

Functional Plant Biology

Continuing *Australian Journal of Plant Physiology*

Contents

Volume 32 Number 7 2005

*Review: Light-acclimation of cladode photosynthetic potentials in *Casuarina glauca*: trade-offs between physiological and structural investments*

Ülo Niinemets, Aljona Lukjanova, Ashley D. Sparrow and Matthew H. Turnbull 571–582

Many species in arid or exposed sites have sparse canopies with upright or drooping foliage that has a cylindrical cross-section. This offers reduced light interception, and is effective prevention against photoinhibition, extreme foliage temperatures and excessive water loss. The authors test the hypothesis that species with cylindrical photosynthetic organs, such as *Casuarina* cladodes, respond plastically to irradiance gradients. They conclude that the cladodes acclimate significantly, and that photosynthetic capacity is traded off against supporting structures.

Modelling seasonal and diurnal dynamics of stomatal conductance of plants in a semiarid environment

Qiong Gao, Mei Yu, Xinshi Zhang Hongmei Xu and Yongmei Huang 583–598

Because plants in arid regions are more likely to endure prolonged severe water stress, stomatal control of gas exchange is particularly strong. This makes reliable modelling particularly challenging, as ecosystem non-linearity often comes into play. These authors have developed a stomatal conductance model for arid and semiarid regions that improves on existing models by introducing factors that may differ between mesic and arid systems, such as plant water storage, higher levels of water stress and conductance.

Unravelling the relationship between stem temperature and air temperature to correct for errors in sap flow calculations using stem heat balance sensors

Kathy Steppe, Raoul Lemeur and Diego Dierick 599–609

Heat storage can introduce considerable errors in sap-flow measurements. These authors present a novel approach to correct for such errors, even if no data on stem temperature are available. The relationship between stem and air temperature is unravelled during sap-flow measurements, and the reasons why stem and air temperature patterns are in phase at low sap flow rates and not at high sap flow rates are elucidated. Mathematical relationships are developed to assess the relative importance of air temperature and sap-flow rate for fluctuations in stem temperature inside the sap-flow sensor for young oak trees. Based on these relationships, a novel approach to correct for errors due to heat storage was proposed and successfully tested.

Cell wall immobilisation and antioxidant status of *Xanthoria parietina* thalli exposed to cadmium

Luigi Sanità di Toppi, Rosita Marabottini, Zulema Vattuone, Rita Musetti, Maria Augusta Favali, Agostino Sorgonà and Maurizio Badiani 611–618

Lichens act as symbiotic organisms, and can be reliably exploited as bioindicators and biomonitors of heavy-metal pollution. These authors investigate the response of lichen to Cd, measure its accumulation and immobilisation at the cell wall level, and describe the resulting effects on the activity of a variety of redox enzymes. They observed that Cd stress caused an increase in the levels of reduced ascorbate and GSH and the extent of membrane lipid peroxidation, as reflected by the content of membrane breakdown products.

*Cover illustration: Anatomy of a *Casuarina glauca* first-order cladode. A freehand cross-section (20–60 µm thick) was stained with phloroglucinol, which reacts with aldehyde residues of lignin to yield red pigments in lignified tissues. (See Niinemets *et al.* pp. 571–582.)*

Cytokinin flows from *Hordeum vulgare* to the hemiparasite *Rhinanthus minor* and the influence of infection on host and parasite cytokinins relations

Fan Jiang, Sveta Veselova, Dima Veselov, Guzel Kudoyarova, W. Dieter Jeschke and Wolfram Hartung

619–629

Rhinanthus minor is a facultative root hemiparasite, about which little is known regarding the cytokinin status before and after attachment to the host. These authors examine the flow of a number of different cytokinins between the hemiparasite and barley, and have modelled the flow of cytokinin from phloem and xylem between the two. Their findings might explain the performance of the hemiparasite in its attached state on the host, particularly with regards to the improved leaf development and stomatal reactions.

Temperature influences growth and maturation of fruit on 'Hayward' kiwifruit vines

William P. Snelgar, Alistair J. Hall, A. Ross Ferguson and Peter Blattmann

631–642

Temperature variation during the growing season of kiwifruit can affect many attributes that are important measures of fruit quality and are used to determine the prices received by growers. Therefore, the relationships between these components, and how they vary between seasons, can have significant economic consequences. This paper provides useful information on the response to changes of kiwifruit in the growth environment.

Arabidopsis AtCNGC10 rescues potassium channel mutants of *E. coli*, yeast and *Arabidopsis* and is regulated by calcium / calmodulin and cyclic GMP in *E. coli*

Xinli Li, Tamás Borsics, H. Michael Harrington and David A. Christopher

643–653

Although our understanding of the role of cyclic-nucleotide gated channels (CNGCs) in animal systems is high, for plants it is rudimentary. These authors show that AtCNGC10 transports K⁺, and that growth of the *E. coli* K⁺ channel mutant is partially inhibited in an AtCNGC10-specific manner by Ca²⁺ / calmodulin in *E. coli*, while treatment with cGMP reverses the inhibitory effect. This is the first use of the *E. coli* LB650 mutant to study the functional effects of calmodulin / Ca²⁺ and cGMP on a plant CNGC.

Long-term night chilling of cotton (*Gossypium hirsutum*) does not result in reduced CO₂ assimilation

Bir Singh, Luke Haley, Jamie Nightengale, Won Hee Kang, Candace H. Haigler and A. Scott Holaday

655–666

Hailing from tropical regions, cotton is generally sensitive to temperatures below 20°C, with optimal photosynthesis occurring between 25 and 30°C. These authors studied the effect of cool nights on photosynthesis in chilling-sensitive cotton. It was found that, contrary to earlier reports, long-term growth of cotton in regions experiencing cool nights does not negatively affect photosynthesis. In fact, cool nights may actually retard the diminishing of photosynthesis with aging of cotton leaves. However, an exposure of warm-grown plants to one or two cool nights does result in a small reduction in photosynthesis.

Research note: Increasing Amb a 1 content in common ragweed (*Ambrosia artemisiifolia*) pollen as a function of rising atmospheric CO₂ concentration

Ben D. Singer, Lewis H. Ziska, David A. Frenz, Dennis E. Gebhard and James G. Straka

667–670

The growth rate of many plants with C₃-type photosynthesis is limited by carbon levels, so projected increases in atmospheric CO₂ concentration should result in increased growth. This brings with it subsequent potential increases in pollen production in plants such as common ragweed, the pollen of which is a major airborne allergen and significant cause of allergic disease. This Research note quantifies increases in the allergen in response to various CO₂ levels, with potential effects on pollen dispersal and public health.