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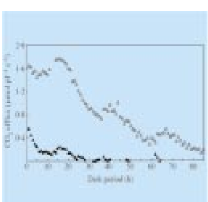
John Bryant takes a closer look at some of this month's Original Articles

Will the real clematis please stand up?

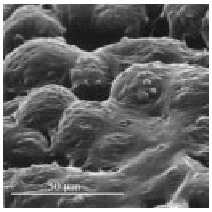
Any paper that, without contrivance or irony, cites Charles Darwin is surely worth a closer look. Darwin was typical of his time in pursuing many interests in science, one of which was climbing plants. This is the subject of investigation by **Isnard *et al.* (Montpellier, France and Frieberg, Germany, pp. 407–417)**. The plant in question is *Clematis flammula*, var *maritima*, which inhabits sand dunes in the Mediterranean region, an atypical habitat for a lianoid climber. Three types of stem are described. There is an extensive underground network of perennial stems; these give rise to upright stems which extend to form the lianoid climbing stems. However, other plants on which to climb are very scarce and thus the clematis stems cling together to form trellis-like structures up to 40 cm tall. The question then is whether this variety exhibits any differences from the biomechanical features of more typical climbers: 'juvenile' stems that are relatively stiff and self-supporting which act as 'searchers' and then extend and branch to form climbing stems which are much more pliant and flexible and thus not self-supporting. Surprisingly, the authors found little apparent adaptation, either in biomechanical properties or in internal anatomy, to this particular habitat. The early upright stems seemed, if anything, slightly less stiff than the juvenile stems of typical climbers and the lianoid stems were as flexible as those of typical climbers. However, the initial upright stems do exhibit more stiffness at their bases and they are also effectively stiffened by being 'rooted' into the sand by the underground perennial stems. The authors propose that it is these underground perennial stems that provide a stabilizing feature in a mobile habitat such as sand, and suggest that climbers of this type may have a general use as stabilizers of sand dune systems that are in danger of degradation.



In the long dark night, fruit come first

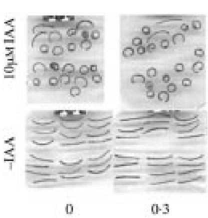
When financial circumstances are difficult, a key question is 'Which activities are expendable and which are essential?' We can ask similar questions about the carbohydrate economy of plants, as shown by **Gary *et al*. (INRA, Avignon and INRA, Villenave d'Ornon, France, pp. 429–438)**. In an investigation of source–sink relationships they exposed tomato plants to either 'poverty' or 'wealth' in respect of carbon assimilation, i.e. low light and low CO_2 concentration or high light and high CO_2 concentration. The plants were then transferred to total darkness and sampled at intervals. From a very thorough and wide-ranging data set, I focus here on aspects of respiration, carbohydrate metabolism and growth. As might be expected, the pre-treatments had a profound effect on the plants before transfer to darkness. With the exception of flower buds and in expanding fruit, concentrations of soluble carbohydrates and starch were very much lower throughout the plant after low-assimilation conditions than after high-assimilation conditions. Respiration in darkness reflected this. At the whole plant level, respiration rate in the low-carbon group declined to almost zero within 48 h, whereas in the high-carbon group, whole plant respiration was still detectable at 80 h. In both groups, carbohydrate content of all organs except for fruit declined as darkness continued and there was evidence for mobilization of proteins to provide emergency 'respiratory' substrates. However, in early fruit and in expanding fruit, in both in the low-carbon and high-carbon groups, carbohydrate content did not decline. Concomitant with this, fruit expansion rate actually increased significantly in the first 15 h of darkness and then declined (but fruit expansion was in fact maintained throughout the 80 h of the experiment). It is thus abundantly clear that in times of carbohydrate poverty, the next generation takes precedence.

Continued overleaf



Strictly for the bees?

The many types of interaction between flowering plants and their pollinators continue to provide fruitful and fascinating topics for research. Thus, we take a further look at the work of **Davies and colleagues** (**Cardiff University and Swansea Botanic Garden, pp. 439–446**). Their paper continues their previous research on the pollination of orchids and the possibility of rewards for the pollinators. They have investigated labellar secretions in the genus *Maxillaria*, focusing on three species, *M. acuminata*, *M. cerifera* and *M. notylioglossa*. Although not yet verified from field observations, these are thought to be pollinated by small bees. The question then is whether or not these orchids offer a reward to those bees. A clue comes from the specific name *cerifera*, meaning 'bearing wax' and the accuracy of that description is borne out by this work. The authors have first examined the floral labella by TEM, clearly demonstrating the presence of osmiophilic globules secreted by the papillae (which have many of the features of typical secretory cells). The presence of osmiophilic material in the secretions implies the presence of lipids, and this was confirmed by histochemical analysis: the secreted material was stained strongly by Sudan III, which is also indicative of lipids. The authors have exhibited admirable caution in not describing the secretion as waxy, the term 'wax' having a specific biochemical connotation. They prefer the term *lipoidal* but they do note that the secretions have a waxy appearance. Finally they ask 'What is in it for the bees?' Some authors have suggested that when waxy material is gathered by pollinating bees it is used in nest building. However, these authors raise the possibility that the secretions may be of nutritional value because, in addition to lipid, they also contain aromatic amino acids and protein. The fascinating story of plants and pollinators thus continues.



Curling leaves challenge cherished assumptions

It is certain that, like me, many of our readers have used 2,4-D in place of the naturally occurring auxin, IAA. In making this substitution we assume that 2,4-D acts in the same way as IAA. In many situations this is undoubtedly correct, but the work of **Kawano *et al.* (Champenoux, France and Hiroshima, Japan, pp. 465–471)** shows that it is not always so. Confirming the results of previous authors, they find that IAA causes a marked epinastic curvature of tobacco leaf strips. However, application of 2,4-D instead of IAA caused only a very weak curvature. This in itself is interesting, implying that in this system there is a significant quantitative difference between the effects of the two hormones. This contrasts with many other epinastic responses where IAA and 2,4-D have the same effect. A further factor in this situation is that many epinastic responses to auxin are actually mediated by ethylene, the synthesis of which is stimulated by the auxin whether it is IAA or 2,4-D. However, the epinastic response in tobacco leaf strips is ethylene-independent. Even more intriguing is the finding that when 2,4-D is applied to tobacco leaf strips together with IAA at optimal concentration, the 2,4-D inhibits the IAA-induced epinastic response. Further evidence for a different mode of action of the two hormones in tobacco leaf strips comes from a kinetic analysis of the interaction, using the Lineweaver–Burke plot. This clearly shows that inhibition by the synthetic auxin of the action of the natural auxin is not competitive. It is thus very unlikely that in this ethylene-independent response, they are acting via the same receptor, and the discovery in another laboratory of a 2,4-D-binding protein adds weight to this suggestion. We await with great interest the results of further research on these unexpected findings.