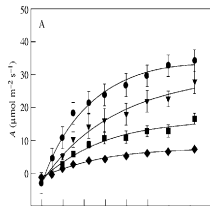


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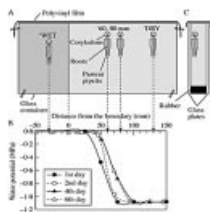
John Bryant takes a closer look at some of this month's Original Articles



Dry and salty: a recipe for reduced photosynthesis

There are several situations in which plants suffer from reduced availability of water. One of these is low soil water content and another is salinity where water uptake is impeded by highly negative osmotic potentials. Plants that grow in habitats in which they are exposed to both salt and drought are therefore exposed to double jeopardy. One such species is the shrub *Lycium nodosum*, a member of the Solanaceae, which grows in the coastal scrub communities in Venezuela. **Tezara and colleagues at Caracas (pp. 757–765)** report that plants may be exposed to salt both from the soil and from sea spray.

They are also exposed to very low soil water content during the dry season. The authors investigated plants growing in natural habitats varying in salt exposure in both the wet and dry seasons and greenhouse-grown plants exposed to individual 'stress factors': water deficit or salt spray or salt irrigation. Plants growing nearer the sea have more succulent leaves than those growing further inland and succulence was also induced in the greenhouse-grown plants that were exposed to salt spray or salt irrigation, suggesting that this feature is an adaptation to salinity. A further adaptation was osmotic adjustment, especially in salt-irrigated plants. In general, effects on photosynthesis were more severe for water deficit than for salinity but both factors eventually led to marked reductions in photosynthetic CO₂ fixation. Reduction in the rate of photosynthesis was, as may be expected, correlated with stomatal closure, but it was also clear that carboxylation efficiency was lowered. However, in contrast to some other plants, this was not caused by photo-inhibition (chlorophyll fluorescence ratios were unaffected, indicating tolerance to high irradiance), suggesting that there are metabolic factors that affect photosynthetic efficiency. Overall, the authors conclude that these responses 'allow the plants to maintain a positive carbon balance and growth in a stressful environment'.

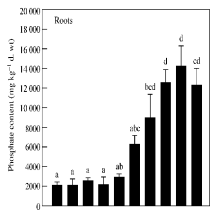


Roots go round the bend for water

Knowledge of tropisms, the growth of plant organs towards particular stimuli, goes back many years. And yet we are still far from having a complete picture of this set of responses. One of the difficulties is separating the growth patterns that result from two or more tropisms. Mutants that lack particular tropic responses are therefore very useful experimental models. It is exactly this approach that has been taken by **Tsuda and co-workers at Tokyo and Sendai (pp. 767–770)**. They point out that study of root hydrotropism is complicated by root gravitropism. Even for a plant as well-investigated as pea

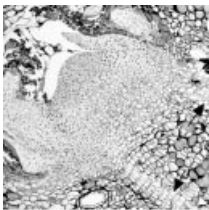
(*Pisum sativum*), there was no clear evidence for hydrotropism in the soil, although it had been shown in roots exposed to a humidity gradient in air. The authors tackled the problem in an elegantly simple set of experiments. Seeds of an agravitropic pea mutant were germinated in Petri dishes. They were then placed in open-ended glass tubes placed vertically in a glass-sided box containing vermiculite growth medium. The seedlings were positioned so that the roots had to elongate a further 15 mm before exiting from the glass tubes. In the growth medium, the authors set up a gradient of water potential simply by placing a block of wet vermiculite in contact with a block of dry vermiculite. Diffusion of water from wet to dry established the gradient. Roots emerging into completely dry or completely wet vermiculite exhibited no clear directional growth trends. However, most of the roots emerging into the zone of water potential gradient grew strongly towards the wet vermiculite. So pea roots really do exhibit hydrotropism. Furthermore this knowledge is of more than academic interest because, as the authors point out, an understanding of the interactions of hydrotropism and gravitropism in both main and lateral roots will lead to better planning of crop irrigation regimes.

Continued overleaf



Rusty reed roots reveal a complex response to iron

There is increasing interest in the use of biological systems to remediate contaminated land. This relies on the ability of particular organisms either to metabolize or to take up and immobilize the contaminant in question. ‘Low-tech’ but nevertheless effective versions of this are constructed wetlands and reed-beds used to treat land contaminated by heavy metals from mines and other industrial operations. However, even the most tolerant of plants eventually reach their limits. This is well illustrated in the paper by **Batty and Younger (University of Newcastle, UK, pp. 801–806)** on the iron tolerance of *Phragmites australis* (common reed). The authors grew *P. australis* in culture solution augmented with iron (as $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) at various concentrations. Concentrations of Fe above 1.0 mg L^{-1} increasingly inhibited plant growth whereas no ill-effects were observed at lower concentrations. Indeed, Fe at 0.5 mg L^{-1} or less actually stimulated root elongation growth. The question then arises as to whether the toxicity of higher concentrations of iron is direct, perhaps by interacting with membranes or enzymes, or indirect, for example by inhibition of uptake of other nutrients. The authors observed that at concentrations of 1.0 mg L^{-1} and above, a red plaque of iron oxyhydroxide formed on the roots and they considered it possible that this impeded uptake of phosphate. However, this idea was not born out by their data. Increasing iron concentrations led to a slight increase in the phosphate content of rhizomes and shoots but a very marked increase, especially above 2.0 mg L^{-1} Fe, in the phosphate content of roots. Much of this increase was not mobilised to rhizomes and shoots and the authors suggest that the excess phosphate was complexed with or trapped in the iron oxyhydroxide plaque. Nevertheless, even at these high Fe concentrations the phosphate content of all organs was adequate for growth. The search for understanding of this complex situation continues.



Down in the wood something stirs

It is not surprising that when we travel from continent to continent we will encounter very different floras. However, one feature that may surprise us is the different architecture of particular groups of plants. Thus, I was amazed when I stepped off a plane in Australia for the first time, at the different shapes of many of the trees, compared with those common in Europe and North America. **Burrows et al., from Wagga Wagga and Mount Annan, NSW, Australia (pp. 835–844)** remind us that 23 different architectural types have been reported amongst woody plants. They work specifically with *Wollemia nobilis*, a member of the Araucariaceae that exhibits atypical architecture. Most members of this family possess a single trunk with plagiotropic branches. If the main trunk is badly damaged it can be replaced by a bud outgrowth from lower down. However, *W. nobilis* exhibits both the formation of new branches from the base (coppicing) and from pre-existing stems and branches in the absence of damage, giving it a very different appearance from other species in the family. The authors have thus investigated the distribution of axillary meristems from top to bottom of small (2-m high) *W. nobilis* trees. Near the stem apex, the meristems are identified as clusters of dividing or potentially dividing cells but there is no differentiation of bud primordia or of vascular connections. However, the further down the stem the meristems are situated, the more they are differentiated, even though they are buried deeper beneath the bark. Thus, the meristems are not only maintained in the older parts of the stem but they are more and more able to grow into shoots, thus enabling the formation of new branches. The interesting question now is what stimulates the outgrowth of these branches. Is it just reduced apical dominance or is there also a specific signal?

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