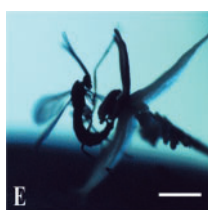


Co-habitee leaves deposit for cuticular transfer

Insectivorous plants come in many forms but the essentials of the habit are regarded as the ability to capture insects and the possession of enzymes to digest the prey. However, **Bruce Anderson, University of Cape Town, South Africa (pp. 757–761)** describes a different mode of insectivory. The leaves of plants in the genus *Roridula* possess sticky traps that capture large numbers of insects. However, these insects are not digested by the plant because it does not possess digestive enzymes. Nevertheless, plants have been shown to take up insect nitrogen. How does this happen? Previous

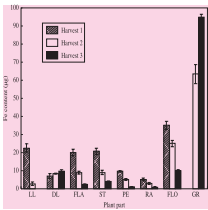
work had suggested that a carnivorous hemipteran insect, *Pameridea*, that lives obligately in close association with the *Roridula* plants is essential for nitrogen transfer. If *Pameridea* is excluded, insect nitrogen is not taken up by the plants. *Pameridea* devour the prey caught by the plant and the hypothesis is that the plant receives nitrogen from the trapped prey via the carnivorous hemipteran. The route of transfer is not immediately apparent until one realizes that the hemipteran deposits its liquid faeces on the leaf surface. However, there is still a problem: the cuticle appears to place an impenetrable barrier in the way of nutrient uptake from the faecal material. The author has therefore investigated the ability of *Roridula* leaves to take up neutral red dye. Mature leaves are uniformly permeable to the dye, in contrast to young leaves and to leaves of non-insectivorous species from the same region. This ability to absorb the dye is attributed to the thinness and irregularity of the cuticle and to discontinuities in the cuticle. Younger leaves of *Roridula* and all leaves of non-insectivorous plants have thicker, intact cuticles. Further, *Roridula* epidermal cell walls are invaginated, thus providing a greater surface area for uptake. The author concludes that *Roridula* species are truly insectivorous, achieving this status via a remarkable obligate mutualism.



Gnatty answer to pollination puzzle

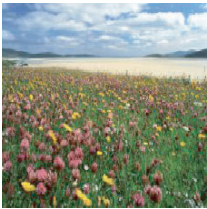
It is well known that many orchids are pollinated by male insects that attempt to mate with the flowers. In the great majority of these insect-deceiving mechanisms, the pollinia are transferred during the pre-copulatory behaviour of the male; copulation itself does not occur. However, an extreme form of this rewardless or deceit pollination has been described in an Australian orchid genus, *Cryptostylis*: pollinium transfer only occurs during the actual act of copulation, hence the process is termed genitalic pseudo-copulation. But is it confined to *Cryptostylis*? The answer,

provided by the work of **Mario Blanco and Gabriel Barboza (Gainesville, Florida and Puntarenas, Costa Rica, pp. 763–772)**, is clearly 'no'. These authors have worked with a New World tropical orchid genus, *Lepanthes*, which contains over 800 species. The authors describe *Lepanthes* species as epiphytes with tiny, brightly coloured and complex flowers that offer no reward to pollinators. The latter feature, combined with the floral structure, suggests that pollination occurs via sexual deceit but until recently there had been no confirmation of that. However, one of the authors had noticed that the flowers are visited by male fungus gnats and this led to detailed observations of insect visitations. The authors have obtained beautiful pictures of sexually aroused male gnats 'mating' with the flowers of *L. glicensteinii*, showing clearly that the pollinia are transferred to the gnat during genitalic pseudo-copulation, with evidence in some visits of actual ejaculation by the gnat. The relationship between the gnat, which itself was a newly described species, *Bradysia floribunda*, and the orchid appears to be species specific. This paper thus illustrates beautifully the value of careful direct observation on living plants. Further, *Lepanthes* is a very large genus and the similarity of the flowers across the genus suggests that it is possible, even likely, that this type of deceit pollination may be more common than previously thought.



Growing grains and moving metals

In considering the nutritional quality of cereal grains we sometimes forget the importance of grain mineral content. Thus, the investigation by **Garnett and Graham (University of Adelaide, pp. 817–826)** on the distribution to the grain of Fe and Cu in wheat plants is very timely. The soil in which the plants were grown contained Fe at a low concentration and Cu at a very low concentration. Higher concentrations were achieved by watering the soil with a micronutrient solution. Initial studies showed that Fe concentration did not affect plant growth. However, without added Cu, growth was extremely poor and, in order to ensure seed set, the low Cu treatment included adding some Cu. Plants subjected to the low Cu treatment showed a delay in all phases of growth, including anthesis and senescence, and a reduction in plant biomass and grain yield. In relation to the nutrient quality of the grain, it is the re-mobilization of Fe and Cu to the grain that is important. The authors clearly showed that both elements are readily mobilized post-anthesis. For Fe, adequate concentrations were maintained in the plant during growth and then about 77 % of shoot Fe was transferred to the grain. For the high Cu treatment, about 62 % of plant Cu was transferred to the grain but in the low Cu treatment it was a different story. Low Cu plants were able to maintain only a barely adequate Cu content during growth and only about 40 % of this low Cu content was transferred to the grain. Interestingly, in field-grown plants, Fe is much less mobile than in these experiments and the authors suggest that adding Fe in the field is not the way to increase grain Fe content. Instead they propose that the focus should be on improving the phloem pathway for Fe movement, a challenging target for the plant breeder.



The answer is blowing in the wind

I remember well my first view of machair, the complex of dunes and grassland that occurs along the west coast of the Outer Hebridean islands of north-west Scotland. The white sand, the complex dunes and the plant communities of the grassland sward of the machair ‘plains’ combined to make a very strong impression. Equally impressive was the near hurricane-force wind that battered my tent, pitched in the machair during a field trip. The paper by **Kent *et al.* from Plymouth and Bodmin, UK (pp. 869–877)** describing the photosynthetic activity of sand-buried machair plant communities thus evoked vivid memories. These authors removed turves representing four different sub-communities within the machair ecosystem and then transferred them to a greenhouse. After acclimatization, turves were buried under 20 mm of sand for 2 or 6 weeks, mimicking the effects of transient burial by wind-blown sand in the natural situation. Gas exchange was measured in control and buried turves. As might be expected, burial completely prevented photosynthesis in these communities. Further, there was evidence that dark respiration rates were reduced, possibly indicating a maintenance type of metabolism during burial. The sand was then removed and photosynthetic rates were determined at 16–20 h and 40–44 h after sand removal. Although the data were somewhat variable, it was clear that photosynthetic capacity of the buried turves started to recover when the sand was removed. Indeed, it appeared that the turves subjected to longer burial resumed net carbon gain faster than those buried for a shorter time. However, there was some variation between the different ‘sub-communities’ in that the turves from dune slacks showed a much lower capacity for recovery than from the other three locations. Overall, however, the ability of these community samples to maintain their photosynthetic capacity during burial is regarded by the authors as an adaptation for survival in the machair ecosystem.

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