

Functional Plant Biology

Contents

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Metabolomic characterisation of the functional division of nitrogen metabolism in variegated leaves
Guillaume Tcherkez, Florence Guérard, Françoise Gilard, Marlène Lamothe, Caroline Mauve, Elisabeth Gout and Richard Bligny 959–969

Metabolic differences between green and white parts of variegated leaves, which may help understanding nitrogen assimilation and partitioning in horticultural species, are poorly documented. Here, using integrative and isotopic methods, an enhancement of amino acid and alkaloid synthesis in white parts and an exchange of nitrogenous compounds between leaf parts is demonstrated. White parts seem to play the role of an advantageous 'nitrogen reserve' to sustain leaf metabolism.

Gender-specific variation in physiology in the dioecious shrub *Corema album* throughout its distributional range
Leonor Álvarez-Cansino, Mari Cruz Díaz Barradas, María Zunzunegui, Mari Paz Esquivias and Todd E. Dawson 98:–99:

Understanding gender-specific responses of dioecious species to environmental constraints is crucial to assess the effects of reproductive investment in plant performance. The analysis of physiological responses and growth of a dioecious shrub along a climatic gradient revealed gender differences to be site-specific and strong physiological limitations under higher aridity conditions. Results highlight potential effects of climate changes on gender dimorphism and species distribution.

Temperature influences the ability of tall fescue to control transpiration in response to atmospheric vapour pressure deficit
Shannon M. Sermons, Thomas M. Seversike, Thomas R. Sinclair, Edwin L. Fiscus and Thomas W. Rufty 99:–988

Understanding how turfgrasses control water use is vital for development of new drought tolerant varieties and determination of irrigation needs. Our results show that tall fescue has the ability to limit water loss in dry air, but that this control is inhibited at high temperature and strengthened by extended exposure to dry conditions. The changeable nature of plant control of water use, which adjusts depending on growth environment, must be considered during variety development and may cause considerable variation in irrigation requirements.

Reflectance continuum removal spectral index tracking the xanthophyll cycle photoprotective reactions in Norway spruce needles
Daniel Kováč, Martin Navrátil, Zbyněk Malenovský, Michal Štroch, Vladimír Špunda and Otmar Urban 989–; ; :

Plant photochemistry includes a photoprotective cycle of xanthophyll pigments. This study introduces a leaf reflectance continuum removal index that can track changes in composition of the xanthophylls induced by increasing light intensity and air temperature independently from an actual content of chlorophylls and carotenoids. If successfully tested at the canopy level, the index may serve as a xanthophyll remote sensing indicator.

Cover illustration: Typical variegated leaf of *Pelargonium × hortorum* (var. Panache Sud) used to disentangle nitrogen metabolism in different leaf parts (Tcherkez *et al.* pp. 959–967). Photograph by Guillaume Tcherkez.

Use of water extraction variability to screen for sunflower genotypes well adapted to soil water limitation

Ando M. Radanielson, Jeremie Lecoeur, Angelique Christophe and Lydie Guillion ; ; –102:

Improving crop production under drought needs novel breeding strategy. Plant ability in water extraction was found as a promising trait to screen for well adapted cultivar to water stress in sunflower, with a wide resource of variability among genotypes. Easier phenotyping method was developed for conventional selection use but further investigation is needed for its application in marker assisted selection.

Effect of high temperature on the reproductive development of chickpea genotypes under controlled environments

Viola Devasirvatham, Pooran M. Gaur, Nalini Mallikarjuna, Raju N. Tokachichu, Richard M. Trethowan and Daniel K. Y. Tan 102; –103:

High temperature is a major cause of yield loss in chickpea. The effect of high temperature on reproductive development is seen mainly in the male tissues (anther and pollen); the pollen being more sensitive to high temperature than the stigma. Therefore, there is the potential to use pollen studies in breeding programs for chickpea heat tolerance.

Stomatal behaviour of irrigated *Vitis vinifera* cv. Syrah following partial root removal
V. Zufferey and D. R. Smart

103; –1027

The coordination of root and leaf activity with respect to water uptake and transpiration is a highly complex physiological process in woody plants. We showed such coordination can occur on nearly an instantaneous basis by removing a small portion of roots of grape in dry and irrigated soils. Leaves responded by greatly increasing their resistance to transpiration water loss.

Regulation of stomatal movement and photosynthetic activity in guard cells of tomato abaxial epidermal peels by salicylic acid

Péter Poór and Irma Tari 1028–1037

Salicylic acid (SA) is a plant growth regulator and is a central regulator of defence against (hemi-) biotrophic pathogens. We investigated stomatal closure over a range of SA concentrations in tomato leaves and abaxial epidermal peels. SA concentrations of 10^{-7} or 10^{-3} M induced stomatal closure, but in epidermal peels 10^{-4} M SA induced stomatal opening without increasing the level of signalling intermediates. This suggests that a balance exists between the intermediates (reactive oxygen species and nitric oxide) to regulate stomatal aperture.

Differential responses of the mangrove *Avicennia marina* to salinity and abscisic acid

Ruth Reef, Nele Schmitz, Britt A. Rogers, Marilyn C. Ball and Catherine E. Lovelock 1038–1046

An experiment investigating the interactive effect of salinity and the plant hormone ABA on the growth and physiology of the mangrove *Avicennia marina* has shed some light on how salinity tolerance is achieved in this plant. The response of *A. marina* to elevated salinity is not similar to drought responses: ABA is not greatly involved in the salinity response. Nutrients, both nitrogen and phosphorus are possibly playing an important unknown role in salinity tolerance. This study highlights significant differences between the salinity response of a salt-tolerant mangrove and non salt-tolerant plants.

Selective transport capacity for K^{+} over Na^{+} is linked to the expression levels of PtSOS1 in halophyte *Puccinellia tenuiflora*
Qiang Guo, Pei Wang, Qing Ma, Jin-Lin Zhang, Ai-Ke Bao and Suo-Min Wang

1047–1057

The halophyte *Puccinellia tenuiflora* has a high selectivity for K^{+} over Na^{+} by roots under salt stress. Our aim was to investigate the molecular basis of this observation: we found that PtSOS1 is the major component of selective transport capacity for K^{+} over Na^{+} in *P. tenuiflora* under salt stress. This result will broaden the understanding of interplay between SOS1 and HKT as a factor depolarising xylem parenchyma, which leads to xylem K^{+} loading via SKOR.

Two *Arabidopsis thaliana* dihydrodipicolinate synthases, DHDPS1 and DHDPS2, are unequally redundant

Susan Jones-Held, Luciana Pimenta Ambrozevicius, Michael Campbell, Bradley Drumheller, Emily Harrington and Thomas Leustek

1058–1067

The enzymes needed for biosynthesis of amino acids are sometimes encoded by a family of genes, each producing a slightly different enzyme. The reason for the existence of gene families is not well understood, but possibly results from the evolution of specialised functions. Analysing the effect of knockout mutants revealed that the two genes in *Arabidopsis thaliana* for the first step of lysine biosynthesis both have redundant and specialised functions.

A rice mutant lacking a large subunit of ADP-glucose pyrophosphorylase has drastically reduced starch content in the culm but normal plant morphology and yield

Frederick R. Cook, Brendan Fahy and Kay Trafford

1068–1078

Understanding starch synthesis in rice is an important means to improve crop productivity. The role of one component of the starch biosynthetic machinery was investigated using a mutant that lacked this protein and consequently lacked starch in one of its temporary carbohydrate storage pools: the culm. The starch content in the leaves of the mutant was increased, revealing plasticity in the distribution of photosynthates among different temporary stores within plants.
