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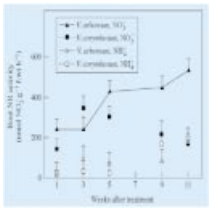
John Bryant takes a closer look at some of this month's Original Articles

Sprinting pollen prepared for quick start

Many of us are interested in sporting records but it is not only sport that provides records of note. The natural world also has its share of record holders that are every bit as fascinating as their human counterparts. Thus, **Stone *et al*. (Murdoch University and University of Western Australia; pp. 369–378)** comment that pollen tube elongation rates vary enormously between species; *Zea mays* exhibiting one of the fastest previously recorded *in vivo* rates (2.7 μm s^{-1}, reducing to 1.14 μm s^{-1} *in vitro*). However, maize pollen is positively sluggish compared with that of *Conospermum* species (family Proteaceae). The authors have studied the germination *in vitro* of *Conospermum* pollen, revealing the unusual (but not unique) feature of the emergence of not one but up to three pollen tubes. The emergence of multiple tubes also occurs in pollen germinating *in vivo*. The two pollen nuclei travel in one of the tubes but the 'empty' tubes also continue to grow. And it is the extension rate of the tubes that is particularly remarkable. The rate recorded during the first few seconds after emergence *in vitro* is extraordinarily high: some tubes achieve 55 μm s^{-1}! The authors suggest that this early growth is much too fast to be dependent on concurrent biosynthesis of cell wall components and conclude that ready-made stock must be available to enable this 'quick get-away'. After the rapid start, the rate of extension then declines to about 2 μm s^{-1}. This overall rate (which is still fast for *in vitro* conditions) is achieved by a series of very short growth spurts (several per second) as revealed by video microscopy. What controls the bursts is not known, but the authors showed that they were not affected by calcium channel blockers. So, even though the system is not fully understood, we can only be truly amazed by the extraordinary growth rates of these pollen tubes.



Blueberries battle for nutritious nitrogen

Vaccinium corymbosum (high blueberry or swamp blueberry) is one of several *Vaccinium* species cultivated in the USA for their fruit. Unlike most agricultural and horticultural crops, cultivated *Vaccinium* species are very selective in respect of soil type. **Poonnachit and Darnell (University of Florida, Gainsville, USA; pp. 399–405)** describe the ideal soil for *Vaccinium* as acidic (pH 4·0–5·5), with a high level of organic matter, readily available iron and ammonium-nitrogen. At higher pH values, uptake of both iron and nitrogen is limited and growth is poor. However, it would be very helpful for growers if the plants could be produced that are more versatile. To help achieve this end it would thus be useful for breeders if a related species more tolerant of a range of soil types could be found. Accordingly, the authors have looked at a species, *V. arboreum*, which shows adaptation to a wider range of soils than most other members of the genus. They demonstrate its ability to grow in soils just on the acid side of neutral, with low iron content and with nitrogen mainly in the form of nitrate. Although both species actually prefer ammonium as a nitrogen source, *V. arboreum* is able to utilize nitrate much more efficiently than *V. corymbosum.* Paradoxically, both show increased root nitrate reductase activity in response to nitrate but, in *V. corymbosum,* the activity declines again after 3 weeks. With respect to iron, *V. arboreum*, despite its ability to grow on soils with low iron content, does not appear to possess any specific adaptation to iron deficiency, whereas in *V. corymbosum* ferric chelate reductase activity increases under iron deficiency. This results in increased iron uptake on return to iron-sufficient conditions. There was no discernible direct connection between iron and nitrogen metabolism, despite the presence of iron in the nitrate reductase enzyme. The authors conclude that the adaptation of *V. arboreum* to a wider range of soil types is related to its greater ability to utilize nitrate.

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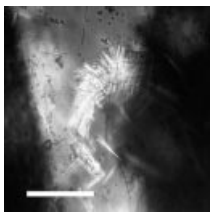

Raphide revisitation reveals relationships

The synthesis and accumulation of oxalic acid and/or calcium oxalate occurs in many species distributed throughout the plant kingdom. In monocots, calcium oxalate is most often laid down and usually as bundles of needle-shaped crystals known as raphides. **Scott Zona (Fairchild Tropical Gardens, Miami, Florida, USA; pp. 415–421)** states that raphides are ubiquitous in palms, and quotes from earlier literature to show that they are deposited in roots and in all the aerial parts of the plant. However, this is not the whole story because it had been previously noted that raphides also occur in the embryos of some palms. This has led the author to carry out a survey amongst 127 taxa of palms to determine the distribution of embryo-located raphides. This work, combined with a more limited data set from an earlier author, gave a survey covering 148 taxa. Embryos were dissected out from fresh or preserved seeds, stained in toluidine blue and examined under the microscope. The author comments that if raphides were very abundant they could be detected under normal light, but their presence became much more obvious under polarized light. Raphides were classified as absent, scarce, present or abundant and the distribution of species in these categories was compared with the current taxonomy of the palms. The occurrence of embryonic raphides was clearly not random within the palm family; in particular, they were very scarce in two subfamilies but very abundant within two tribes of a third sub-family. The author suggests that this relatively simple molecular feature may be a further aid in studying the evolution and taxonomy of the palms. Finally, the question of the function of embryo storage of calcium oxalate is discussed. The author considers it unlikely to be an anti-feedant in embryos. It is more likely, he suggests, to be a storage compound.

Pollen participates in fruity features

Several 'vine-cacti' are now grown in different parts of the world as commercial crops. In Israel, vine cacti are cropped despite the absence of natural pollinators and the need for hand pollination since the species in question is an obligate outbreeder. This inconvenience has spurred **Mizrahi *et al.* (Ben-Gurion University, Beer-Sheva, Israel; pp. 469–472)** to study the effects of pollen source on fruit development. The major vine-cactus genera grown in Israel are *Hylocereus* and *Selenicereus.* Amongst the cultivated species, there are no cross-fertilization barriers within each genus, or between the two genera. Taking pollination of *H. polyrhizus* as an example, the authors' data clearly show that other *Hylocereus* species and *S. grandiflorus* are equally effective pollinators: stigmatic receptivity and pollen tube growth rates are very similar. However, there are obvious effects of the source of pollen on fruit development. This is particularly apparent in the different growth and ripening rates of fruit following fertilization by pollen of different species, even when the fruit are growing on the same plant. Thus, for both *H. polyrhizus* and *S. grandiflorus*, pollination by *H. undatus* leads to earlier ripening but smaller final fruit size than pollination by *S. grandiflorus*; the fruit ripening characteristics tending to mimic those of the pollen parent. However, these effects of pollen source are manifest in tissues that are totally maternal in origin: the male parent does not contribute any genetic material to parts of the fruit that show these effects. This is therefore an example of the phenomenon known as metaxenia. The mechanisms involved in metaxenia, which has been described only for a handful of other genera, are unknown. Nevertheless, the authors note that this phenomenon may be commercially useful since it makes it the possible deliberately to manipulate the time of fruit ripening as a mean of regulating the supply of fruit for the market.

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