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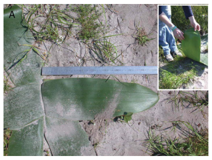
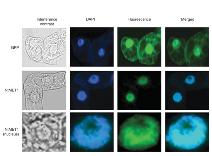
John Bryant takes a closer look at some of this month's Original Articles



Flat out to modify carbon 'footprint'

Some growth forms adopted by plants are highly characteristic of particular habitats. **Cramer *et al*. (Universities of Cape Town, South Africa and Western Australia, pp. 835–844)** highlight the phenomena in respect of the winter-rainfall regions of South Africa. Many species of this habitat are geophytes whose aerial parts exhibit a very unusual prostrate growth habit causing the leaves to lie flat on the ground, a feature that is extremely rare in the rest of the world. What is the advantage of this prostrate growth form in this habitat? One possibility is that the plants may supplement photosynthetic fixation of atmospheric CO_2 with CO_2 from the soil. The authors have tested this with *Brunsvigia orientalis*, comparing photosynthesis in prostrate leaves with that in leaves that were fortuitously held aloft by surrounding vegetation. Leaf anatomy would certainly allow fixation of CO_2 derived from chemical and biotic processes in the soil. The underside of the leaves possesses about 22 % of the total leaf stomata and the lower and upper surfaces of the leaf are connected via extensive lysigenous air channels. These provide a route for CO_2 taken up through the lower surface to reach the cells exposed to the sun in the upper half of the leaf. Direct measurement of CO_2 uptake showed that between 20 % and 30 % entered via the lower surface in prostrate and in 'propped-up' leaves. However, comparison of $\delta^{13}C$ abundances in CO_2 assimilated via the upper and lower surfaces of propped-up and prostrate leaves showed that only about 7 % of the photosynthetically fixed CO_2 in prostrate leaves came from the soil. This is certainly a measurable contribution to the plant's carbon economy and, combined with the ability to assimilate CO_2 from the 'air pocket' beneath the leaf with little or no transpirational water loss, is very likely to be advantageous.



Mitotic movement of mystery methylase

One of the mechanisms that contributes to the regulation of gene activity is DNA methylation at cytosine residues in CpG dinucleotides. These methylated sites may be maintained through DNA replication by methylation of the complementary GpC in the daughter strand, catalysed by type 1 methyltransferases (MET1). **Kim *et al*. (Nara, Japan, pp. 845–856)** have investigated MET1 in tobacco (*Nicotiana tabacum*). They obtained the cDNA encoding the enzyme and used a baculovirus vector to express it in an insect cell line. The purified enzyme was assayed with both hemi-methylated and unmethylated DNA but showed no methylase activity with either target. The reasons for this are not clear but it is possible that the folding of the over-expressed protein resulted in the active site being masked by intramolecular interactions. In order to find out whether the protein expressed from cDNA was active *in planta*, the authors over-expressed it in tobacco. Surprisingly, the plants over-expressing the enzyme showed less DNA methylation than control plants. This was not caused by multi-copy suppression of gene expression. Rather it seems that the presence of excess enzyme suppressed the activity of that expressed from the plant's own genome. Nevertheless, the location of MET1 during the cell cycle is consistent with it being involved in some way with DNA. It is located in the nucleus during 'interphase', including S-phase, but is present mainly in the cytoplasm during mitosis, especially metaphase. This pattern is similar to that exhibited by Ran GTPase, with which MET1 was shown to interact physically. In a previous paper (Yano *et al.*, *Annals of Botany* **98**: 1179–1187), the same research group showed that Ran GTPase interacted with a methyl-CpG-binding protein and with that protein was implicated in chromatin movement. It is thus possible that MET1, in addition to its still unconfirmed methylase activity, also has a role in the dynamic behaviour of chromatin.

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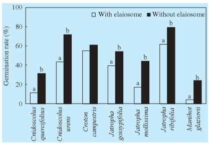

Getting a handle on ants' activities

Seed dispersal by ants (myrmecochory) is a feature of sclerophyll ecosystems in different parts of the world, but, as discussed by **Leal *et al.* (Recife, Brazil and Kaiserslauten, Germany, pp. 885–894)**, little is known of its importance in Brazil's Caatinga ecosystem. This consists of patches of seasonally dry forest and sclerophyll vegetation. Although some seeds may be fortuitously dispersed by ants, it is generally held that seeds adapted for myrmecochory possess an appendage, the elaiosome. This is believed to serve two functions. First, it may be used as a handle enabling the ants to carry the seed to the nest. Secondly, it provides food for the ants. After consumption of the elaiosome, the 'cleaned' seed is discarded. The authors' initial observations revealed that seeds of approx. 25 % of the woody species in this region were 'manipulated' by ants but only about half of these, nearly all members of the Euphorbiaceae, exhibited true myrmecochory. In some of these species, myrmecochory was preceded by ballistic discharge. For further study of ant–seed interactions, the authors set up a 100-m transect and placed seeds of seven of the myrmecochorous euphorbs along it at 10 m intervals. Subsamples of seeds had their elaiosome removed prior to being placed. Seeds were set out at 0700 h and ant behaviour was observed at intervals until 1800 h. Ants collected and transported eliaosome-bearing seeds at twice the frequency of elaiosome-less seeds. Of the seeds picked up by ants, over 80 % were eventually discarded on nests; dispersal distances ranged from a few centimetres to over 11 m. Perhaps surprisingly, the ants only removed elaiosomes from about one-third of the seeds transported to the nest. This is important because in greenhouse experiments, removal of the elaiosome led to a 30 % increase in germination. Further, in all the plant species tested, percentage germination was higher in soil from ants' nests than in soil from random sites.

Rapid take-off to evade bank robbers

Amongst the hazards faced by seeds in natural seed banks is consumption by herbivores and attack by pathogens. It is this latter situation that has interested **Beckstead *et al.* (Spokane and Provo, USA, pp. 907–914)**, focusing on *Pyrenophera semeniperda*, a pathogen that invades seeds of the grass *Bromus tectorum*. Newly shed seeds of *B. tectorum* are dormant, and require a period of warm, dry weather before they will germinate. Thus, the seeds do not germinate in summer but do so in the wetter autumn weather. However, some seeds fail to germinate even then, especially in drier habitats. Instead, they may become secondarily dormant or simply remain ungerminated until the spring, the two classes contributing to the 'carry-over' seed bank. Thus, there are banks of *B. tectorum* available as hosts or as food, especially in drier habitats. The authors studied the effects of artificial and natural inoculation with *P. semeniperda* on seeds varying in primary dormancy and natural inoculation of seeds in the carry-over seed bank. The results showed that seeds that germinate slowly were much more likely to be killed by the pathogen in both artificial and natural inoculations than seeds that germinate quickly. Thus, a large proportion of a fully after-ripened seed population, in which nearly 100 % of the seeds germinated between day 3 and day 5 of incubation, escaped the pathogen whereas slower germinating populations suffered significant losses. Further, banked seeds were much more vulnerable to the pathogen than unbanked seeds while seeds in drier habitats were up 50 times more likely to be killed than seeds in mesic habitats. Finally, the authors note that *B. tectorum*, introduced into the USA from Europe in the late 19th century, is an invasive nuisance. Their data, taken with those of other groups, suggest that *P. semeniperda* may be used as a 'bio-herbicide', reducing significantly the number of *B. tectorum* seeds that are able to germinate.

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