

# Functional Plant Biology

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Elevated CO<sub>2</sub> accelerates flag leaf senescence in wheat due to ear photosynthesis which causes greater ear nitrogen sink capacity and ear carbon sink limitation

**Chunwu Zhu, Jianguo Zhu, Qing Zeng,  
Gang Liu, Zubing Xie, Haoyan Tang,  
Jiling Cao and Xingzeng Zhao**

291–299

Elevated CO<sub>2</sub> accelerated the flag leaf senescence due to the insufficiency of ear carbon sink strength and greater demand for N in the ear. However, if the ear was covered, these responses to CO<sub>2</sub> were absent. So, under elevated CO<sub>2</sub>, higher enhancement of ear photosynthesis is the major factor for acceleration of the flag leaf senescence.

Willow species (genus: *Salix*) with contrasting habitat affinities differ in their photoprotective responses to water stress

**Jessica A. Savage, Jeannine Cavender-Bares  
and Amy Verhoeven**

300–309

In response to a dry-down, six willow (*Salix*) species demonstrated an increase in xanthophyll cycle activity and a rise in nonphotochemical quenching. Our results suggest that although these species are relatively drought intolerant, they still utilise xanthophyll-mediated thermal dissipation to reduce photodamage under drought conditions, and the extent and rate of this response relates to their habitat affinity.

Heat acclimation of grapevine leaf photosynthesis: mezo- and macroclimatic aspects

**Zsolt Zsófi, Gyula Váradi, Borbála Bálo,  
Marianna Marschall, Zoltán Nagy  
and Sándor Dulai**

310–322

Heat sensitivity of grapevine (*Vitis vinifera* L. cv. Kékfrankos) photosynthesis was studied. Water deficit and early leaf senescence had a significant effect on temperature dependence of Chl fluorescence parameters. Water deficit resulted in higher thermostability under high light conditions as a result of enhanced xanthophyll cycle pigment pool size.

Induction of secondary metabolism in grape cell cultures by jasmonates

**Claudio D'Onofrio, Agnieszka Cox, Christopher Davies  
and Paul K. Boss**

323–338

Secondary metabolites produced by grapes are determinants of wine quality. Grape cell cultures, when treated with elicitors, produce some of these compounds, allowing the genes most important to their production by the relevant biosynthesis pathways to be identified.

The superhydrophilic and superoleophilic leaf surface of *Ruellia devosiana* (Acanthaceae): a biological model for spreading of water and oil on surfaces

**Kerstin Koch, Inga Christina Blecher, Gabriele König,  
Stefan Kehraus and Wilhelm Barthlott**

339–350

On leaves of the tropical herb *Ruellia devosiana* (Acanthaceae), water and oil droplets spread to thin films within less than 0.3 s. The structural composition of the leaf surface and the spreading and transport of oil and water on the leaves and on leaf replicas are described.

*Cover illustration: (Left) A flowering bloom on a branch of Ruellia devosiana (Acanthaceae). Droplets of oil or water applied on R. devosiana leaves show a very fast spreading behaviour of both liquids, leading to contact angles of 0° in less than 0.3 s. (Right) Scanning electron microscopy showing the adaxial leaf surfaces, which are composed of five different cell types: conical cells, glands, multi-cellular hairs, hair-papilla cells and some longitudinal expanded, flat epidermis cells. In combination with the surrounding papilla cells, the five different cell types form channel-like structures (see Koch et al. pp. 339–350).*

A PRp27 gene of *Nicotiana benthamiana* contributes to resistance to *Pseudomonas syringae* pv. *tabaci* but not to *Colletotrichum destructivum* or *Colletotrichum orbiculare*  
**Weilong Xie and Paul H. Goodwin** 351–361

*NbPRp27* belongs to family 17 of pathogenesis-related proteins. It was induced in leaves by wounding, BTH, ethylene, methyl jasmonate, ABA, NAA as well as fungal and bacterial infection. To determine its role in basal resistance, virus-induced silencing of *NbPRp27* was done, resulting in unaltered fungal resistance but reduced bacterial resistance.

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Auxin regulation of gibberellin biosynthesis in the roots of pea (*Pisum sativum*)  
**Diana E. Weston, James B. Reid and John J. Ross** 362–369

In roots of the garden pea, reducing auxin signalling or auxin levels down-regulated gibberellin (GA) synthesis genes and up-regulated GA deactivation genes, resulting in reduced bioactive GA content. These results indicate that endogenous auxin is required to maintain a normal level of bioactive GA, which is essential for root elongation. No evidence was obtained that endogenous auxin facilitates the GA-induced destabilization of the growth-inhibitory ‘DELLA’ proteins.

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Role of geranylgeranyl reductase gene in organ development and stress response in olive (*Olea europaea*) plants  
**Leonardo Bruno, Adriana Chiappetta, Innocenzo Muzzalupo, Cinzia Gagliardi, Domenico Iaria, Alessandro Bruno, Maria Greco, Donato Giannino, Enzo Perri and Maria Beatrice Bitonti** 370–381

The NADPH-dependent geranylgeranyl reductase gene (*OeCHLP*) involved in chlorophyll, tocopherols and plastoquinones biosynthesis was characterised in olive plants. Expression levels and transcripts accumulation were investigated by quantitative RT–PCR and *in situ* hybridisation. We found that *OeCHLP* expression was modulated during organ development and was rapidly enhanced under stress conditions.

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