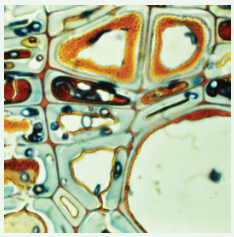


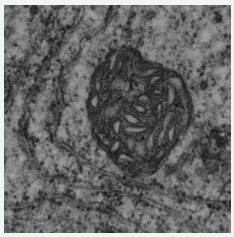
Secondary metabolites of xylem in response to decay fungi (Review)

Annals of Botany 125:
701–720, 2020
doi: 10.1093/aob/mcz138

Trees are highly compartmented organisms that are exposed to range of pests and pathogens during their often very long lifespans. The CODIT model (Compartmentalisation of Damage/Dysfunction in Trees) helps to explain the defence processes in a tree from macro-to-microscopic scales. In this review, **Morris *et al.*** discuss tree defence systems involving secondary metabolites using an expanded CODIT model with current biological knowledge.

Authors: Hugh Morris, Ari M. Hietala, Steven Jansen, Javier Ribera, Sabine Rosner, Khalifah A. Salmeia, and Francis W. M. R. Schwarze

For a Commentary on this article see this issue, pp. iv–vi.



The mitochondrial hub of stress signalling (Review)

Annals of Botany 125:
721–736, 2020
doi: 10.1093/aob/mcz184

The plant cell is an attractive model to understand the integration of environmental stress responses, organelle functioning and cell homeostasis. Involvement of mitochondria in this integration entails a complex network of signalling which has not been fully elucidated, given the diversity of mitochondrial constituents that are linked to stress signalling pathways. Drawing on different examples of abiotic and biotic stresses, **Dourmap *et al.*** review stress signalling connections that are related to mitochondrial electron transport chain and oxidative phosphorylation. They discuss how these are involved in stress perception and transduction, signal amplification, and cell stress response modulation.

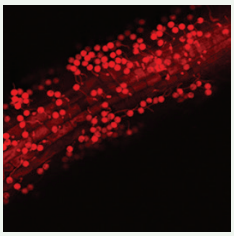
Authors: Corentin Dourmap, Solène Roque, Amélie Morin, Damien Caubrière, Margaux Kerdiles, Kyllian Béguin, Romain Perdoux, Nicolas Reynoud, Lucile Bourdet, Pierre-Alexandre Audebert, Julien Le Moullec, and Ivan Couée

Exploring chemical defence theory using *Thapsia garganica* (Research in Context)

Annals of Botany 125:
737–750, 2020
doi: 10.1093/aob/mcz151

There are many models that predict why investment in chemical defences varies between individuals of the same plant species, and these can be contradicting or relatively unspecific. *Thapsia garganica* (Apiaceae), the 'deadly carrot', produces a small number of highly toxic defence compounds, thapsigargins, within all tissue types. **Martinez-Swatson *et al.*** compare concentrations of thapsigargins from wild populations of *T. garganica* to multiple model predictions. Models predicting the general defense strategy of *T. garganica* performed well and can be combined. Conversely, models predicting variation over environmental gradients performed less well, but partitioning defences into constitutive and induced defences could improve predictions.

Authors: Karen Martinez-Swatson, Rasmus Kjøller, Federico Cozzi, Henrik Toft Simonsen, Nina Rønsted, and Christopher Barnes



Role of extensin arabinosylation in root defence

Annals of Botany 125:
751–763, 2020
doi: 10.1093/aob/mcz068

Although roots are exposed to a myriad of soilborne microbial pathogens, knowledge related to root immunity is limited. Extensins are cell wall glycoproteins known to be involved in wall strengthening, but the role of their glycans in response to pathogens is not understood. **Castilleux *et al.*** use *Arabidopsis thaliana* mutants impaired in extensin arabinosylation and a set of anti-extensin-specific monoclonal antibodies to investigate the role of extensin arabinosylation in response to elicitors in roots. The data highlight the importance of extensin arabinosylation in cell wall remodelling as a response of root cells to pathogen-derived elicitors.

