

Functional Plant Biology

Continuing *Australian Journal of Plant Physiology*

Contents

Volume 30 Number 3 2003

Review: Understanding plant responses to drought — from genes to the whole plant

Manuela M. Chaves, João. P. Maroco and João S. Pereira 239–264

This review presents an overview of most aspects of plant physiology in response to drought stress from whole-plant to gene expression, where most previous reviews focused on only a few of these aspects. The authors cover current understanding of the processes underlying plant responses to drought, with some consideration of plant responses in natural environments.

Exposed red (anthocyanic) leaves of *Quercus coccifera* display shade characteristics

Yiannis Manetas, Yiola Petropoulou, George K. Psaras and Antonia Drinia 265–270

This paper deals with the possible photoprotective function of anthocyanins. Using a combination of chlorophyll fluorescence, pigment, and microscopy data, the authors investigate factors leading to a shade acclimation of the photosynthetic machinery in red leaves. They argue that anthocyanins act as visible light screens in leaves, leading to a 'shade-adapted' state.

Loss of pod set caused by drought stress is associated with water status and ABA content of reproductive structures in soybean

Fulai Liu, Mathias N. Andersen and Christian R. Jensen 271–280

Drought is a problem worldwide that threatens food supplies, and flowering is a particularly sensitive stage of development. Soybean produces more flowers than eventually set pods, even under optimal conditions, and the mechanisms of what controls abortion and abscission are unknown. These authors show how root-originated abscisic acid affects pod abortion and seed yield in soybean under drought conditions

An ultrastructural study using anhydrous fixation of *Eragrostis nindensis*, a resurrection grass with both desiccation-tolerant and -sensitive tissues

Clare Vander Willigen, Norman W. Pammenter, Mohamed A. Jaffer, Sagadevan G. Mundree and Jill M. Farrant 281–290

This paper presents an anatomical perspective to desiccation tolerance and sensitivity using freeze-substitution of tissue of resurrection grass, *Eragrostis nindensis*. The authors propose the possible cause of water-stress-induced damage in various tissues, adding strong evidence to current theories on how plants survive desiccation.

Effects of high temperature on grain growth and on the metabolites and enzymes in the starch-synthesis pathway in the grains of two wheat cultivars differing in their responses to temperature

Morteza Zahedi, Rajinder Sharma and Colin F. Jenner 291–300

These authors studied the effect of moderate temperature increases on wheat grain filling, investigating the likely cause of high-temperature-tolerance of starch synthesis through comparison of two lines: Kavko (relatively tolerant) and Lyallpur (relatively intolerant). They demonstrate that cultivar differences in final grain weight were due to their sensitivity to grain filling, indicating a direct effect on the rate of starch synthesis.

*Cover illustration: Seeds of *Lolium rigidum* (annual ryegrass), the primary weed of southern Australian cropping regions, lose dormancy in a temperature- and water-dependent manner (see Steadman *et al.*, pp. 345–352).*

Photoacclimation involves modulation of the photosynthetic oxygen-evolving reactions in *Dunaliella tertiolecta* and *Phaeodactylum tricornutum*
Antonietta Quigg, John Beardall and Tom Wydrzynski
301–308

These authors describe the activity of the oxygen-evolving complex in two species of microalgae, which was found to be both species-specific and influenced by photoacclimation. They show how photosynthetic organisms adjust to extremely low, limiting light conditions, present novel evidence that super-reduced states can be generated *in vivo*, and speculate on the physiological significance.

Effects of UV-B radiation on plant growth, symbiotic function and concentration of metabolites in three tropical grain legumes
Samson B. M. Chimphango, Charles F. Musil and Felix D. Dakora
309–318

These authors address a problem that has been confused by contradictory findings, that of the effect of UV-B radiation on growth, symbiotic performance and root metabolite concentration in cowpea, soybean and common bean. Growth and symbiotic function remain unaltered under exposure to above-ambient levels of UV-B, with a differing response to below-ambient levels.

The operation of the lutein epoxide cycle correlates with energy dissipation
José I. García-Plazaola, Antonio Hernández, José M. Olano and José M. Becerril
319–324

This article continues a series of papers published recently in FPB dealing with the recently-discovered lutein epoxide cycle. The authors show that the operation of this cycle is correlated with thermal dissipation of excess energy, thus representing a second type of photoprotective xanthophyll cycle in higher plants.

Tissue stresses and resistance to water flow conspire to uncouple the water potential of the epidermis from that of the xylem in elongating plant stems
John B. Passioura and John S. Boyer
325–334

Passioura and Boyer present a theoretical treatment of problems related to 'tissue tension' phenomena. They connect facts and theories from the fields of growth physiology, cell and tissue water relations, and biomechanics, attempting to reach a consistent quantitative hypothesis. They test this hypothesis in numerical simulations, and find good agreement with published experiments under specific conditions.

Screening methods for waterlogging tolerance in lucerne: comparative analysis of waterlogging effects on chlorophyll fluorescence, photosynthesis, biomass and chlorophyll content
Christiane F. Smethurst and Sergey Shabala
335–343

These authors compare the effects of waterlogging on leaf photosynthesis, pigment composition, chlorophyll fluorescence and plant growth characteristics in four different lucerne cultivars. They describe the kinetics of the development of waterlogging symptoms, and discuss the underlying physiological mechanisms and the applicability of measurements of these parameters for screening lucerne for waterlogging tolerance.

Dormancy release in *Lolium rigidum* seeds is a function of thermal after-ripening time and seed water content
Kathryn J. Steadman, Andrew D. Crawford and Robert S. Gallagher
345–352

This paper describes the influence of temperature and seed water content on the breaking of dormancy during after-ripening in annual ryegrass seeds. The authors use their results to develop a predictive thermal time model, using both laboratory and field studies.

Erratum to:

Review: Mechanisms of anoxia tolerance in plants. I. Growth, survival and anaerobic catabolism
Jane Gibbs and Hank Greenway
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