

Functional Plant Biology

Contents

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Goldacre Review: From little things big things grow:
karrikins and new directions in plant development
Mark T. Waters

373–385

By sensing changes in the local environment, plants adapt their growth patterns to maximise reproductive success. This review summarises our understanding of how plants detect chemical compounds released into the soil during fire events. This field of research has led to the discovery of an evolutionarily conserved signalling system that has implications for agriculturally relevant aspects of plant development.

Active defence by an Australian native host,
Lomandra longifolia, provides resistance
against *Phytophthora cinnamomi*
Md Tohidul Islam, James E. Rookes
and David M. Cahill

386–399

The plant pathogen *Phytophthora cinnamomi* poses a major threat to a wide range of host plants. This study examined resistance in *Lomandra longifolia* (an Australian native plant) and found high levels of resistance to infection, along with the identification of several resistant-related components. Understanding *L. longifolia*'s resistance to the pathogen may help develop strategies for protection of more susceptible species.

Evaluation of root porosity and radial oxygen loss of
disomic addition lines of *Hordeum marinum* in wheat
Dennis Konnerup, A. I. Malik, A. K. M. R. Islam
and Timothy David Colmer

400–409

Hordeum marinum is a waterlogging-tolerant wild relative of wheat (*Triticum aestivum*) and has been hybridised with wheat to produce amphiploids containing genomes from both species. We found that the amphiploids had improved root aeration traits than the wheat parents, but the addition lines did not have a barrier to radial O₂ loss or higher root porosity than the wheat parents. Therefore, we challenge the strategy of using *H. marinum* as a donor of root aeration traits to wheat.

Vein density is independent of epidermal
cell size in *Arabidopsis* mutants
Madeline R. Carins Murphy, Graham J. Dow,
Gregory J. Jordan and Timothy J. Brodribb

410–418

It has been proposed that the densities at which veins and stomata are present in leaves are co-ordinated by epidermal cell expansion. However, we found that vein density is not causally linked to epidermal cell size. This suggests that adaptation favours synchronised changes to cell size in different leaf tissues to coordinate vein and stomatal density, and thus, maintain a balance between water supply and transpirational demand.

Transcriptome profiling of rice seedlings under
cold stress
Luciano C. da Maia, Pablo R. B. Cadore,
Leticia C. Benitez, Rodrigo Danielowski,
Eugenia J. B. Braga, Paulo R. R. Fagundes,
Ariano M. Magalhães Jr and
Antonio Costa de Oliveira

419–429

Sub-optimal environmental conditions for crops are called abiotic stress; cold is one of the main stresses for rice. In this study, the RNAseq technique was used to identify genes expressed in response to cold in rice germination. The results indicated that a large number of genes were expressed in the sensitive genotype and few genes in the tolerant genotype. We have identified possible genes that are responsible for cold tolerance in rice plants of the cold tolerant cultivar.

Cover illustration: Simplified model of karrikin and strigolactone perception and response (see Waters pp. 373–385).

Nitrate increases ethylene production and aerenchyma formation in roots of lowland rice plants under water stress

Cuimin Gao, Lei Ding, Yingrui Li, Yupei Chen, Jingwen Zhu, Mian Gu, Yong Li, Guohua Xu, Qirong Shen and Shiwei Guo

430–442

It remains unclear how water stress affects ethylene production and aerenchyma formation in rice plant supply with different nitrogen forms. The results showed that nitrate nutrition increased ethylene production and aerenchyma formation in roots of lowland rice plants under water stress. We concluded that nitrogen source supply is involved in the regulation of ethylene biosynthesis and function, especially under water stress.

Defence mechanisms associated with mycorrhiza-induced resistance in wheat against powdery mildew

Ghalia Mustafa, Ngan Giang Khong, Benoît Tisserant, Béatrice Randoux, Joël Fontaine, Maryline Magnin-Robert, Philippe Reignault and Anissa Lounès-Hadj Sahraoui

443–454

Little is known about the biocontrol ability of the arbuscular mycorrhizal fungi (AMF) to protect plants against foliar fungal pathogens. We assessed the ability of *Funneliformis mosseae* to protect wheat against powdery mildew caused by *Blumeria graminis* f.sp. *tritici*. AMF treatment revealed a systemic resistance of wheat to *B. graminis* associated with a stimulation of plant defence responses and interpreted as mycorrhiza-induced resistance.

Malus domestica ADF1 severs actin filaments in growing pollen tubes

Qing Yang, ShengNan Wang, ChuanBao Wu, QiuLei Zhang, Yi Zhang, QiuJu Chen, Yang Li, Li Hao, Zhaoyu Gu, Wei Li and Tianzhong Li

455–463

In this work we cloned a new gene ADF1 that severs actin filaments in apple pollen tubes. The aim of the work is to give references to understand the function of ADF generally *in vitro* and *in vivo* and the main discovery is ADF severs actin filaments. Finally, we fit the original images into the software Photoshop 6.0 for bigger pictures and use software Image J to produce the video clips.

The inhibition of photosynthesis under water deficit conditions is more severe in flecked than uniform irradiance in rice (*Oryza sativa*) plants

Jiali Sun, Qiangqiang Zhang, Muhammad Adnan Tabassum, Miao Ye, Shaobing Peng and Yong Li

464–472

The effect of water deficit on photosynthesis in fluctuating irradiance is not well understood, although leaves within a canopy experience a highly variable light environment. This study was conducted by investigating steady-state and dynamic photosynthesis of two rice (*Oryza sativa* L.) cultivars grown under well-watered and water stress conditions. We found that the inhibition of photosynthesis under water deficit condition is more severe in flecked than steady-state irradiance.