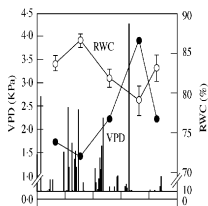


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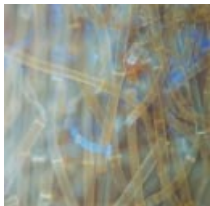
John Bryant takes a closer look at some of this month's Original Articles



Remaining active in old age

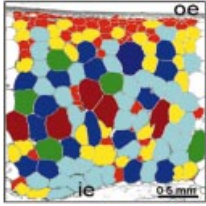
Perennial plants of the Mediterranean region must be able to survive the difficult conditions of summer: low rainfall, high temperatures and high solar irradiance. One such plant is the evergreen shrub, *Pistacia lentiscus*. In common with other species of similar habit and habitat, *P. lentiscus* exhibits summer leaf senescence and abscission. Leaves that are formed in the spring of one year become senescent in the summer of the next, thus allowing recycling of nutrients to the new batch of leaves. This summer senescence phenomenon has been studied by **Munné-Bosch and Peñuelas at Barcelona (pp. 385–391)**. Plants were grown for 3 years in a greenhouse and were then planted out of doors. After establishment, the plants were unshaded and received no water except for rainfall. Leaf senescence was monitored between March and August. The earliest signs of senescence were observed in April with a partial loss of chlorophyll, particularly chlorophyll *a*, and a small decline in leaf biomass. Interestingly, however, the leaves maintained their protection against oxidative stress. Photosystem II (PSII) efficiency and chlorophyll fluorescence ratios were unchanged, antioxidant mechanisms, including the xanthophyll and ascorbate cycles, were maintained and concentrations of some anti-oxidant compounds, including α -tocopherol, increased. The latter is especially important in the protection of D1 protein in PSII. Thus, in this early senescence phase, photosynthetic activity was maintained and the senescing leaves continued to contribute to the plant's carbon economy. However, by late May or early June, as the summer conditions began to be more severe, the situation changed. Chlorophyll degradation and decline of leaf biomass accelerated, anti-oxidant activity decreased and oxidative damage occurred. The final stage was abscission of the leaves in July and August. This biphasic mode of senescence thus aids the plant in exploiting the less severe conditions of early summer while ensuring that maximum recycling of nutrients occurs prior to leaf fall.

Damp and defenceless?



Recalcitrant seeds share the feature of being intolerant to desiccation and are rather more common than the standard textbooks imply. The term suggests difficult or even stubborn behaviour but this is a very human-centred view based on the difficulty of storing such seeds; one presumes that for the plant, this behaviour has a selective advantage. Storage problems are compounded in certain tropical and subtropical species in which desiccation-intolerance is matched by intolerance to low temperatures; further, at normal ambient temperatures, the seeds are metabolically active. According to **Anguelova-Mehar and colleagues, University of Natal (pp. 401–408)** they are more akin to seedlings than to 'conventional' seeds. In investigating the problems of seed storage these authors have used *Avicennia marina*, a species of the mangrove communities in South Africa and have focused on vulnerability to fungal infection. Freshly collected seeds were surface-sterilized and were then subject to 'clean storage' (after a brief pre-treatment with fungicide) or 'infected storage' (after inoculation of embryonic axes with *Fusarium moniliforme*) at 25 °C. Embryo axes were assayed at intervals for two enzymes, β -1,3-glucanase and chitinase, thought to be involved in defence against fungal attack. Both enzymes were present in fresh seeds and increased during storage. However, in the inoculated seeds, these increased enzyme activities were not sufficient to prevent colonization by *F. moniliforme*, and the embryo axes succumbed to infection. In the clean-stored seeds, glucanase activity declined after 10 days, whereas chitinase activity remained high for at least 18 days. Seeds transferred from clean storage after 4 or 10 days and then inoculated with the fungus maintained high levels of both enzymes and furthermore did not succumb to the infection. The role of the enzymes in defence is thus not clear; their effectiveness may be affected by other factors. However, the application of this work is clear: avoid fungal infection during seed storage.

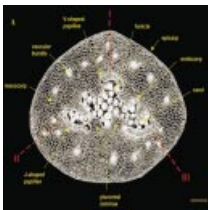
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Concerned about size? It's a matter of nature and nurture

Many traits that breeders seek to modify are quantitative and are often influenced by the activity of several genes (usually termed quantitative trait loci—QTLs). A breeder interested in modifying a quantitative trait therefore needs to identify QTLs that contribute most to the variance of the trait in question. Thus, **Bertin and colleagues, from INRA, Avignon, Bordeaux and Montfavet (pp. 415–424)** identified QTLs that contribute significantly to fruit weight and sugar content in tomato. Furthermore, they have bred lines (CF12-C and CF 14-L) that are isogenic except for these four QTLs.

They analysed several features of fruit development of which we focus on aspects of fruit size. The major determinants of fruit size are cell number and cell volume. Fruit size was measured throughout fruit development; in terms of fruit number per truss, the two lines are identical and both show a decrease in final fruit size from basal to tip position in the truss. Direct comparison between fruit at similar positions showed that CF14-L fruit are bigger than CF12-C fruit. This is achieved by the development of more cells—on average CF14-L fruit has 1.67 more cell layers than CF12-C—and not by differences in cell volume. Thus the QTLs that affect fruit size are thought to influence cell division. However, the situation is actually more complex. Removal of some young fruit from a truss leads to the remaining fruit growing bigger in both these lines. This is achieved by increases in cell volume and not by increases in cell number. Indeed, pruning the truss results in a *decrease* in cell number in CF14-L so that it no longer has more cell layers than CF12-C. This result is very interesting: an environmental factor—decreased competition—can over-ride what appears to be a clear genetic difference between the two lines. The nature–nurture debate continues.



Freshly mixed for a fuller flavour

Vanilla is very widely used as a food flavouring. It is produced in the seeds ('beans') of an orchid, *Vanilla planifolia*, a native of Central America but now grown in several tropical countries. In some, such as Madagascar, it contributes extensively to the economy. In traditional production, 'pods' are harvested while mature but unripe—the beans are still green and do not possess the classic vanilla flavour. The unripe pods are 'cured' by controlled heating in a damp atmosphere, conditions that have been developed to prevent pod dehiscence and to induce the production of vanilla in the beans. In nature, vanilla production occurs during ripening and the flavour-rich ripe seeds are released by pod dehiscence. But what actually happens in curing or ripening to cause vanilla production? In the unripe seed, vanilla is stored as a glycoside, glucovanillin, and it is cleavage of the glycosidic linkage by a glucosidase that releases the vanilla. **Odoux and colleagues at Montpellier (pp. 437–444)** have examined the distribution of both glucovanillin and the glucosidase in mature green beans. Within the beans, they have a very similar distribution with the highest concentration around the placenta. Thus, the enzyme and substrate must be kept apart within the cells at this stage. The subcellular location of the enzyme is not entirely clear but it does not appear to be bound in the wall, as are some hydrolytic enzymes. The authors suggest that its substrate, glucovanillin, is likely to be sequestered in the vacuole. In nature, the two are thus likely to encounter each other because of changes in the tonoplast that occur during seed ripening and blackening, changes that are mimicked during the sweating phase of the curing process. The authors now wish to confirm the subcellular localization of glucovanillin, while in the industry it is hoped to apply this knowledge in more efficient production.