

Functional Plant Biology

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Editorial: PrometheusWiki: online protocols gaining momentum

Adrienne Nicotra and Emma McIntosh iii–v

Goldacre Review: Carotenoids in nature: insights from plants and beyond

Christopher I. Cazzonelli 833–847

Carotenoid pigments are essential in nature contributing to colour, aroma, hormone synthesis, photoprotection and photosynthesis in plants. In animals, carotenoids promote health, behavior, reproduction and contribute to survival. The biochemical pathway for carotenogenesis is now almost complete. This review will describe processes coordinating carotenoid accumulation, storage and degradation as well as highlight the importance of photostimulation, epigenetic regulation and metabolic feedback control in modulating composition and flux through the pathway.

Inherent nitrogen deficiency in *Pistacia lentiscus* preferentially affects photosystem I: a seasonal field study

Constantinos Nikiforou and Yiannis Manetas 848–855

The natural variation in leaf nitrogen contents of mastic tree was exploited in order to investigate its effects on light reactions of photosynthesis under field conditions. It was found that nitrogen deficiency preferentially affects photosystem I throughout the seasons, while photosystem II is only affected during the adverse winter period. Adaptive trade-offs between reductive power- and energy-generating electron flows under nitrogen deficiency are inferred.

Leaf stripe form of esca induces alteration of photosynthesis and defence reactions in presymptomatic leaves

Maryline Magnin-Robert, Patricia Letousey, Alessandro Spagnolo, Fanja Rabenoelina, Lucile Jacquens, Laurence Mercier, Christophe Clément and Florence Fontaine 856–866

Over the last decade, fungal grapevine trunk diseases such as esca have become the most threatening diseases of vineyards worldwide. Characterising the impact of esca on grapevine physiology showed that it can react precociously by reducing photosynthesis and triggering defence mechanisms. These data could represent a key step in pointing out a molecular target exploitable for control of this disease.

Cover illustration: Metabolic feedback control of carotenoid biosynthesis (see Cazzonelli pp. 833–847). Major reactions in the higher plant MEP and carotenoid biosynthetic pathways showing key isoprenoid metabolites, carotenoid precursors (windows in pipes) and carotenoid sinks (windows in barrels). The round windows within the main central chrome pipe represents key regulatory nodes. The side funnels indicate carotenoid feedback regulation from altered PSY, CRTISO and PDS enzymatic activity. Taps controlling the smaller chrome pipes reveal positive and negative feedback as shown by green and red stop lights, respectively. Figure prepared by Christopher Cazzonelli and Sharyn Wragg (Australian National University).

Evidence that banana (*Musa* spp.), a tropical monocotyledon, has a facultative long-day response to photoperiod

Jeanie A. Fortescue, David W. Turner and Ronald Romero

867–878

Seasonal temperature variation is the main environmental driver for the number of bunches of banana and plantain that appear each week during the year. We discovered that day length, independently of temperature, contributes to the seasonal distribution of bunch appearance in the tropics and subtropics. Bananas, a tropical monocotyledon, respond quantitatively to long days and this helps coordinate their reproductive development.

Patchy nitrate promotes inter-sector flow and ¹⁵N allocation in *Ocimum basilicum*: a model and an experiment

Alexandra M. Thorn and Colin M. Orians

879–887

The ability of roots to conduct water changes with nitrate availability, but the consequences are poorly understood. We modeled how these changes affect nitrate transport from a nutrient patch, and experimentally tracked nitrate movement in hydroponic basil to test these predictions. Our results suggest that nitrate-induced increases in conductance cause a more even nitrate distribution in the crown.

Morpho-structural and physiological performance of Sangiovese and Montepulciano cvv. (*Vitis vinifera*) under non-limiting water supply conditions

Alberto Palliotti, Stefano Poni, Oriana Silvestroni, Sergio Tombesi and Fabio Bernizzoni

888–898

Climate change scenarios emphasises the importance of intraspecific traits variability. Key morpho-structural characteristics and physiological performance were evaluated in the two most cultivated Italian red grape cultivars. Some vine physiology-related traits greatly changed and it suggests different fitness in limiting and non-limiting conditions. Our data point out that intraspecific variability may offer a chance to face adverse environmental conditions related to climate change.

Soil temperature moderates grapevine carbohydrate reserves after bud break and conditions fruit set responses to photoassimilatory stress

Suzy Y. Rogiers, Jason P. Smith, Bruno P. Holzapfel and W. James Hardie

899–909

In grapevines photosynthetic deprivation impairs the transformation of flowers to berries. Aiming to discover whether carbohydrates from root stores condition photosynthetic deprivation we found that soil warming increased the number of flowers while the proportion that became berries was strongly correlated with root carbohydrate levels. These responses reveal important influences of soil temperature on seasonal variation in grapevine fruiting.

Root growth of lupins is more sensitive to waterlogging than wheat

Helen Bramley, Stephen D. Tyerman, David W. Turner and Neil C. Turner

910–918

Wheat and lupin often experience transient waterlogging in southwest Australia. The effects of waterlogging on wheat and lupin roots were characterised by examining patterns of root growth and changes in root anatomy and morphology. The greater tolerance of wheat roots to waterlogging than lupin roots was related to contrasting growth responses and anatomical features that affect internal oxygen deficiency and root hydraulic properties; attributes that influence root survival and recovery.

Physiological and morphological factors influencing leaf, rhizome and stolon tensile strength in C₄ turfgrass species

Filippo Lulli, Lorenzo Guglielminetti, Nicola Grossi, Roberto Armeni, Sara Stefanini and Marco Volterrani

919–926

Sports turfgrass is often required to have a very high traffic resistance. Tensile strength tests and laboratory assays on C₄ species' tissues highlighted the positive (lignin) and negative (starch and sugars) role of certain compounds on mechanical resistance. As such, turfgrass breeders can use these simple markers (i.e. starch) for predicting the mechanical strength of selected varieties and species.