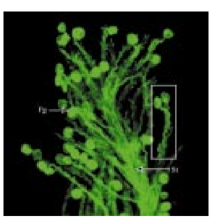
Content*Select*

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

The bitter harvest of self-inflicted wounds

Formation of bulky fruits relies on good transport mechanisms from source to sink. However, there is evidence from some species that these transport mechanisms may not be as efficient as we might suppose. Apples, for example, may be prone to a range of conditions that result from calcium deficiency, e.g. bitter pit. This implies that the transport of calcium is hindered in some way. As is pointed out by **Drãzeta and colleagues (Palmerston North and Havelock North, New Zealand, pp. 275–282)** calcium is a xylem-transported element and it is well-known that xylem becomes dysfunctional during fruit development. They therefore studied this progressive loss of xylem function to determine whether there are differences between apple varieties that differ in their proneness to bitter pit. The varieties selected were 'Braeburn' and 'Granny Smith', the former being the more susceptible. Previous studies had already shown a decline in calcium accumulation that was correlated with decline in xylem function. In this study, the authors used transport of dye to study xylem function and showed that xylem dysfunction worked its way back from within the fruit towards the stalk and that the primary bundles were particularly affected. Especially interesting was the finding that in 'Braeburn', the susceptible variety, loss of xylem function occurred significantly earlier than in 'Granny Smith'. Indeed in the latter variety there was still some xylem function in ripe fruit. But why does the xylem become dysfunctional? Microscopic examination of damaged xylem and of the parenchyma of the growing fruit leads the authors to suggest that the rapid growth of the fruit causes stress-deformation and finally breakage in the xylem vessels, which then collapse. There still remains the puzzle of why the phloem in the same bundles remains functional. Nevertheless, these data demonstrate clear correlations between fruit growth, xylem damage, calcium transport and susceptibility to bitter pit.

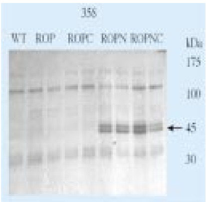


Taking steppes towards grass breeding

Readers of a general botanical journal such as this have the advantage of being made aware of the huge, often surprising and always interesting variety of plant life. This variety is even apparent within the very small proportion of plants that are directly exploited by humankind. An example of this is seen in the paper by **Huang *et al*., (Beijing and Fuzhou, China, pp. 295–301)**. They describe a perennial rhizomatous grass, *Leymus chinensis*, that is widely distributed in the Asian steppes but, I confess, a species of which I had not heard prior to reading this paper. The authors describe the grass as being very stress-tolerant with ideal qualities for grazing and forage production, and for stabilisation of soils in arid areas. Its general usefulness makes it a suitable target for breeding programmes but these are hindered by the grass's low sexual fecundity (in contrast with its very efficient vegetative propagation). The authors have therefore investigated the breeding biology of this obligate out-breeder in a natural population in inner Mongolia. In this population, in 2002 flowering occurred over a period of 5 d at the end of June. A major peak of pollen release from the hermaphrodite flowers occurred in the late afternoon. The newly released pollen showed a relatively low viability (62 %), as indicated by staining with 1,2,3-triphenyl tetrazolium chloride and the pollen rapidly became inviable after about 3 h. Further, the stigmatic surface also quickly lost its receptivity to pollen so that within about 3 h from anthesis the pistil was effectively non-functional. Even with these limitations approx. 87 % of the pistils were pollinated. However, successful pollination did not lead necessarily to successful seed set which exhibited a maximum of 36 %. The reason for this discrepancy between pollination and seed set was not clear. Further investigation of *L. chinensis* breeding biology is obviously warranted.

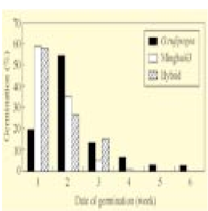
Continued overleaf

Peptides fail to deliver proteins to particular places



Post-translational modifications play important roles in regulating the activity of many proteins. For certain proteins, particularly those that are destined for the endomembrane system or for secretion, correct folding, glycosylation and protein cleavage are intimately connected in producing the active protein in the right cell compartment. It is this aspect of horse radish peroxidase (HRP) that has interested **Kis *et al.*, (Maynooth and Dublin, pp. 303–310)**. One of the HRP isozymes, isozyme C, is synthesised as a pre-protein with both N-terminal and C-terminal peptide extensions; it has been suggested that these peptides are involved in protein targeting. The authors used a synthetic copy of the isozyme C gene and transferred it to tobacco plants under the control of either a strong constitutive promoter (CaMV 35S) or a strong light-inducible promoter (RUBISCO small subunit). The gene itself was used in four versions: the protein coding sequence alone, and the protein sequence spliced to the sequences encoding either the C-terminal or the N-terminal peptide or both. The results were both clear and surprising. In the absence of either peptide, very little expression of the transgene was detected, either at protein or mRNA levels. Adding the C-terminal peptide had no significant effect; indeed, the mRNA was actually undetectable with this construct. There was certainly no evidence that the C-terminal peptide was involved in vacuolar targeting. Only when the N-terminal peptide was present were high levels of expression observed; the presence of the C-terminal peptide did not affect this. In respect of post-translational modification, the protein synthesised from constructs containing the N-terminal peptide appeared to be glycosylated and to be mostly located in the ER. About 20 % of activity was associated with the cell walls, a proportion too low, the authors suggest, to represent a specific secretion mechanism. Thus there remains much to do before we understand the processing and secretion of HRP isozyme C.

Fitness factors in F_1 hybrids



In a recent commentary I discussed the possibility of gene flow from crops, whether GM or conventionally bred, to related wild plants. One of the questions that arises is whether such hybrids may be at a selective advantage, thus allowing the maintenance of particular genetic traits, derived from the crop species, in the wild. Although many crop plants do not have the potential to hybridise with wild relatives, others certainly do. One such is cultivated rice, *Oryza sativa*, which is well-known to cross with wild rice, *O. rufipogon*. **Song *et al.* (Fudan University, Shanghai, pp. 311–316)** have therefore carried out an extensive investigation of the fitness of the hybrids in relation to both parental species. They point out that a proper evaluation of overall fitness cannot be obtained by assessment at any particular stage of growth or development. Fitness is a lifelong feature and thus the authors compared performances at many stages of the plants' lives, including germination, seedling survival, various aspects of growth, clonal propagation and sexual reproduction. Morphologically, the hybrids resemble more closely the wild parent; in vegetative growth they performed better than either parent, thus exhibiting hybrid vigour. However, within a single generation grown under normal rice cultivation conditions, there was no significant difference in overall fitness between the three lines. But ultimately fitness involves reproductive success and here the hybrids perform significantly less well than either parent. This suggests that the F_1 generation is likely to be a barrier, albeit not a strong one, to the introgression of crop genes into wild populations. Further, the hybrid shows a similar lack of seed dormancy to the crop parent, thus lacking a winter survival mechanism possessed by wild rice. This may explain the failure of *O. sativa–O. rufipogon* hybrids to become widely established even in areas where hybridisations are relatively frequent.

Professor J. A. Bryant
University of Exeter, UK
E-mail j.a.bryant@exeter.ac.uk