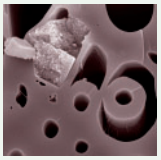


Wood anatomy of archaeological and historical specimens (Invited Review)

doi:10.1093/aob/mcv056

The science of wood anatomy has evolved in recent decades to add archaeological and historical wood to its repertoire of documenting and characterizing modern and fossil woods. **Cartwright (pp. 1–13)** presents an overview of the current state of principles and procedures involved in the study of such specimens, which may be preserved through a variety of processes including charring, waterlogging, desiccation or mineral replacement. Such varying preservation of wood anatomical characteristics often limits the level of identification to taxon, although new-generation scanning electron microscopes and complex optical microscopes can provide opportunities to the specialist for high-quality imaging and analysis of problematic or poorly preserved samples.

Cycling of clock genes entrained to the solar rhythm (Research in Context)

doi:10.1093/aob/mcv070

An endogenous rhythm synchronized to dawn cannot time photosynthesis-linked genes to peak consistently at noon since the interval between sunrise and noon changes seasonally. **Yeang (pp. 15–22)** uses a meta-analysis of 14 published datasets to examine the cyclic behaviour of the *Arabidopsis thaliana* photosynthesis-related gene *CAB2*, and the clock oscillator genes *TOC1* and *LHY* in T cycles and N-H cycles, and proposes a solar clock model with two daily timing references synchronized to noon and midnight. He finds that changes in the rhythms of *CAB2*, *TOC1* and *LHY* in plants subjected to non-24-hour light/dark cycles match the hypothesized changes in their behaviour as predicted by the model, thus validating it. The cycling of key clock genes tethered to the solar rhythm enables plants to tell time, and facilitates peak expression of photosynthesis-related genes at noon independently of day length.

SlbHLH068 is involved in iron homeostasis in tomato

doi:10.1093/aob/mcv058

Basic helix-loop-helix (bHLH) transcription factors play an important role in the regulation of iron homeostasis in plants, and FER is the first identified bHLH protein involved in the regulation of iron uptake in tomato, *Solanum lycopersicum*. **Du *et al.* (pp. 23–34)** isolate an iron-deficiency induced bHLH protein, SlbHLH068, and determine that the heterodimer it forms with FER binds on the promoter of *FRO1* to activate its transcription. Suppression of *SlbHLH068* expression by virus-induced gene silencing causes the deregulation of iron uptake genes and increased sensitivity to low-iron stress. They conclude that SlbHLH068, as a putative transcription factor, is involved in iron homeostasis in tomato via an interaction with FER.

Orinus as a case study for species delimitation in plants

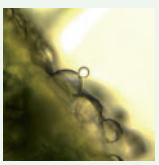
doi:10.1093/aob/mcv062

Defining species objectively and consistently remains a challenge for plants distributed in remote regions where there is often a lack of sufficient previous specimens. **Su *et al.* (pp. 35–48)** use the genus *Orinu*s (Poaceae) as a model system and apply multiple approaches and lines of evidence to determine species boundaries for plants occurring in the Qinghai–Tibet Plateau. They find compelling evidence that the six previously recognized species of the genus that were examined should be reduced to two, with new circumscriptions, and a third, identified in this study, should be described as a new species. This empirical study highlights the value of applying genetic differentiation, morphometric statistics and ecological-niche modelling in an integrative approach to re-circumscribing species boundaries.

Root growth dynamics linked to above-ground growth

doi:10.1093/aob/mcv064

Detailed knowledge of below-ground growth is poor relative to that of growth above ground and limits our understanding of whole-plant responses to the environment. **Contador *et al.* (pp. 49–60)** use minirhizotron techniques to examine below-ground growth in field-grown walnut (*Juglans regia*) and find that root production follows a unimodal curve across the season, with the decline in root production corresponding to increased soil temperature, as well as to the period of major carbohydrate allocation to reproduction. Root vertical distribution appears to have greater plasticity than timing of root production in this system, with temperature and/or carbohydrate competition constraining the timing of root growth.



