

# Functional Plant Biology

## Contents

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*Review:* Evolution of growth-promoting plant hormones

**John J. Ross and James B. Reid**

795–805

The evolution of three groups of plant growth promoting hormones – auxins, gibberellins and brassinosteroids – are discussed using recent evidence from sequencing projects. Both biosynthesis and signalling pathways are compared between the hormone groups and comments on possible evolutionary trends are provided.

*Review:* The evolution of abscisic acid (ABA) and ABA function in lower plants, fungi and lichen

**Wolfram Hartung**

806–812

Absciscic acid – the universal stress hormone of eukaryotes – occurs in almost all organisms tested from cyanobacteria up to higher plants. A physiological function can be observed when organisms start to colonise terrestrial habitats. Then endogenous ABA is increased even under mild drought stress, desiccation-protecting mechanisms are stimulated, the formation of terrestrial organs is induced and stomata of bryophytes respond to ABA.

Transient and permanent changes of xylem sap exudation by maize root systems after application of hydrostatic and osmotic forces

**Michael Fritz, Stephan Lorenzen, Maria Popova and Rudolf Ehwald**

813–827

Effects of small hydrostatic and osmotic forces on the exudation rate were analysed. There was no significant difference between the efficiencies of these forces to change the steady-state flow rate. The strong initial short-term effect of hydrostatic pressure on flow was due to elasticity of the vascular system.

Woody species of a semi-arid community are only moderately resistant to cavitation

**Juan de Dios Miranda, Francisco M. Padilla, Jordi Martínez-Vilalta and Francisco I. Pugnaire**

828–839

Vulnerability to drought-induced cavitation of shrub species was measured in a community strongly limited by water availability. Overall, the studied species were more vulnerable to xylem embolism than expected and experienced high rates of native embolism and percentage of leafless branches during summer drought, but with high recovery rates. Xylem resistance to embolism had no relationship with minimum leaf water potential.

Primary nerve (vein) density influences spatial heterogeneity of photosynthetic response to drought in two *Acacia* species

**Katy E. Sommerville, Teresa E. Gimeno and Marilyn C. Ball**

840–848

Greater foliage primary nerve (vein) density was associated with greater spatial homogeneity in photosynthetic function with drought in a comparison of two *Acacia* species. Greater primary nerve density may enhance drought tolerance in *Acacia* consistent with the predominance of acacias with high primary nerve density in drier areas.

*Cover illustration:* Flowers of *Magnolia ovata* during the female (left) and male (right) phases of anthesis. The beetles are *Cyclocephala literata* entering the floral chamber in the female phase and visiting the open flower in the male phase. Temperature probes that measured the floral chamber before opening are visible (see Seymour *et al.* pp. 870–878).

The magnitude of diurnal variation in carbon isotopic composition of leaf dark respired CO<sub>2</sub> correlates with the difference between  $\delta^{13}\text{C}$  of leaf and root material

**Frederik Wegener, Wolfram Beyschlag and Christiane Werner**

849–858

Leaf dark respired CO<sub>2</sub> displayed marked  $^{13}\text{C}$ -enrichment during the light period, with differences between plant functional groups. Magnitude of diurnal enrichment was correlated with the difference in  $\delta^{13}\text{C}$  between leaf and root material indicating that fractionation during leaf dark respiration may play a role in the  $^{13}\text{C}$ -depletion of photosynthetic tissues compared with non-photosynthetic tissues.

Operation and regulation of the lutein epoxide cycle in seedlings of *Ocotea foetens*

**Raquel Esteban, Shizue Matsubara, María Soledad Jiménez, Domingo Morales, Patricia Brito, Roberto Lorenzo, Beatriz Fernández-Marín, José María Becerril and José Ignacio García-Plazaola**

859–869

The particular environmental and physiological conditions as well as the light history of each individual leaf of *O. foetens* would continuously modify the actual lutein epoxide content to optimise the ever-conflicting balance between light use and energy dissipation in leaves of these trees, from a daily basis up to longer acclimation during the canopy development.

Respiration and temperature patterns in thermogenic flowers of *Magnolia ovata* under natural conditions in Brazil

**Roger S. Seymour, Ilse Silberbauer-Gottsberger and Gerhard Gottsberger**

870–878

Pollination of the Brazilian tree *Magnolia ovata* involves chamber-flowers that attract large scarab beetles. The flowers warm themselves to help vaporise their attractant fragrances, and the beetles enjoy the benefit of the warm chambers in which they avidly mate and eat. The insects leave 24 h later, carrying pollen to the next flower.

Carbon and nitrogen balance in beech roots under competitive pressure of soil-borne microorganisms induced by girdling, drought and glucose application

**Jana Barbro Winkler, Michael Dannenmann, Judy Simon, Rodica Pena, Christine Offermann, Wolfgang Sternad, Christian Clemenz, Pascale S. Naumann, Rainer Gasche, Ingrid Kögel-Knabner, Arthur Gessler, Heinz Rennenberg and Andrea Polle**

879–889

Microbial-driven soil processes and root-internal processes of N transformation were strongly dependent on carbohydrates allocated from the shoot to the roots of young beech plants. Limited below-ground carbon flux resulted in root accumulation of amino acids, decreased glutamine uptake and increased ammonium and nitrate in soil. The effects were reversible by glucose addition.

High-temperature tolerance of a tropical tree, *Ficus insipida*: methodological reassessment and climate change considerations

**G. Heinrich Krause, Klaus Winter, Barbara Krause, Peter Jahns, Milton García, Jorge Aranda and Aurelio Virgo**

890–900

Heat tolerance of sun leaves of a neotropical pioneer tree species, *Ficus insipida*, was determined. Reassessment of the chlorophyll fluorescence method showed that the decline of potential efficiency of photosystem II,  $F_v/F_m$ , measured 24 h after heat treatments, is the fluorescence parameter most closely related to permanent leaf tissue damage. The limit of heat tolerance (50–53°C) was only a few degrees Celsius above peak leaf temperatures *in situ*.