Authors: Romain Castilleux, Barbara Plancot, Bruno Gügi, Agnès Attard, Corinne Loutelier-Bourhis, Benjamin Lefranc, Eric Nguema-Ona, Mustapha Arkoun, Jean-Claude Yvin, Azeddine Driouich, and Maïté Vicré

For a Commentary on this article see this issue, pp.vii–viii.

Invasive grasses of sub-Antarctic Marion Island

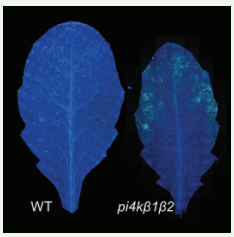
Annals of Botany 125:
765–773, 2020
doi: 10.1093/aob/mcz156

Ripley *et al.* demonstrate that recent warming on sub-Antarctic Marion Island may have favoured invasive Pooid grass species with capacity to respond with phenotypic plasticity at the expense of stress tolerance. Under warming conditions, invasive species increased photosynthetic rates up to 2-fold, while non-invasive species did not respond. This may explain interspecific differences

in range expansions documented on the island and highlights the vulnerability of cold ecosystems to warming. Selection for stress tolerance limits the responsiveness of native species to environmental change, while introduced invasive species may have no such limitations.

Authors: Brad S. Ripley, Amy Edwardes, Marius W. Rossouw, Valdon R. Smith, and Guy F. Midgley

For a Commentary on this article see this issue, pp. ix–x.

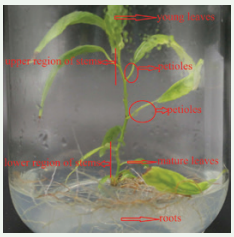


Phosphatidylinositol-4-kinase beta double mutant and salicylic acid

Annals of Botany 125:
775–784, 2020
doi: 10.1093/aob/mcz112

Phosphoinositides are minor components of cell membranes, acting as signaling components during growth and stress responses. Mutation in phosphatidylinositol-4-kinases beta, *pi4kβ1β2*, causes accumulation of a phytohormone salicylic acid (SA). It coincides with stunted growth, deposition of secondary metabolites in leaves, but also with resistance to several pathogens. SA is a powerful stress mediator itself, so its increase can mask other specific effects of the mutation. **Kalachova *et al.*** use reverse genetics approaches to dissect SA-dependent and -independent behaviour of the *pi4kβ1β2* mutant. They focus on hormonal balance, callose deposition and immune responses to adapted and non-host pathogens.

Authors: Tetiana Kalachova, Martin Janda, Vladimír Šašek, Jitka Ortmannová, Pavla Nováková, I. Petre Dobrev, Volodymyr Kravets, Anne Guivarc'h, Deborah Moura, Lenka Burketová, Olga Valentová, and Eric Ruelland

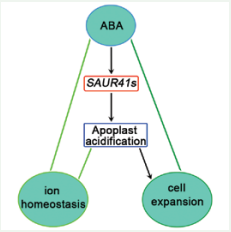


PtHMGR promotes environmental stress tolerance in poplar

Annals of Botany 125:
785–803, 2020
doi: 10.1093/aob/mcz158

PtHMGR catalyzes a reaction involving HMG-CoA and NADPH to form mevalonate for improved drought and salinity tolerance. **Wei *et al.*** find that in the presence of NaCl and PEG_{6000}, the rates of rooting and survival of *PtHMGR*-overexpressing poplars were higher than those of wild-type poplars, *Populus*× *euramericana* (Salicaceae). These results suggest that *PtHMGR* modulates the expression of reactive oxygen species (ROS) scavenging-related genes and formation-related genes The overexpression of *PtHMGR* increased the expression of stress-related genes and decreased that of others, leading to the overall enhancement of the stress resistance of poplar.

