give & take

Plant pollination strategies

TEXT & PHOTOGRAPHS **HUGH CHITTENDEN**

above Scadoxus *flowers are visited by insects and birds, like this bee and Olive Sunbird. However, their tightly packed petals prevent bees from accessing their nectar. The transfer of pollen occurs mostly on the bird's forecrown (as seen here). So bees benefit from the pollen and sunbirds from the nectar.*

In the fascinating and complex world of plant pollination, plants in the subtropical regions of southern Africa have evolved some intriguing methods to entice birds and insects to act as successful pollen carriers.

For pollen-bearing plants to reproduce, their flowers need a facilitator to transfer the pollen from their stamens to the stigma receptacles of other flowers on the same plant or another of the same species. Birds (and insects) play the role of facilitator and are enticed to provide this essential service with nectar. Their sweet reward can range from just a minute drop to a few millilitres of this energy-giving sugar-water.

So, if you were a plant, what strategy would you adopt to entice potential customers to your front door (in this case, a nectar-producing flower)? Bearing in mind that competitors in the form of other pollen-bearing plants of different species may be only a couple of metres away, when you offer your merchandise (nectar) you don't want your precious pollen to get mixed with or covered by theirs. The trick seems to lie in what you make the bird do to get to the nectar – and sometimes being choosy in which particular birds you want to do the job.

left *Tubular aloe bracts prevent most large insects from accessing nectar. An Olive Sunbird (far left) with its face and the base of its bill covered with* Aloe arborescens *pollen. A female Scarlet-chested Sunbird (left) sips nectar from the base of an* A. parvibracteata *flower tube. This aloe species has shorter stamens, so pollen is confined to the base of the bird's bill.*

PLANTS HAVE DEVELOPED DIFFERENT METHODS TO ENSURE THAT SPECIFIC BODY PARTS OR FEATHER REGIONS **ARE THE SOLE CARRIERS OF THEIR POLLEN**

Sunbirds have evolved a long bill and tongue that make them highly efficient pollinators and recipients of the nectar on which they depend as a source of energy. In these species, the most common method of pollen transfer is via their facial feathers, onto which the pollen adheres. Plants have developed different methods to ensure that specific body parts or feather regions are the sole carriers of their pollen; for example, a bird's feet (as in *Strelitzia* species) or, less commonly, the surface of its bill are also targeted by plants.

Many plants show a range of adaptations to attract pollinators. Nectar is made available to sunbirds (and insects that have a long proboscis, such as moths), but flower design is often engineered to stop insects from accessing nectar; narrow, tubular flowers, such as those of aloes, are classic examples of designs that allow sunbirds access to nectar but exclude bees and other insects.

A plant that sometimes grows close to aloes is the green-leaf wormbush *Cadaba natalensis*, an insignificant scrambler that occcurs in the hotter woodland regions of north-eastern >

above *A Grey Sunbird takes nectar from the base of an* Aloe chabaudii *flower. The flower's structure is such that pollen is deposited mainly on the chin and lores of sunbirds.*

above *The elongated stamens of* Cadaba natalensis *deposit pollen onto the crown of a Grey Sunbird (above and centre). At the same locality, a male White-bellied Sunbird (right) feeds on a nearby* Aloe chabaudii *plant and gets pollen brushed onto his lores. This bird has just fed on* Cadaba natalensis *nectar, as seen by the pollen on his crown.*

right *Cape honeysuckle showing the pollen-bearing capsules to the left of the longer, pinkish-coloured stigma on the right. A Grey Sunbird (far right) getting its forecrown coated with pollen. Note how the stigma (pollen receptor) extends beyond the hanging pollen sacs, so that when a sunbird arrives at the flower the sticky stigmatic surface collects the pollen from another flower or plant before its own pollen is transferred to the sunbird's forehead, thus once more beginning the cycle of pollen transfer.*

KwaZulu-Natal. This small, flowering climber has somewhat bizarre elongated stamens that deposit pollen neatly onto the crown of a sunbird and thus exclude the overlap of pollen from its nearby aloe 'competitors' that flower at the same time.

