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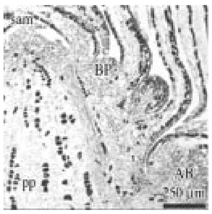
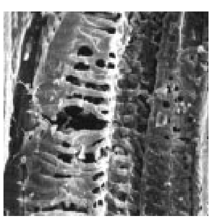
John Bryant takes a closer look at some of this month's Original Articles



SAM accumulates reserves for growth potential

In common with many woody species, *Pinus pinaster* exhibits clear differences between juvenile and adult growth patterns. In male plants the transition from juvenile to adult occurs after 3 years and in females after 5 years. Transition is characterised by several features, of which **Marie-Noëlle Jordy (Vandoeuvre, France, pp. 25–37)** has focussed on the activity of the shoot apical meristem (SAM). In juvenile plants, there are two peaks of shoot growth, one in April and one in October although only the spring peak is associated with an increase in meristem size. Similar spring and autumn peaks occur in the organogenetic potential of the SAM, as indicated by the establishment and emergence of bud primordia. By contrast the SAMs of adult plants exhibit growth and organogenetic activity from spring through to autumn with a peak in July. Within this adult pattern, sub-patterns are seen: leaf primordia are established throughout the growing season, with shoot primordia in the summer; reproductive structures are established in summer in male plants and in autumn in female plants. So, what is it that controls these different growth patterns? At present there is no clear answer to this question. However, the author has demonstrated a number of seasonal variations in shoot biochemistry. RNA accumulation is associated with the autumn (but not with the spring) peak of activity in the juvenile SAM and with the summer growth peak in the adult SAM. In both juvenile and adult plants, higher concentrations of starch and tannins are correlated with the peaks of growth activity whereas lipids are laid down in autumn, retained in winter and metabolised during spring and summer. In both juvenile and adult plants there is thus a complex network of morphological and biochemical changes and it will be very interesting to elucidate the environmental and developmental signals that regulate these changes.

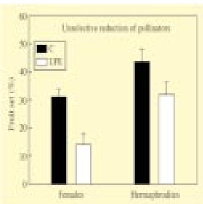


Casing the joint—lignification at a graft union

Grafting, used for many years in the propagation of shrubs and trees, has until recently been used only rarely with non-woody species. Further, we know little about the formation of the graft union in non-woody plants especially in comparison to our understanding of grafts in woody species. **Fernández-García et al. (Murcia, Spain, pp. 53–60)** have therefore studied the formation of the graft union in tomato (*Lycopersicon esculentum*). Grafts were made between aerial shoots of *cv* Fanny and rootstocks of *cv* AR-9704. Establishment of vascular continuity was studied by microscopy and by assaying hydraulic conductivity. The early stages were marked by cell death at the graft site, followed by cell proliferation. After 4 days, there was measurable hydraulic conductivity, concomitant with the early stages of vascular tissue formation. After 8 days, fully formed xylem and phloem traversed the graft junction but hydraulic conductivity continued to increase until day 15. The formation of xylem was, as expected, accompanied by lignification, initially in scion and rootstock but soon traversing the graft site. Increases in peroxidase (an enzyme involved in lignin formation) activity were detectable in both scion and rootstock from day 4 and continued until at least day 15. The activity was thus correlated with the onset and continuation of lignification. Catalase activity also increased between day 4 and day 8 but then declined to baseline levels, these changes coinciding with a rise and fall in the concentration of H_2O_2, the substrate for catalase. The reason for the peak in H_2O_2 is not clear but the authors surmise that it represents an excess produced during rapid lignification. It remains to be seen whether this is so. However, it is clear firstly that graft formation is a workable tool in improvement of tomato cultivars and secondly that this system provides a good model for studying the induction of specific developmental pathways.

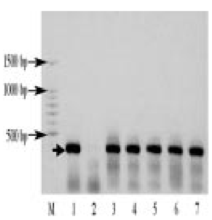
Continued overleaf

Open all hours—Daphne maximises chances of reproduction



In natural selection as in human life, we are familiar with the idea of cost–benefit analysis. This is beautifully illustrated by the reproductive ecology of the shrub, *Daphne laureola*, described by **Conchita Alonso (Sevilla, Spain, pp. 61–66)**. In its Mediterranean upland habitat, *D. laureola* flowers very early (late January to early April), thus minimising competition for pollinators. However, pollinators are themselves relatively scarce at this time of the year and during periods of poorer weather their foraging may be very limited. Against this background, the evolved strategies for breeding in *D. laureola* include a long flowering season, long-lived flowers that last for up to a month, availability to pollinators for 24 h per day and two different breeding systems: female plants are obligately out-breeding while hermaphrodite plants may be out- or in-breeding. The author has carried out experiments to determine the importance of these features, firstly by assaying pollinator choice — there was no evidence of preference for hermaphrodite *versus* female flowers — and secondly by exclusion of pollinators. When pollinators were excluded for half the flowering season, fruit set dropped from *ca* 30 % to *ca* 15 %, *i.e.* in proportion to the period of pollinator exclusion. In hermaphrodite plants, which were in any case more fecund, the drop was only from ca 43 % to ca 31 %, indicating the role of self-pollination in these plants. However, when pollinators were excluded from the flowers at night but not in the day, there was no effect on fruit set in female plants and even a slight increase in hermaphrodite plants. The author concludes that, in this population of *D. laureola*, nocturnal pollinators are not important, despite the flowers being visited by night-flying moths. We do not know whether this holds for other populations of this shrub but nevertheless, the paper provides some fascinating insights into what the author calls ‘early blooming’s challenges.’

Going with the flow – are designer genes good movers?



The possibility of gene flow from crops to related wild plants to create superweeds is often raised by anti-GM campaigners. However, it is not confined to GM varieties: it can happen with any crop plant if conditions are right; the GM debate has raised our awareness of this. So, we need to ask three questions. Firstly, are there related wild species in the area in which the crop is grown? Secondly, does hybridisation actually occur? Thirdly, if it does, what are the consequences? With the first of these questions already answered positively, **Chen et al., (Kyongsan, South Korea**; **Kunming and Shanghai, PR China: pp. 67–73)** set out to answer the second. They established large experimental plots in which a GM rice (*Oryza sativa*) variety carrying a herbicide tolerance gene was grown in the presence of ‘weedy’ rice (*O. sativa spontanea*). They also established plots of GM rice adjacent to plots of wild rice (*O. rufipogon*). The GM rice was used as the pollen donor and seeds were collected from the weedy and wild plants. Germination of seeds in the presence of the herbicide revealed some tolerant progeny. The presence of the herbicide-tolerance gene in those hybrid progeny was detected by PCR and the heterozygote nature of the tolerant plants was established by the detection of particular repeat sequences. The frequencies of the hybrids were low: a maximum of 0.046 % for crop rice to weedy rice and a maximum of 2.19 % for crop rice to wild rice. Nevertheless these data demonstrate that gene flow does indeed occur although it is not known whether the herbicide-tolerance trait makes the recipient species more competitive. This reinforces the view that all crop varieties carrying new genetic traits, whether GM or ‘conventionally’ bred, need to be evaluated for the possibility of out-crossing and, if it does occur, of the possible ecological consequences.

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