

Functional Plant Biology

Contents

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Review: The evolution and functional significance of leaf shape in the angiosperms

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535–552

Angiosperm leaves manifest a remarkable diversity of shapes and several non-mutually exclusive theories have been proposed to explain this diversity. Here we review the evolutionary context of leaf shape diversification, discuss the genetic control of leaf shape, and consider the functional significance of leaf shape.

Stay-green QTLs effects on water extraction, transpiration efficiency and seed yield depend on recipient parent background

Vincent Vadez, Santosh P. Deshpande, Jana Kholova, Graeme L. Hammer, Andrew K. Borrell, Harvinder S. Talwar and C. Thomas Hash

553–566

Staygreen QTL effects on transpiration efficiency and water extraction under terminal drought depend on parental recipient background. Stg1 QTL increased water extraction in S35 while StgB increased transpiration efficiency in R16. Both water extraction and transpiration efficiency increased grain yield but their effects also closely depended on the recipient background.

Two distinct strategies of cotton and soybean differing in leaf movement to perform photosynthesis under drought in the field

Ya-Li Zhang, Yuan-Yuan Hu, Hong-Hai Luo, Wah Soon Chow and Wang-Feng Zhang

567–575

The hypothesis that cotton and soybean differing in leaf movement have distinct strategies to perform photosynthesis under drought was proposed and tested. The results indicated that soybean preferentially used light-regulated non-photochemical energy dissipation under drought whereas cotton appeared to rely on enhanced electron transport flux for light energy utilisation.

Induction and reversal of crassulacean acid metabolism in *Calandrinia polyandra*: effects of soil moisture and nutrients

Klaus Winter and Joseph A. M. Holtum

576–582

Calandrinia polyandra Benth., an annual succulent herb endemic to Australia, is a facultative CAM (crassulacean acid metabolism) plant. Drought stress elicits a complete C₃ to CAM transition. The C₃-CAM shift is reversible either upon rewetting alone, or upon a combination of rewetting and addition of nutrients. *C. polyandra* could be an excellent model system for studying the biochemical and molecular foundations of CAM.

Ecological implications of organic carbon dynamics in the traps of aquatic carnivorous *Utricularia* plants

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583–593

Utricularia exude significant amount of photosynthates into their traps, which harbour a microbial community thought to enhance plant nutrient acquisition. We investigated the composition of organic carbon in the trap fluid, its availability for microbial uptake, the influence of plant nutrient status and trap age on its biodegradability, and the composition of prokaryotic assemblages within the traps of three *Utricularia* species.

Cover illustration: The genus *Pelargonium* provides an excellent example of leaf shape variation in a single lineage. The evolution and functional significance of leaf shape variation is explored in Nicotra *et al.* (pp. 535–552). Photographs courtesy of Stuart Hay, ANU Photography.

<p>Contrasting hydraulic regulation in closely related forage grasses: implications for plant water use Meisha-Marika Holloway-Phillips and Timothy J. Brodribb</p>	594–605	<p>Cultivars of two forage grass species with different drought tolerance ratings, <i>Lolium multiflorum</i> Lam. and <i>Festuca arundinacea</i> Schreb., were assessed for xylem function and stomatal regulation to leaf water status. Species-specific differences were observed in several water-use traits, and their effect on whole-plant performance was examined under well-watered and restricted watering conditions.</p>
<p>Ion-mediated compensation for drought-induced loss of xylem hydraulic conductivity in field-growing plants of <i>Laurus nobilis</i> Patrizia Trifilò, Andrea Nardini, Fabio Raimondo, Maria A. Lo Gullo and Sebastiano Salleo</p>	606–613	<p>Field-growing <i>Laurus nobilis</i> L. plants were subjected to mild drought stress. Drought treatment induced a significant increase in xylem embolism and sap potassium concentration. The increased potassium concentration induced significant enhancement of xylem hydraulic conductivity in excised stems, and field measurements of stem hydraulics revealed no change between water stressed plants and controls. Ion-mediated enhancement of residual xylem hydraulic conductivity apparently buffered the loss of plant hydraulic conductance under mild drought stress conditions.</p>
<p>Characterisation of xylem conduits and their possible role in limiting the vase life of cut <i>Acacia holosericea</i> (Mimosaceae) foliage stems Jilushi W. Damunupola, Kamani Ratnayake, Daryl C. Joyce and Donald E. Irving</p>	614–623	<p>Anatomy of the xylem affects stems hydraulic conductivity (K_h). To understand constraints on K_h we characterised <i>Acacia holosericea</i> xylem conduits. Predominantly short vessels had simple perforation plates and bordered vestured pits which could increase the resistance to flow. Further research will relate these anatomical features with K_h of cut foliage stems.</p>
<p>Ageing in embryos from wheat grains stored at different temperatures: oxidative stress and antioxidant response Carmelina Spanò, Stefania Bottega, Roberto Lorenzi and Isa Grilli</p>	624–631	<p>Oxidative stress as an important cause of seed deterioration during ageing was studied in wheat embryos stored at room temperature or at low temperature. The differences detected in differently stored materials confirmed that both germination parameters and the length of storage period are important in determining grain condition.</p>