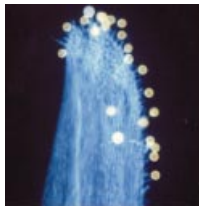


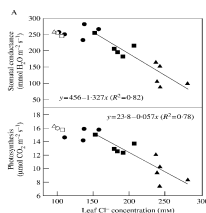
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John Bryant takes a closer look at some of this month's Original Articles



Having it both ways: outbreeding and inbreeding

When it comes to sex, angiosperms present a wonderful array of breeding systems ranging from apomixis (no sex at all) to obligate outbreeding with all possible variants in between. Indeed, individual genera may contain species exemplifying several types of breeding system. One such genus is *Silene*, highlighted by **Buide and Guitián (University of Santiago de Compostela, pp. 691–699)**. Their paper focuses on *S. acutifolia* and particularly on the phenomenon of dichogamy, the separation in time of anther dehiscence (and hence pollen availability) and stigma receptivity. It occurs in many species possessing hermaphrodite flowers in which it is perceived to be a barrier to inbreeding. In individual flowers of *S. acutifolia*, anthers dehiscence before stigmas are receptive, with pollen viability declining to a very low level within 48 h of their release. Thus, it would be expected that flowers would not be self-pollinated. However, the flowers within an inflorescence do not open synchronously: within one inflorescence there is enough overlap between pollen availability and stigmatic receptivity to allow some self-pollination. Furthermore, as the authors show, there is no self-incompatibility barrier to pollen germination, fruit set being as efficient with self- or non-self-pollination. The disadvantage of self-pollination becomes apparent at seed set which declines to about one-third of the level achieved in non-self-pollinations. Thus, although the self-compatibility index is high (0.98 %), the self-fertilization index is rather lower (0.36 %), and this difference is seen both in natural and forced self-pollinations. The authors could detect no evidence of inbreeding depression, at least in respect of seed fitness. Thus, the overall effect of dichogamy in *S. acutifolia* is to reduce the probability of seed set from self-pollination without eliminating it completely. The selective advantage of this 'both ways' breeding system may well be to ensure some seed set in small or scattered populations.



Well-salted carrots

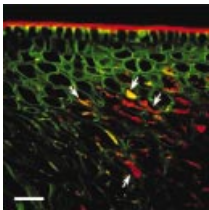
Salinization is a problem in irrigated land. However, it can also occur as a direct result of drought, e.g. in the south-eastern USA where decreased river flows in summer 2002 led to increases in tidal flows of sea water up river. Despite its importance in many regions of the world, we know very little about the effects of increased salinity on many crop species. This has led **Gibberd and colleagues (CSIRO, Western Australia and CSIRO, Victoria; pp. 715–724)** to investigate the responses to salt of carrot, a widely grown cash crop. They exposed plants to NaCl concentrations from 1 to 80 mM and monitored ion uptake, gas exchange and photosynthesis. At all concentrations, plants took up Cl⁻ and transported it to the leaves. This uptake and transport was tightly regulated, and even an increase in NaCl concentration from 1 to 80 mM led to only a 1.5-fold increase in shoot Cl⁻ concentration. In contrast, Na⁺ uptake and accumulation were more closely related to external NaCl concentrations, although there was clearly some ability to exclude Na⁺, the shoot concentration of which increased by about seven-fold in an 80-fold increase in NaCl concentration. Effects on gas exchange and photosynthesis were observed at external NaCl concentrations as low as 8 mM. At 80 mM NaCl, both were reduced very significantly. At the highest salt concentrations, there was evidence of impairment of both RuBP carboxylase and photosynthetic electron transport. However, effects on growth and yield were less dramatic, possibly indicating some ability to compensate for decreased photosynthesis. There was no decrease in yield at salt concentrations below 20 mM, but above this a 7 % reduction occurred for every 10 mM increase. The authors suggest that for NaCl, carrot is 'in the upper range of the sensitive class'. Overall, the paper shows the importance of careful analysis in assessing the effects of salinity on crop growth.

Continued overleaf



Falling fruit or filling fruit

‘Just look at the fruit on that!’ exclaimed my companion, a distinguished plant physiologist for whom the internal transport logistics of plants holds a strong fascination. At the time, we were looking at a date palm and the point he went on to make was that a large amount of material is needed to be transported over relatively long distances for the fruit to grow to maturity. Just this problem has been investigated by **García-Luis *et al.* at Valencia (pp. 755–764)** but working with clementines (*Citrus clementina*) rather than with dates. In this species, a significant proportion of the ovaries are shed after anthesis but before fruit set. Later, abscission of fruitlets takes place, and by fruit maturity only a small proportion of the original flowers (7 % in this instance) are retained as fruit. Pedicel vascularization occurs early in fruit growth and the phloem reaches its maximum cross-sectional area at the end of the main fruitlet abscission phase. Xylem continues to expand and to undergo thickening rather longer, concomitant with the need for increasing support as the fruit enlarge. Then come the key questions: are either the fate of the fruit (abscission or maturation) or the rate of dry matter accumulation in maturing fruit limited by the phloem in the pedicel? Dealing with the second question, removal of 37 % of the phloem by girdling increased the specific mass transfer in the remaining phloem but caused no decrease in fruit growth rate. Thus, the phloem responded to the growth pattern of the fruit rather than the reverse. In respect of the first question, the authors state in their discussion that the ‘fate of developing fruitlets is determined early in their development’ and indeed may already be determined at the time of flowering, an intriguing statement that clearly calls out for more research!



Orange rind damage is self-inflicted

Supermarket shoppers are familiar with beautiful displays of unblemished fruit, carefully presented to induce purchase. However, these high standards can cause problems for growers who may be unable to avoid the conditions that cause surface damage. One such condition is oleocellosis, a specific type of lesion in orange rind resulting from exposure to oils produced by the rind itself. In nature, excessive release of rind oils may occur because of damage of various types, but undamaged fruit may also suffer as a result of contact with damaged fruit. But how exactly is the damage caused? **Knight *et al.* (University of Adelaide, pp. 765–773)** have subjected oranges to controlled rind damage and have also applied rind oil externally (to mimic the effect of contact with damaged fruit). They then examined, in detail, the structure of cells in the layers of rind tissue. Mechanical damage caused breakage of the oil glands beneath the epidermis and leakage of oils into the underlying cell layers, which collapsed within 12 h. Application of oil to the rind caused damage to the epidermis, followed by discolouration, and more severe damage to the underlying layers. The first ultrastructural changes in membrane integrity were observed within 30 min and may be associated with the ability of the oil to enter and accumulate in the cells. Loss of membrane integrity also led to a breakdown in compartmentation prior to total cell collapse; enzymes such as polyphenol oxidases may be released with the potential to contribute further to discolouration of oil-damaged epidermis. Oleocellosis typifies situations in which a toxic compound arrives in the wrong place, thus causing self-harm. This is interesting in the context of natural selection but perhaps we might also say retailers have imposed an *un-natural* selection against this phenomenon.

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