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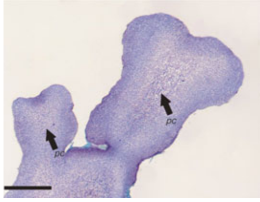
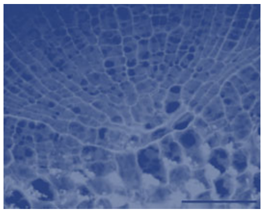
John Bryant takes a closer look at some of this month's Original Articles



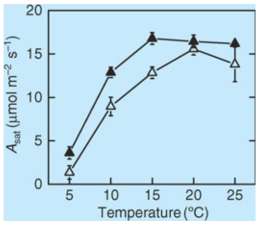
Position and picloram pull together in peach palm programme

Many of our readers will be unfamiliar with peach palm (*Bactris gasipaes*). It is native to Central America and northern South America and was widely cultivated by indigenous peoples before the arrival of European settlers, who ignored it, preferring crops with which they were more familiar. However, peach palm is coming back into favour and is regarded as having great potential, although it is listed by the International Plant Genetic Resources Institute (www.biodiversity.org) as a neglected crop. Nevertheless, breeding programmes are under way and, as aid to those programmes, there is also active research on tissue culture and micropropagation, as typified by the work of **Steinmacher *et al.* (Florianopólis and Manaus, Brazil, pp. 699–709)**. They used zygotic embryos as starting material for establishing callus cultures. A key part of their technique is the use of very thin (0·7–1·0 mm) explants. The main factors in the establishment of callus were the position from which the explant came (the shoot apex and the immediately sub-apical zone were best) and the presence of the auxin analogue, picloram at concentrations of 150–600 μM. Embryogenic potential was at its highest (43 %) in calli from apical explants cultured with 300 μM picloram. A good proportion of these embryogenic calli actually went on to form functional somatic embryos from which plantlets were established. The use of amplified fragment length polymorphism (AFLP) enabled the authors to compare the genomes of the cloned plantlets with their 'mother' plants, thus giving a possible indication of somaclonal variation. Most (92 %) of the plantlets were true to type, at least at the level of detection afforded by AFLP, whilst 8 % showed gain or loss of amplified fragments. It is obvious then that this thin-cell-layer technique is useful in micropropagation of peach palm, even though the authors state, rather modestly, that further optimization is needed.



RAMs and roots in fields

Generation of electrical activity is a feature of all plant cells and is involved in several aspects of plant growth and physiology. The ability of plants to maintain an electromagnetic field (EMF) has evolved against a background of the Earth's own EMFs and thus it is interesting to observe the effect on plant growth of changes in the 'electrical environment'. **Wawrecki and Zagórska-Marek, Wroclaw, Poland (pp. 791–796)** have applied DC electric fields of 0·5–1·5 V cm^{-1} to roots of *Zea mays* grown in liquid medium. Exposure was for 3 h and roots were then observed immediately and over the next 5 d. At 0·5 V cm^{-1} there was no observable effect on root growth or architecture but at 1·0 and 1·5 V cm^{-1} roots bent strongly towards the cathode. This was continued for about 24 h after switching off the electricity before the roots resumed normal gravitropic growth (although some of the roots exposed to 1·5 V cm^{-1} died after the electrical treatment). In addition to these obvious morphological effects, there were also effects on the architecture of the root apical meristem (RAM). *Zea mays* has a RAM of the closed type in which there is a clear junction between the root proper and the root cap. In treated roots, this junction became much less distinct over a period of 24–48 h from the end of the treatment. The process started with the occurrence of new periclinal divisions in first tier of the root body, giving a new layer of cells between the procambial cylinder and the root cap junction; these grew into the root cap, converting the organisation from closed to open. However, cells in the epidermis–cortex complex gradually became organized as a new junction, now deeper in the root, eventually restoring the closed type of architecture. Exposure to a low-level electric field, even for just 3 h, clearly disrupts normal patterns of cell lineage and differentiation and raises again the question of the significance of change in electromagnetic field as an environmental factor influencing plant development.



Good graft for cool cucumbers

The cucumber plants in my unheated greenhouse are currently fruiting prolifically. However, even at this stage, an unseasonably cold night can affect plant performance: *Cucumis sativus* is a cold-sensitive species. Its near relative, *Cucurbita ficifolia*, the figleaf gourd, is by contrast much less cold-sensitive. **Zhou *et al.* of Hangzhou, China and Barcelona, Spain (pp. 839–848)** have used the difference between the two species to study the role of root-to-shoot signalling in the response to chilling. A major part of their experimental protocol involved the use of *C. cucumis* shoots grafted onto *C. ficifolia* rootstocks. Chilling of *C. cucumis* affected significantly the rate of photosynthesis at saturating light; this effect being more marked when the root zone was chilled than when the shoot was chilled. Grafting onto the *C. ficifolia* rootstock did not affect the response to shoot chilling but ameliorated significantly the response to root chilling. In all other experiments, whole plants were subjected to the chilling conditions and, as expected, ungrafted plants showed, amongst other things, a reduction in carboxylation activity and in Rubisco content, while the concentration of reactive oxygen species in the leaves increased. Effects on the activities of ROS-scavenging enzymes were more variable. In all these respects, shoots that had been grafted performed better than self-rooted shoots: carboxylation activity and Rubisco content were less reduced, ROS accumulated to lower concentrations and activities of ROS-scavenging enzymes were higher. Further, in ungrafted plants chilling caused a very marked increase (nearly 50-fold) in the ABA concentration in root xylem exudate and a marked decrease in cytokinin concentration also. In grafted plants, there was a much smaller increase (approx. 10-fold) in ABA content and an increase in cytokinin content. These experiments throw more light onto the role of root–shoot communication in the response to chilling and suggest a way of increasing the tolerance to chilling in cold-sensitive plants.

No O spells death for bladdered prey

Carnivory has evolved several times in the plant kingdom, giving rise to the development of an amazing array of traps including pitchers, sticky glands and rapidly closing fly traps. However, spectacular as these may be, they cannot compete for complexity with the much smaller traps possessed by the bladderworts (*Utricularia* spp.), as discussed by **Lubomír Adamec at Třeboň, Czech Republic (pp. 849–856)**. In general, *Utricularia* species are rootless wetland plants that feed on small aquatic organisms. The prey are trapped when they trigger sensitive hairs around the trap-doors of tiny (1–4 mm long and 2–6 mm in diameter) water-filled bladders or utricles. These are maintained under negative pressure in relation to the surrounding medium so that when the trap-door is opened the prey animal, such as a protozoan or a small crustacean, is swept in by the inrush of water. Once inside, the prey dies but exactly how this happens is a mystery. One hypothesis is that prey are killed by anoxia and this has led the author carry out a very elegant series of experiments measuring oxygen concentrations in traps, using sensors linked to microprobes that were able to penetrate the bladder walls. Oxygen concentrations in traps were very low (up to 4·7 μM) and many were below the detection limit of the sensor (1·3 μM). By contrast, the aquatic medium exhibited O_2 concentrations of between 0·35 and 0·9 mM, so that when a trap was triggered the O_2 concentration inside the trap rose dramatically. However, the plant was able, within 20–100 min, to reduce this back to the very low values, presumably by a resumption of aerobic respiration. This has two implications. Firstly, the cells lining the traps must be tolerant of anoxic conditions, as must the organisms living commensally in the traps. Secondly, these data are consistent with the hypothesis under test, that the prey organisms die from lack of oxygen.

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