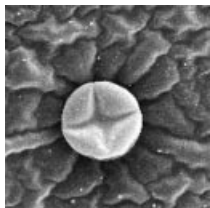


# ContentSelect

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

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## Basil puts on sun-block to screen out UV-B

Imagine a tomato salad: sliced tomatoes, drizzled with olive oil and vinegar, sprinkled with black pepper and freshly torn leaves of basil, and even accompanied by slices of mozzarella — delicious! But wait, is the basil perhaps less aromatic or flavoursome than usual? If so, it may have been grown under glass or plastic rather than out of doors. Sweet basil, *Ocimum basilicum*, is an important herb and a source of plant oils. It is a complex mixture of the latter that gives the herb's aroma and flavour. Different cultivars differ in the detail of their oil composition, but in general terpenoids are the major class of compound while some varieties also contain significant amounts of phenylpropanoids. A very interesting piece of work carried out by **Daphne Ioannidis and colleagues (Mediterranean Agronomic Institute of Chania, Crete and University of Reading, UK, pp. 453–460)** has demonstrated the essential role of exposure to UV-B in the production of these oils. They grew plants under glass (which screens out UV-B) at both Reading and Chania; for experimental treatments, the light was supplemented with UV-B giving a daily exposure equivalent to that received 'on a summer's day in the Mediterranean'. The results were very clear. Developing leaves produce more essential oils than mature leaves, but in both significantly larger amounts are produced in plants exposed to UV-B. Furthermore, this is not just an effect on biochemical production: development of the oil glands themselves is stimulated by UV-B. In control plants many of the glandular trichomes fail to fill properly and do not burst. By contrast, plants grown under supplementary UV-B exhibit filling and then bursting of the glands, releasing a 'volatile shield' that is thought to contribute to the protection of leaves against exposure to ultra-violet radiation. The lesson for herb growers is clear: UV-B is not all bad!

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## New advice: keep your powder wet

Conservation of endangered species has many facets ranging from prevention of habitat loss to maintenance of what is loosely called germplasm. It is this latter aspect that is the concern of **Luis Quintanilla et al. (Madrid and Santiago de Compostela, pp. 461–467)**. They are working with five fern species (*Culcita macrocarpa*, *Dryopteris aemula*, *D. corleyi*, *D. guanchica* and *Woodwardia radicans*) that occupy particular habitats in the sub-tropical islands of the eastern Atlantic and in parts of southern Europe, including regions of Spain. The ferns are rare because of their habitat and geographical requirements. They are also under threat because in mainland Spain their habitat is considered ideal for commercial growth of *Eucalyptus globulus*. The authors have studied the germinability of the spores of these ferns in relation to storage conditions to optimize conditions for germplasm maintenance. In comparison with knowledge of angiosperm seed physiology, very little is known about fern spores. Some attempts at storage of fern spores have followed the practice used for many crop plant seeds, i.e. they have been stored under very dry conditions. However, what may be good for seeds may not be good for spores. In all five species, wet storage preserved spore viability better than dry storage, although in the three *Dryopteris* species, dry storage was nearly as effective as wet storage. Temperature was also important: in wet storage, 20 °C was a more effective temperature than 5 °C (but spores of *W. radicans* actually germinated at 20 °C in darkness), whereas in dry storage the reverse was true. Wet storage at –20 °C was lethal for spores of all species whereas dry storage at this temperature had variable effects but was only totally lethal for *C. macrocarpa*. The authors have thus made a good start in defining optimum conditions for preservation of spore viability in these threatened species.

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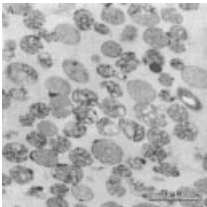
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### Protein-rich reward pulls the pollinators

Orchids never cease to amaze when it comes to interaction with their pollinators. In describing those interactions we use terms such as attraction, deceit and reward, which may equally apply to human interactions. In respect of reward, no orchid allows its pollinators to obtain pollen, because the pollen is contained in pollinia and is inaccessible to the pollinating insect. However, there are several genera of orchid that provide a pollen-like reward in the form of 'pseudopollen'. **Davies *et al.* (University of Wales, Cardiff and Kew Gardens, pp. 477–484)** have made an extensive study of pseudopollen production in the large genus *Polystachya*. Pseudopollen originates from food hairs situated on the flower's labellum. 'True pseudopollen' (as the authors call it) occurs when these food hairs fragment during floral maturation to form individual cells that may, in general appearance, resemble pollen. This study suggests that true pseudopollen is confined to just one taxonomic section within the genus. However, in many species of *Polystachya*, food hairs do not break into individual cells but become detached as complete structures. To the unaided eye both appear as a floury powder on the labellum, but they are readily distinguished under the microscope. Chemical analysis of both types reveals that the main nutrient is protein although in many species starch-containing amyloplasts are also present. The authors note that pseudopollen and/or food hairs occur in several orchid genera, and based on the relationships between those genera they conclude that these features have evolved several times within the Orchidaceae. It has not yet been possible to show how effective pseudopollen is in attracting pollinators but it is reasonable to conclude that the cost of laying down nutrients in food hairs surely must confer an advantage. The attraction of pollinators as part of the reproductive strategy is likely to be involved in that advantage.

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### Mitochondria give mixed messages about cell death

Programmed cell death (PCD) occurs in plants and animals as part of particular developmental processes and in response to various stimuli including abiotic stresses. The best characterized form of PCD is apoptosis in animal cells. In one of the signalling pathways that regulate apoptosis, cytochrome *c* leakage from the mitochondria leads to activation of the apoptotic proteases. The leakage of cytochrome *c* can occur either non-specifically via the mitochondrial permeability transition pore (opening in response to calcium-induced mitochondrial swelling) or, more specifically, via a channel formed in response to an apoptosis-inducing protein such as BAX. There is disagreement in the literature as to whether any forms of PCD in plants resemble apoptosis. For example, do plant mitochondria behave in a similar way to animal mitochondria? The paper by **Virolainen *et al.* (Helsinki University, pp. 509–516)** addresses this question. In plants that cannot adapt to anoxia, exposure to low oxygen tension may lead to PCD. This group have therefore studied the effects of anoxia on mitochondria from wheat roots, and have revealed a complex situation. Anoxia initially causes a loss of membrane potential, shrinkage of the matrix and efflux of  $\text{Ca}^{2+}$ . However, if high concentrations of  $\text{Ca}^{2+}$  are present externally, the mitochondria exhibit some re-uptake of  $\text{Ca}^{2+}$  (the extent of which is limited by the lack of oxygen) followed by swelling and efflux of cytochrome *c*. This is consistent with observations that cytochrome *c* release occurs in some forms of PCD in other plants. However, before concluding that cytochrome *c* from mitochondria is part of a signalling pathway leading to PCD in anoxic wheat roots, we need information on the calcium status of the root cells themselves; we also need to know what happens 'downstream' of the cytochrome *c* efflux. Clearly there is interesting and valuable research still to be done.