

Functional Plant Biology

Contents

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Foreword

Gradients of light availability and leaf traits with leaf age and canopy position in 28 Australian shrubs and trees

Ian J. Wright, Michelle R. Leishman, Cassia Read and Mark Westoby 407–419

These authors quantified leaf traits for 28 Australian species with respect to leaf age, canopy position and light climate. This represents by far the largest interspecific study of its type, and is one of only a handful to consider Australian species. The observed trends largely conflicted with expectations from widely-accepted canopy optimisation models, and the discrepancies most likely relate to shallow canopy light gradients. They suggest several ways to improve future optimisation models.

Re-examining the empirical relation between plant growth and leaf photosynthesis

Eric L. Kruger and John C. Volin 421–429

The use of classical growth analysis to understand the determinants of interspecific differences in relative growth rate (RGR) has provided important insights. The authors present an analysis of data gathered from 19 studies in order to address the following questions: from both statistical and mechanistic standpoints, how closely does plant growth correlate with measures of leaf photosynthesis? Moreover, in this context, does the importance of leaf photosynthesis as an explanatory variable differ among growth light environments?

Estimating the internal conductance to CO₂ movement

Charles Warren 431–442

One of the least studied parts of the pathway of CO₂ movement during its photosynthetic assimilation is internal conductance (or mesophyll diffusion conductance). Past studies have clearly indicated that internal resistances may reduce the uptake of CO₂, but its measurement is difficult and often problematic. This is an interesting and timely review of a potentially very important feature. It compares various methods to estimate internal conductance and chloroplast CO₂ concentration.

Some like it wet — biological characteristics underpinning tolerance of extreme water stress events in Antarctic bryophytes

Jane Wasley, Sharon A. Robinson, Catherine E. Lovelock and Marianne Popp 443–455

This in-depth analysis of the influence of moisture conditions on Antarctic bryophytes makes a most valuable contribution to Antarctic ecology. It is the first to investigate desiccation and submergence tolerance of Antarctic moss species, and provides important insights into their response to climate change. The breadth of biochemical and physiological analysis will ensure that it is of interest to colleagues in many areas of plant stress biology but particularly those interested in desiccation tolerance and waterlogging.

Cover illustration: *Eucalyptus racemosa* Cav., one of approximately six eucalypts that have scribbles, occurs on low-nutrient, sandy soils on Stradbroke Island, Queensland, Australia. The scribbles are made by moth (*Ogmograptis scribula*) larvae. Photograph by Andrew Netherwood (www.ndesign.net.au).

¹⁵N partitioning in tomato: vascular constraints versus tissue demand

Amy E. Zanne, Steven S. Lower, Zoe G. Cardon and Colin M. Orians 457–464

The basis of this study is the notion that, within plants, available resources may not be distributed in proportion to tissue demand in sectorial plants, since not all roots are connected to all leaves. The authors argue that resource allocation patterns in sectorial plants are a complex function of at least two influences: vascular conduit arrangement and tissue demand. In addition, these patterns may be a function of effective sectoriality, which is influenced both by ionic concentrations in xylem sap and the size of the resource being transported.

Adaptations of strangler figs to life in the rainforest canopy

Susanne Schmidt and Dieter P. Tracey 465–475

This study was performed on Australian *Ficus* species with terrestrial and strangling habits in the forest and glasshouse to elucidate the figs' strategies to adapt to the epiphytic habitat, including nitrogen- and water-use. The authors compare strangler figs in epiphytic and mature soil-rooted life phases, comparing morphological and physiological traits, and examining two species of strangler figs under three water and three light regimes in the glasshouse.

Cyanogenesis in the Australian tropical rainforest endemic *Brombya platynema* (Rutaceae): chemical characterisation and polymorphism

Rebecca E. Miller, Judy Simon and Ian E. Woodrow 477–486

This comprehensive investigation into the nature and consequences of an intriguing chemical defense polymorphism describes the presence of cyanogenic compounds and their characterisation in a rainforest tree species, *Brombya platynema*. The authors identify the cyanogenic glycosides in the first characterisation of cyanogens within the genus, and only the third within the Rutaceae. In addition, they describe both qualitative and quantitative variation in cyanogenesis within a single population.

Novel aspects of cyanogenesis in *Eucalyptus camphora* subsp. *humeana*

Elizabeth H. Neilson, Jason Q. D. Goodger and Ian E. Woodrow 487–496

These authors report cyanogenesis for the first time in *Eucalyptus camphora*, a species that has not previously been considered cyanogenic. They have identified at least three different cyanogenic glycosides present in foliage material and report quantitative polymorphism in two natural populations. In addition, a progeny trial revealed that seedlings exhibited markedly lower levels of cyanogenesis and condensed tannins, although the seedlings were higher in total phenolics. Their novel finding, that this species contains more than one cyanogenic glycoside, when considered against the background of other *Eucalyptus* species, is intriguing.

The accumulation of terpenoid oils does not incur a growth cost in *Eucalyptus polybractea* seedlings

Drew J. King, Roslyn M. Gleadow and Ian E. Woodrow 497–505

Phylloxera infestation is a significant threat to viticulture worldwide, and the key to effective management is early detection to avoid substantial economic losses. These authors show that phylloxera infestation produces significant changes in leaf pigmentation soon after infestation. With development, this may allow the early identification of phylloxera infestation in vines using remote sensing technologies.

Phylloxera-infested grapevines have reduced chlorophyll and increased photoprotective pigment content — can leaf pigment composition aid pest detection?

**Annette L. Blanchfield, Sharon A. Robinson,
Luigi J. Renzullo and Kevin S. Powell** 507–514

Through either evolutionary selection or internal regulation, plants strike a balance between the primary processes of growth and reproduction, and the expense of the production of secondary chemicals (such as terpenoid oils) to maximise plant fitness. These authors examined the growth costs of oil accumulation in seedlings of *Eucalyptus polybractea* grown with replete or limiting nitrogen. Oil concentration was related to nitrogen, but composition was not. No cost in terms of growth, or leaf and nitrogen productivity was detected.

Research note: Leaf cooling curves: measuring leaf temperature in sunlight

**Andrea Leigh, John D. Close, Marilyn C. Ball,
Katharina Siebke and Adrienne B. Nicotra** 515–519

This work presents a solution to a common dilemma associated with using infrared technology for measuring leaf temperature in sunlight. The authors ascertain the extent to which specular reflection affects the accuracy of leaf temperature measurements in sunlight, and propose a simple solution. The paper has relevance to plant physiologists and ecologists interested in leaf temperature and thermography, and wider researchers measuring material surface temperatures, particularly in remote sensing fields.
