here is a model to describe light energy allocation in PSII under fluctuating light intensities at the seconds-to-minutes time-scale. The work offers insights into how chlorophyll fluorescence can be better used to estimate energy partitioning in the light reactions of photosynthesis. The authors integrated the dynamic adjustment of NPQ to changes in light intensity into a dynamic model, and use chlorophyll fluorescence data for the estimation of several parameters.

Relationships between chlorophyll fluorescence parameters and photochemical reflectance index of tree species adapted to different temperature regimes

**Jen-Hsien Weng, Yaw-Nan Chen and Tien-Szu Liao**      241–246

Although much is known about variation in  $F_v/F_m$  with ambient temperature, less is known about the variation in the photochemical reflectance index (PRI) with ambient temperature. This statistical analysis of the relationships between chlorophyll fluorescence parameters and PRI of three tree species adapted to different temperature regimes shows that the method of measuring the fate of absorbed light energy can be used in different species, but that the relationships may not be universal.

Genetic diversity of *Cistus albidus* in south-east Spain does not relate to mesoclimate

**Olga M. Grant, Tom McNeilly and Lynton D. Incoll**      247–255

This paper follows on from a previous publication on adaptive strategies in *Cistus albidus* populations in south-east Spain. The authors explore genetic aspects in terms of isozyme loci and ecophysiological and growth traits, showing that the causal background of genetic diversity of plant populations is poorly understood. In contrast to current understanding, the comparison between *C. albidus* populations from sites with severe drought stress and those from more humid sites revealed no loss of genetic diversity within the stressed population.

*Cover illustration:* Birch leaves in the sun: where is the energy going? Original photograph by Martti Perämäki, edited by Albert Porcar-Castell. (See Porcar-Castell *et al.* pp. 229–239.)

Expression of bacterial starch-binding domains in *Arabidopsis* increases starch granule size  
**Crispin A. Howitt, Sadequr Rahman and Matthew K. Morell** 257–266

Howitt *et al.* present the results of an interesting study utilising starch binding domains (SBDs) as a mechanism to modulate starch functionality. The results support the functionality of a bacterial SBD in *Arabidopsis*, and show that the expression of SBDs has only a minor effect on glucan composition and gelatinisation properties, but a more significant effect on starch granule size. Their findings have applications in the use of starch as a renewable resource in food and industry.

Isolation and characterisation of a protein elicitor from *Sclerospora graminicola* and elicitor-mediated induction of defence responses in cultured cells of *Pennisetum glaucum*  
**R. G. Sharathchandra, N. P. Geetha, K. N. Amruthesh, K. Ramachandra Kini, B. R. Sarosh, N. P. Shetty and H. S. Shetty** 267–278

*Sclerospora graminicola* is an oomycete pathogen that infects the meristematic tissues of young seedlings. This paper describes the isolation and purification of a zoospore protein that elicits defence responses in pearl millet cells. Treatment of cultured cells with partially purified elicitor resulted in an increase in extra cellular pH and rapid loss of cell viability in resistant cells and provoked increased activities of phenylalanine ammonia lyase and peroxidase in resistant cell cultures. The unique properties of the elicitor can be exploited for novel methods of eco-friendly crop protection.

The high fruit soluble sugar content in wild *Lycopersicon* species and their hybrids with cultivars depends on sucrose import during ripening rather than on sucrose metabolism  
**María E. Balibrea, Cristina Martínez-Andújar, Jesús Cuartero, María C. Bolarín and Francisco Pérez-Alfocea** 279–288

The tomato industry is under constant pressure to produce more fruit of higher quality, which depends on many metabolic and physiological processes involved in assimilate import and partitioning. This paper explores the mechanisms controlling sugar accumulation by comparing sugar content and enzyme activities in the fruit between species and hybrids under normal and saline conditions. Continuous sucrose import during ripening is a key factor to higher fruit quality.

The *rmc* locus does not affect plant interactions or defence-related gene expression when tomato (*Solanum lycopersicum*) is infected with the root fungal parasite, *Rhizoctonia*  
**Ling-Ling Gao, F. Andrew Smith and Sally E. Smith** 289–296

Arbuscular mycorrhizal symbioses are crucial for plant nutrition for many species, yet the molecular basis for these relationships remains unclear. This paper deals with a mutation (*rmc*) in tomato that affects the colonisation of plant roots by three *Rhizoctonia* strains. Mutation does not affect infection or plant defense responses in terms of PR gene expression, and the gene product of *rmc* is specifically involved in the establishment of the mycorrhizal interaction.

Polypeptide metabolites secreted by the fungal pathogen *Eutypa lata* participate in *Vitis vinifera* to cell structure damage observed in *Eutypa* dieback  
**Stéphane Octave, Gabriel Roblin, Magali Vachaud and Pierrette Fleurat-Lessard** 297–307

The fungal pathogen *Eutypa lata* degrades grapevine wood. These authors studied its effects on leaf structure, and the changes induced by secreted polypeptidic compounds and eutypine on leaf and cane structure. Recent research suggests that acetylenic phenol metabolites may not be solely responsible for foliar symptoms, as previously thought, hence the finding that the pathogen may also produce toxic polypeptides is significant.