Flower design varies widely and there are endless combinations of differently shaped pollen applicators and sticky receptors. Two very different flower designs are shown above and on the opposite page. Above, the Cape honeysuckle *Tecoma capensis*, has pollen-bearing capsules that open from below, dropping pollen onto the crown of sunbirds, and an even longer stigma to collect pollen. The flower tube is so designed that when a sunbird inserts its bill into the flower tube, the stamens automatically droop and deposit pollen onto the bird's crown.

On the page opposite (above), the base of each wild dagga *Leonotis leonurus* flower bract has almost perfect 'brush-on' pollen follicles. The sticky receptacles are positioned behind these pollen 'brushes'.

In contrast to the above examples, strelitzias have evolved

above *A Grey Sunbird feeding on* Leonotis *nectar. Orange-coloured pollen on the crown of an Olive Sunbird (above, right) being wiped onto the white stigma.*

STRELITZIAS HAVE EVOLVED TO BE POLLINATED SPECIFICALLY BY SUNBIRDS. THE NECTAR IS CONCEALED WITHIN A CUP THAT IS ENCLOSED SO AS TO BE INSECT-PROOF (ESPECIALLY FROM BEES)

above *An Olive Sunbird sips nectar from* Strelitzia nicolai. *This bird is positioned perfectly, standing on the sticky pollen that it will then transport on its feet to another plant.*

to be pollinated specifically by sunbirds. The nectar is concealed within a cup that is enclosed so as to be insect-proof (especially from bees), but is easily penetrated by sunbird bills. The sticky pollen is positioned on the flower, well away from the closed nectar cup. A sunbird lands on the blue flower shaft that carries the sticky pollen, then flies to the next open flower, thereby transferring pollen via the soles of its feet.

Weavers, with their short, stubby bills, have learnt to access the strelitzia's nectar by tearing off the covers to the nectar-bearing cup. This usually leads to a subsequent invasion by invertebrates such as flies and bees, which land directly at the nectar source and do nothing to facilitate pollen transfer. Once weavers have torn and damaged the base of the flower and insects have gained access to the nectar, there will be little or no incentive for sunbirds to revisit the flower.

Many plants have evolved to be pollinated by insects rather >

above *A non-breeding Yellow Weaver tears open the strelitzia's nectar receptacle to get at the liquid, allowing insects free access – exactly what the plant doesn't need (above, right).*

right *Along the edge of the Zambezi River in the Caprivi, a male Copper Sunbird forages on mahogany* Trichilia emetica *flowers. The bill tip of a young female White-bellied Sunbird (far right) becomes coated with pollen while the bird feeds on a dune soap-berry* Deinbollia oblongifolia. *In both instances, transfer of pollen is via the tip of the bill.*

than birds. In the case of small flowering plants, insects with long, probing tongues are the primary pollinators while birds play the role of secondary pollinators, transferring pollen via their beaks.

Sunbirds, especially short-billed species, frequently 'disobey' the rules by taking shortcuts and penetrating the side of flowers in their search for nectar, thereby avoiding being brushed with pollen. This is known as nectar robbing, where the bird (or insect) gains free access to sugar-water without the plant deriving any benefit.

Flowers visited by birds are often brightly coloured in various shades of red and orange, whereas many plants that have white flowers stand out better at night and are pollinated nocturnally by moths. Lack of an attractive smell may deter insects, but does not affect birds. It is also possible that birds may provide a service in addition to pollination, as omnivorous species often protect plants from herbivorous insects. ◆

Acknowledgement
My thanks go to Geoff Nichols for the improvements he made to the first draft of this article.

above *An example of nectar robbing, where birds get free access to nectar and the plant derives no resultant benefit. A juvenile Olive Sunbird lands conveniently on the flower of a* Strelitzia reginae *and not on its sticky pollen (to the left).*

left *More examples of nectar robbing. A female Collared Sunbird (far left) opens the side of an erythrina flower; being short-billed, the bird couldn't otherwise reach the nectar source. A young male Purple-banded Sunbird (left) pierces the side of a flower bract for 'free' nectar.*