

Functional Plant Biology

Contents

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Review: Prescreening in large populations as a tool for identifying elevated CO₂-responsive genotypes in plants

Hiroyuki Shimono, Graham Farquhar, Matthew Brookhouse, Florian A. Busch, Anthony O'Grady, Michael Tausz and Elizabeth A. Pinkard

1–14

There is population-wide variation in the responsiveness of trees and crops to higher atmospheric CO₂ that could be exploited to improve future productivity but studies are limited by access to suitable facilities. We examined prescreening as a tool in large genome × CO₂ experiments to limit the size and cost of experiments. Our review identified approaches that can be used for prescreening and how the data can improve genetic selection of high-performing cultivars.

Review: Use of retrotransposon-derived genetic markers to analyse genomic variability in plants

Ruslan Kalendar, Asset Amenov and Asset Daniyarov

15–29

Transposable elements (TEs) are common mobile genetic elements comprising several classes and making up the majority of eukaryotic genomes. TEs are important drivers of species diversity and exhibit great variety in their structure, size and transposition mechanisms, making them important putative actors in evolution. Various applications have been developed to exploit polymorphisms in TE insertion patterns, including conventional or anchored PCR, and quantitative or digital PCR. This review provides an overview of the TE-based applications developed for plant species and assesses the contributions of TEs to the analysis of plants' genetic diversity.

Integrated analysis of transcriptomic and metabolomics data reveals critical metabolic pathways involved in polyphenol biosynthesis in *Nicotiana tabacum* under chilling stress

Peilu Zhou, Qiyao Li, Guangliang Liu, Na Xu, Yinju Yang, Wenlong Zeng, Aiguo Chen and Shusheng Wang

30–43

Chilling stress limits the growth and geographical distribution of chilling-sensitive species. Polyphenols are the most common metabolites, and lignin synthesis plays an important role in the response of tobacco leaves to chilling. Our results provide important technical information for further research on the metabolic regulation of polyphenol biosynthesis and can be used to improve the chilling tolerance of plant varieties.

Phenotyping from lab to field – tomato lines screened for heat stress using F_v/F_m maintain high fruit yield during thermal stress in the field

Damodar Poudyal, Eva Rosenqvist and Carl-Otto Ottosen

44–55

Heat stress is limiting tomato production globally. Tolerant genotypes screened for heat stress using chl *a* fluorescence had better growth under controlled conditions and maintained high fruit production in the field. These results may help downscale laboratory-based high-throughput phenotyping techniques used to develop heat-tolerant tomato varieties.

Impaired terpenoid backbone biosynthesis reduces saponin accumulation in *Panax notoginseng* under Cd stress

Peiran Liao, Yue Shi, Ziwei Li, Qi Chen, Tian-Rui Xu, Xiuming Cui, Huilin Guan, Lanping Guo and Ye Yang

56–68

We explored Cd stress on the accumulation of *Panax notoginseng* saponins (PNS) and the corresponding regulation mechanisms. The reduction in gene expression in the terpenoid backbone biosynthesis pathway and removal of reactive oxygen species caused a decrease in the content of PNS. Findings of the present study will be helpful in preventing Cd stress induced decreases in contents of PNS through biotechnological approaches.

Cover illustration: Sporadic yellow mosaic symptoms in agroinoculated susceptible T9 plants (see Chakraborty and Basak pp. 69–81). Image by Nibedita Chakraborty.

Exogenous application of methyl jasmonate induces defense response and develops tolerance against mungbean yellow mosaic India virus in *Vigna mungo*
Nibedita Chakraborty and Jolly Basak

69–81

Methyl jasmonate (MeJA) is well known for inducing systemic and durable resistance against pathogens in several plant species. We address the effect of exogenous application of MeJA in MYMIV susceptible *Vigna mungo* plants in inducing defense response against MYMIV infection and thereby reducing accumulation of viral coat protein. Our findings provide new insights into the physiological and molecular mechanisms of MYMIV tolerance in *Vigna* induced by MeJA.

Methyl jasmonate improves tolerance to high salt stress in the recretohalophyte *Limonium bicolor*
Fang Yuan, Xue Liang, Ying Li, Shanshan Yin and Baoshan Wang

82–92

It is important to determine how to increase salt tolerance of plants because soil salinisation seriously affects agriculture and production. By measuring the correlations between 14 physiological parameters and salt tolerance, we determined that exogenous methyl jasmonate (MeJA) improves tolerance to high salt stress of *Limonium bicolor*. Results of the present study provide insights into a possible mechanism underlying MeJA-mediated salt stress alleviation.

Mechanistic understanding of iron toxicity tolerance in contrasting rice varieties from Africa:
1. Morpho-physiological and biochemical responses
Dorothy A. Onyango, Fredrickson Entila, Mathew M. Dida, Abdelbagi M. Ismail and Khady N. Drame

93–105

Iron is pivotal in various plant metabolic processes. However, when iron uptake is excessive, it becomes toxic and disrupts plant cellular homeostasis. The aim of this study was to characterise rice genotypes to determine varietal tissue integrity and metabolic compounds allocation under toxic Fe conditions. We present data on the abilities and strategies of rice plants to regulate growth and metabolism to overcome Fe stress.