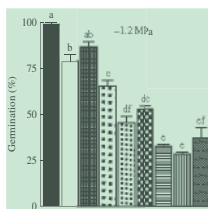


## Stuck-open stomata secrete sugary solution

The value of continuity in research programmes is well illustrated by the work of a regular contributor to *Annals of Botany*, K. L. Davies of Cardiff, UK. The main focus of the author's work is floral biology in the orchid genus *Maxillaria*; the present paper, written by **Davies and colleagues from Lublin, Poland and from Swansea, UK (pp. 217–227)** is no exception. Within the genus, a range of pollinator rewards has been observed, although it appears that many species offer no reward at all.

Whether or not any *Maxillaria* species produce nectar has, until recently, been a matter of controversy. However, it is now clear that a small percentage of species in this genus do so, although this has only been described in detail for one, somewhat atypical species, the bird-pollinated *M. coccinea*. Thus, the authors have focused on a more typical insect-pollinated species, *M. anceps*. They describe the flower as zygomorphic with a well-developed labellum. Nectar is secreted by a structure known as the labellar callus, consisting largely of parenchyma cells overlain by a secretory epidermis. This structure thus functions as a nectary and, somewhat unusually, nectar secretion occurs via modified stomata complete with guard cells. The latter are cuticularized, which prevents full closure of these stomata. The authors state that this is the first report of nectar-secreting stomata in an orchid although they have been described in other angiosperm families. Chemical analysis of the nectar revealed a very high sugar content (*ca.* 62% sucrose with traces of glucose and fructose) plus free amino acids at low concentrations. The fluorescence of the pollen, taken with a staining reaction, indicated the presence of terpenoids, compounds also found in the resinous secretions of some non-nectar-producing *Maxillaria* species. The secretion of a 'high-sucrose' nectar is consistent with bee pollination. Indeed, the authors suggest that the pollinators are stingless bees, a suggestion that invites further careful observations in the field.

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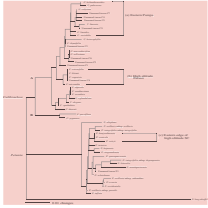


## Salt strength and pulling power put brakes on germination

Salinity is an increasingly important factor in world agriculture because of the higher frequency of flooding of coastal land with seawater and because of side-effects of extensive irrigation. Gaining a fuller understanding of the range of salt tolerance mechanisms is thus a matter of urgency as we seek traits that may be transferred into crop species. One approach to the problem is that adopted by **Laura Sosa and colleagues at San Luis and Rio Cuarto, Argentina (pp. 261–267)**. They have studied the effects of dissolved salts on the germination of *Prosopis strombulifera*, a spiny shrub found in

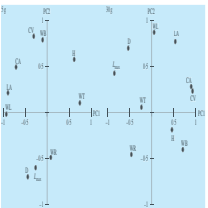
salinized areas in Central Argentina. Although the plant is salt tolerant, germination is inhibited by higher concentrations of salt and the experiments were designed to ascertain the effects of different salts and of osmotica, in order to separate the effects of specific ions from osmotic effects. The first point to note is that at similar osmotic potentials, different salts had different effects on germination. Thus, inhibition of germination by salts is not due to osmotic effects alone; there are some ion-specific events too. Of the salts tested,  $\text{Na}_2\text{SO}_4$  was the most inhibitory to germination but this effect was lessened by the addition of NaCl (even the latter was itself somewhat inhibitory). Similarly, KCl ameliorated the effects of  $\text{K}_2\text{SO}_4$ . Comparison of cations revealed that  $\text{K}^+$  was more inhibitory than  $\text{Na}^+$ . Further, organic osmotica over the same range of osmotic potential as for the salts had less inhibitory effect, at a specific osmotic potential, than the salts. The effects on germination are thus composed of at least two components, one based on osmotic effects and the other(s) on the effects of specific anions and cations. The challenge now is to identify the underlying mechanisms, an important step along the route to transfer of specific genes to crop plants.

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### Branches in the trees for *Petunia* and *Calibrachoa*

It is said that taxonomists come mostly in one of two types: lumpers or splitters. We can see this at several taxonomic levels, including that of the genus, as described by **Ando *et al.***, an international team based in Japan and South America (**pp. 289–297**). They have worked on the ‘old’ broad *Petunia* genus which, since the late 1980s, has been divided into two genera, *Petunia* and *Calibrachoa*. Following this split, several more *Petunia* species have been transferred into *Calibrachoa*. But a leading question is whether or not the evidence to support these changes is strong enough. According to the authors it is, although the two genera are certainly close. This conclusion is based on a molecular genetic analysis using RFLPs (restriction fragment length polymorphisms) in chloroplast DNA, a technique that has been used to establish relationships in several other angiosperm groups. In addition to the two genera in question, *Nicotiana langsdorffii* was used to provide data from a closely related genus in the same family. A total of 212 RFLPs was detected; 89 of these were shared by at least two taxa and were therefore used in the construction of a phylogenetic tree; 85 of the RFLPs could be unambiguously ascribed to gain or loss of a specific restriction site and these were used to construct a distance matrix. The results of the two techniques for assigning relatedness gave remarkably similar results. The most obvious feature is the clarity of the division between the two genera. Further, *Calibrachoa* is a more genetically diverse genus than *Petunia* and its species fall into two clear groups; one contains *C. pygmaea* and the type species *C. parviflora*, while the second contains all the other species. This grouping supports the one suggested by more traditional taxonomic methods. However, the molecular analysis does not resolve unequivocally the interspecific relationships in *Petunia*. Consequently, the authors suggest that further molecular data should now be obtained.



### Crowns above the crowd may help to get ahead

Rain forests are critically important ecosystems and contain a very large proportion of the planet’s biodiversity. But, despite this, there is much to learn. One example is our relative ignorance of how so many different species of forest trees can become established and successfully coexist. This problem has been addressed by **Masahiro Aiba and Tohru Nakashizuka (Otsu and Kyoto, Japan, pp. 313–321)**. The authors investigated juvenile specimens of 18 *Shorea* species that occur within the same forests in Borneo. They focused especially on biomass allocation and plant architecture, where they describe two trade-offs. One is that between a less-branched narrow crown on a slender stem, versus a wide crown on a thicker stem. The other is between what the authors call a ‘robust structure’ and a structure that favours photosynthetic carbon gain. Several features relating to these trade-offs were measured at different phases of growth of young trees. The first point the authors make is that even in this group of congeneric species, there is a very great variation in sapling structure, as great as has been observed between much less closely related species. Secondly, when the data are subjected to principal component analysis, crown architecture and biomass allocation to leaves emerge as major components of the variation between species. Not surprisingly, the latter showed some correlation with photosynthetic capacity but the correlation with wood density was stronger. Crown architecture, on the other hand, was correlated with the size of the seed with, perhaps unexpectedly, large-crowned species emerging from smaller seeds. Overall, it is difficult to relate these features to regeneration, although the authors suggest that poorly dispersed, large-seeded species require small crowns on taller slender stems in order to escape shade. They are clearly right in stating that ‘further . . . studies . . . are required to . . . understand how tree species with a variety of structural traits compete and coexist’.

Professor J. A. Bryant  
University of Exeter, UK  
E-mail [j.a.bryant@exeter.ac.uk](mailto:j.a.bryant@exeter.ac.uk)