Hydathode trichomes in parasitic Orobanchaceae

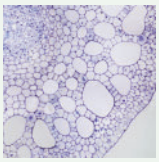
doi:10.1093/aob/mcv065

Root hemiparasites from the Rhinanthoid clade of Orobanchaceae possess metabolically active glandular trichomes that have been suggested to function as hydathode trichomes actively secreting water. **Světlíková *et al.* (pp. 61–68)** conduct macro- and microscopic observations of the leaves of hemiparasitic *Rhinanthus alectorolophus* and combine them with gas-exchange measurements to estimate the carbon budget of hydathode-trichome activity. They find that night-time rates of respiration and transpiration and the presence of guttation drops are positively correlated, clearly indicating hydathode-trichome activity. Peak activity of hydathodes appears to occur in the juvenile stage before flowering. The results provide the first unequivocal evidence for the physiological role of the hydathode trichomes in active water secretion in the rhinanthoid Orobanchaceae.

The RAM/MOR signalling network of plants

doi:10.1093/aob/mcv066

The RAM/MOR signalling network is a conserved regulatory module involved in co-ordination of stem cell maintenance, cell differentiation and polarity establishment in animals, fungi and yeast. To date, no such signalling network has been identified in plants. **Zermiani *et al.* (pp. 69–89)** identify the RAM/MOR core components and transcriptional network in *Arabidopsis thaliana* by *in silico* analysis and visualize tissue-specific expression of some of its genes by *in situ* hybridization. The results suggest that the arabidopsis RAM/MOR pathway may be involved in stem cell maintenance and in cell differentiation in the shoot apical and inflorescence meristems and in pollen tube polarization.



Lysigenic PCD and schizogenously formed aerenchyma

doi:10.1093/aob/mcv067

Plant adaptation to submergence can include the formation of prominent aerenchyma to facilitate gas exchange. **Bartoli *et al.* (pp. 91–99)** investigate the ontogenesis of cortical aerenchyma in the stem of the aquatic macrophyte *Egeria densa* and find that formation of air spaces follows a well-orchestrated developmental programme, consisting of a combination of an early schizogenous differentiation mechanism and a late lysigenous process that involves programmed cell death (PCD). The PCD remodels the architecture of the gas spaces previously formed schizogenously, and also results in a reduction of oxygen-consuming cells and in recycling of material derived from the lysigenic dismantling of the cells. The stems of *E. densa* thus enhance their metabolic efficiency and achieve optimal adaptation to submerged habitats.

Genetic structure of Old World date palm

doi:10.1093/aob/mcv068

Date palms (*Phoenix dactylifera*, Arecaceae) are of great economic and ecological value to the oasis agriculture of arid and semi-arid areas. **Zehdi-Azouzi *et al.* (pp. 101–112)** investigate genetic diversity levels and population genetic structure by genotyping a collection of 295 accessions ranging from Mauritania to Pakistan using a set of SSR markers and a plastid minisatellite. A Bayesian clustering approach shows that the genotypes can be structured into two different gene pools: an Eastern pool, consisting of accessions from Asia and Djibouti, and a Western pool, consisting of accessions from Africa. The results confirm the existence of two ancient gene pools that have contributed to the current diversity of date palm.

Clonal integration in the forest canopy vs forest understorey

doi:10.1093/aob/mcv059

Clonal facultative epiphytes occur in both forest canopies (epiphytic habitats) and forest understories (terrestrial habitats), and clonal integration may be more beneficial in the more stressful and heterogeneous conditions in the canopy. **Lu *et al.* (pp. 113–122)** manipulate rhizome connections in the field in the facultative epiphytic rhizomatous fern *Selliguea griffithiana* (Polypodiaceae) and find that whilst integration is advantageous in both habitats, the effects on survival of single ramets and on ramet number and growth are greater in epiphytic habitats than in terrestrial habitats. The benefits of integration are mainly due to resource sharing, but increasing anchoring capacity may be an additional mechanism.

Intra-population variation in physical dormancy

doi:10.1093/aob/mcv069

Many studies investigate variation in initial seed dormancy, but this is a measure of little value in fire-prone ecosystems where initial dormancy levels are uniformly high. **Liyanage and Ooi (pp. 123–131)** use heat treatments and germination trials to assess intra-population variation in dormancy-breaking thresholds for five physically dormant shrub species (Fabaceae) from fire-prone vegetation. They find that instead of variation in initial dormancy, the species maintain different dormancy-breaking temperature thresholds among individuals growing in close proximity to each other. They conclude that differences found at the individual plant level could contribute to subsequent variation within the seed bank and provide a bet-hedging strategy, and represent a mechanism for increasing the probability of population persistence in the face of variability in the fire regime.