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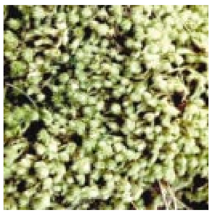
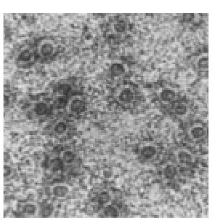
John Bryant takes a closer look at some of this month's Original Articles



Ions ward off acid attacks

In SO_2-polluted environments mosses and lichens growing on limestone buildings often fare better than those growing on other substrata. Similarly, some terricolous (soil-growing) mosses are confined to calcareous soils in polluted areas, but are more widespread in non-polluted areas. It has been suggested that ions taken up from calcareous soils may alleviate the effects of SO_2. However, this does not account for the survival of calcifuge species in SO_2-polluted areas. Thus, **Bharali and Bates (Imperial College, University of London, pp. 337–343)** investigated the role of soil cations in acid and alkaline soils in the response of mosses to bisulfite (HSO_3^-), the predominant form of SO_2 at acid pH. *Pleurozium scheberi*, a strict calcifuge and *Rhytidiadelphus triquetrus*, a facultative calcicole, were the two species used. In both there was an immediate and very marked depression of the rate of photosynthesis after the application of bisulfite, especially at more acid pHs. However, photosynthesis started to recover after 2 h and in the less severe instances of inhibition the photosynthetic rate approached that of control plants after about 10 h. Surprisingly, shoot elongation growth was little affected by weekly applications of sodium bisulfite except in *P. scheberi*, the strict calcifuge, when grown on calcareous soils. The recovery of the rate of photosynthesis and the lack of a significant effect of bisulfite on shoot growth are consistent with earlier suggestions that ions taken up from the soil may ameliorate the effects of bisulfite. Further evidence comes from experiments in which the mosses were pre-treated before application of the bisulfite: $FeCl_3$ ameliorated the photosynthetic inhibition in both species and $CaCl_2$ also did so in *R. triquetrus*, the facultative calcicole. The reasons for the amelioration are not clear (although some are proposed by the authors), but it is clear that these results pave the way for further interesting work.



From root to fruit with cytokinin

Cereal endosperm is arguably the most economically and socially important plant tissue in the world; amongst the cereals rice plays an especially significant role. It is therefore surprising that we know so little about the molecular and physiological controls of the development of this remarkable tissue although there are encouraging signs that this deficiency is now being addressed. The work of **Yang *et al.* (Universities of Yangzhou and Hong Kong, pp. 369–377)** is an interesting example of this growing focus. The authors studied six rice genotypes differing in their pattern of endosperm cell division. In three genotypes, early endosperm divisions were synchronous and rapid in both superior and inferior spikelets which developed at the same rate. In the other three, divisions were asynchronous and proceeded more slowly; endosperm development in superior spikelets preceded that in inferior spikelets. Rigorous assay of cytokinins in the endosperm revealed the presence mainly of zeatin and zeatin riboside. With cell division rates and cytokinin contents known throughout the period of endosperm development in all the genotypes, it was possible to use this large data set to plot cell division rate against zeatin plus zeatin riboside content. The correlation was remarkable ($r = 0{\cdot}95$) suggesting that in this real tissue cytokinins may be involved in the regulation of cell division, just as they are in cultured cells. But what is the origin of these endosperm-located cytokinins? The authors do not answer this question directly. However, they show first that the endosperm concentrations of zeatin plus zeatin riboside are strongly correlated with their concentrations in roots, and secondly that application of exogenous cytokinins to roots stimulates endosperm cell division (application to leaves or panicles was much less effective). These results are thus consistent with a role for cytokinins made in roots in the regulation of endosperm cell division.

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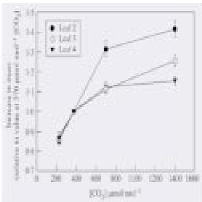

Shedding light on CO_2 at night

There has been extensive discussion about the effects on plants of elevated night-time CO_2 concentrations. Some investigators report an inhibitory effect on respiration, while others do not find this. If night-time respiration is inhibited, is this beneficial (e.g. less loss of photosynthetically fixed carbon) or harmful (e.g. less energy for essential processes)? The careful work of **James Bunce (USDA-ARS, Beltsville, pp. 399–403)** has helped to answer these questions. He studied the effects of night-time CO_2 concentrations on respiration and dry matter accumulation in soybean. The key to his success was the use of very many, very similar plants kept in a strictly controlled environment. In the day, plants were supplied with 350 μmol mol^{-1} CO_2. At night, the concentration range was 220–1400 μmol mol^{-1}. The results are abundantly clear: increasing the CO_2 concentration led to a decrease in respiration rate (respiration rates at the highest CO_2 concentration were about 80 % of those at the lowest). Daytime photosynthesis was also inhibited by high night-time CO_2 concentrations, even though all plants were exposed to the same daytime CO_2 concentration. However, increasing night-time CO_2 concentrations also led to an increase in leaf dry matter, measured over a 3-d period, especially in leaf 2 (despite the inhibition of photosynthesis). Calculation of mean net CO_2 exchange rates during the day and night, coupled with measurement of increases in leaf dry matter, enabled the author to estimate translocation rates. Remarkably, the inhibition of translocation by increased CO_2 concentrations matched very closely the inhibition of respiration. The author neatly brings most of these data together by suggesting that the increases in leaf dry matter occur because of an inhibition of translocation, and the latter results from the inhibition of respiration by high CO_2 concentrations (less energy available to bring about translocation).

Branching out or staying in: it's all a matter of hormones

It is likely that many readers of this journal were introduced to auxin physiology in class experiments on apical dominance. The restoration by auxin of the apical inhibition of axillary bud outgrowth in decapitated *Phaseolus* seedlings is a simple experiment that 'works' even with large classes of first year students. However, our more thoughtful students may point out that some familiar species do not exhibit strong apical dominance; those of us who grow tomatoes will agree with them. Similar variations in apical dominance occur between tree species, and these variations are particularly apparent in comparing proleptic and sylleptic branching. In proleptic branching, exhibited by many trees in temperate regions, buds remain dormant during their season of formation and grow in the following year. In sylleptic branching, the buds grow out during the season in which they are formed. This is common in tropical trees but also occurs in some temperate genera, including *Populus*, as described by **Cline and Dong-Il (Ohio State University, pp. 417–421)**. They worked on three clones of hybrid *Populus* that exhibited very different degrees of sylleptic branching. Saplings of each clone were decapitated and the shoot apices were replaced with auxin applied in lanolin paste. The clone exhibiting the highest degree of sylleptic branching was the least subject to auxin inhibition (and *vice versa*), leading the authors to suggest that the degree of sylleptic branching may be inversely correlated with auxin sensitivity. Furthermore, there were also indications that clones with the highest degree of syllepsis showed the greatest response (in terms of bud outgrowth) to cytokinin applied to dormant buds. The authors conclude that 'The . . . data are consistent with the hypothesis that auxin and cytokinin . . . play repressive and promotive roles . . . in the sylleptic branching of . . . poplar.' This is very reassuring for those of us who teach plant physiology!