Authors: Hui Wei, Ali Movahedi, Chen Xu, Weibo Sun, Lingling Li, Pu Wang, Dawei Li, and Qiang Zhuge



*SAUR41*s are ABA-inducible to modulate cell expansion and salt tolerance

Annals of Botany 125:
805–819, 2020
doi: 10.1093/aob/mcz160

Arabidopsis *SAUR41*s are strikingly ABA-inducible. Knockout of these genes using CRISPR/Cas9 led to reduced cell expansion. The mutant increased the transcription of calcium homeostasis/signaling genes, while the *SAUR41* overexpression promoted cell expansion but increased ABA biosynthesis. Both the mutant and the overexpression were hypersensitive to salt stress. Notably, specific expression of *SAUR41* under an ABA-responsive promoter rescued the mutant. **Qiu *et al.*** suggest that the *SAUR41* subfamily genes are new players in modulation of cell expansion, ion homeostasis and salt tolerance to fine-tune seedling growth, and that balanced expression of ABA-repressed and ABA-induced *SAURs* may be necessary for plant abiotic responses.

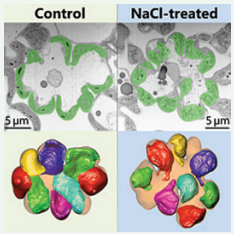
Authors: Ting Qiu, Mengyuan Qi, Xiaohui Ding, Yanyan Zheng, Tianjiao Zhou, Yong Chen, Ning Han, Muyuan Zhu, Hongwu Bian, and Junhui Wang

The role of the plasma membrane in auxinic herbicide resistance

Annals of Botany 125:
821–832, 2020
doi: 10.1093/aob/mcz173

Auxins have a complicated mode of action, and the mechanisms of resistance to synthetic auxin herbicides such as 2,4-D are equally complex. **Goggin *et al.*** quantify differences in plasma membrane protein abundance between a range of 2,4-D-susceptible and -resistant populations of wild radish, and identify a lectin-type receptor-like kinase whose abundance is strongly negatively associated with resistance. This kinase may therefore be involved in perception of 2,4-D at the plasma membrane. Functional characterization of this and two other resistance-associated proteins (a second receptor-like kinase and the auxin efflux transporter ABCB19) will help to clarify their roles in auxin resistance.

Authors: Danica E. Goggin, Scott Bringans, Jason Ito, and Stephen B. Powles

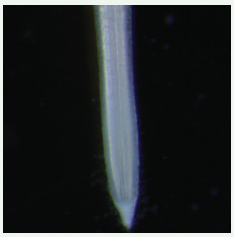


3D structural change of chloroplasts in rice mesophyll cell under salinity

Annals of Botany 125:
833–840, 2020
doi: 10.1093/aob/mcz192

Under salinity stress, chloroplasts in 2D images by conventional transmission electron microscopy (TEM) seem to be swelling. But, did they actually swell? **Oi *et al.*** examine three-dimensional structural changes in a whole mesophyll cell of rice (*Oryza sativa*) responding to salinity stress by serial sectioning with a focused ion beam scanning electron microscope (FIB-SEM). The reconstructed 3D models indicate that the chloroplasts under salinity did not swell but became spherical without increasing their volume. This article demonstrates the importance of 3D observation and quantitative comparison in plant anatomy.

Authors: Takao Oi, Sakiko Enomoto, Tomoyo Nakao, Shigeo Arai, Koji Yamane, and Mitsutaka Taniguchi



Delayed Al-resistance expression in *Urochloa decumbens*

Annals of Botany 125:
841–850, 2020
doi: 10.1093/aob/mcz206

Signal grass (*Urochloa decumbens,* Panicaceae) is one of the most widely used pasture grasses in the world because of its high Al-resistance. Using plant-growth experiments, **Li *et al***. examine Al concentrations of its bulk root tissues and intracellular compartments, as well as cell wall properties. They find that its delayed Al-resistance expression was not associated with Al concentrations in the bulk apical root tissues or bound to the cell wall, nor was it associated with changes in other properties of the cell wall; rather, it is associated with energy-dependent Al exclusion. This study provides valuable information for understanding plant Al resistance.

Authors: Zhigen Li, J. Bernhard Wehr, Peng Wang, Neal W. Menzies, and Peter M. Kopittke