

Specialized bird perch aids cross-pollination

A plant scores by providing an access point for visiting sunbirds to feed on its nectar.

Birds may hover over or perch on flowers when feeding on nectar¹, and this assists cross-pollination if they then visit other plants. Here we investigate the curious sterile inflorescence axis of the South African Cape endemic 'rat's tail' plant (*Babiana rigens*, Iridaceae), whose function — unlike in other bird-pollinated plants — is exclusively to provide a perch for foraging birds. We find that this structure promotes the plant's mating success by causing the malachite sunbird (*Nectarinia famosa*), its main pollinator, to adopt a position ideal for the cross-pollination of its unusual ground-level flowers.

The Cape naturalist Rudolf Marloth was the first to propose that the rat's tail of *B. rigens* (Fig. 1a) could function as a perch to facilitate cross-pollination by visiting sunbirds (cited in ref. 2). We investigated this proposal in two populations of *B. rigens* near Malmé, Western Cape Province, from August to October in 2003 and 2004. Our observations indicated that the plants' only pollinator was the malachite sunbird, the largest of the sunbirds that visit species of Iridaceae in the Cape³.

We observed birds alighting on the sterile axis of the plant and rotating upside down before probing the flowers for nectar (Fig. 1b). Because the floral tube in *B. rigens* curves upwards, rather than downwards as in most bird-pollinated species, a sunbird accesses nectar by inserting its curved beak from above. The plant's sexual organs contact the bird's breast, enabling pollen to be transferred between plants.

To test the function of the bird perch, we compared fitness components in unmanipulated plants with those from which we had removed the sterile axis just before flowering. Perch removal did not alter the floral display or the intrinsic ability of plants to set seed. We found no significant difference in seed set between plants with and without perches following supplemental cross-pollination (repeated measures analysis of variance, specific contrast: $t = -0.87$, $P = 0.39$). Perch removal therefore does not interfere with seed provisioning, and the perch is not a significant source of photosynthetic carbon for seed development. (For methods, see supplementary information.)

Although perch removal did not preclude visitation by sunbirds (Fig. 1c), they preferred plants with intact perches. Of 93 visits recorded after perches were removed from half the plants, 59 were made to plants with perches and 34 were made to plants without perches ($G = 6.80$, $P = 0.009$). Female and male birds showed different preferences for



Figure 1 Features of the South African plant *Babiana rigens*. **a**, The specialized bird perch (arrow) and ground-based flowers of *B. rigens*. **b, c**, Male sunbirds (*Nectarinia famosa*) visiting the plant adopt different positions to feed according to whether the perch is **b**, present, or **c**, absent.

plants with and without perches: only males had a strong preference for plants with perches. Males visited significantly more plants (total visits by males: perch present, 24; perch removed, 11; $G = 4.95$, $P = 0.026$; total visits by females: perch present, 35; perch removed, 23; $G = 2.50$, $P = 0.113$; NS). Males spent longer feeding from flowers (time spent foraging by males: perch present, 53.95 s (s.e. 9.42); perch removed, 12.4 s (s.e. 4.72) (paired t -test, $t = 3.92$, d.f. = 19, $P = 0.0005$); time spent foraging by females: perch present, 23.88 s (s.e. 4.87); perch removed, 13.34 s (s.e. 4.18) ($t = 1.52$, d.f. = 31, $P = 0.07$)).

This sex difference in preference may be associated with the much longer tail feathers of males, which could interfere with ground landings and suffer damage. Males may also be more reluctant to land because of the predation risk associated with their bright colours, or because perching in prominent places may be linked to territoriality.

Perch removal reduced female fertility: plants without perches produced 47% fewer seeds on average than unmanipulated plants (Fig. 2a). Plants without perches set considerably more seed than bagged inflorescences, however, so sunbird-mediated self-pollination seems likely to have occurred in these plants. We confirmed this by analysing mating patterns. Perch removal increased self-fertilization by an average of 35% (Fig. 2b), indicating that perch specialization reduces the genetic costs of self-pollination⁴.

Fitness advantages to mating and fertility arise because the perch manipulates the position of foraging sunbirds for better pollen dispersal. The specialized bird perch of *B. rigens* is a novel example of a structural adaptation that promotes cross-pollination in angiosperms.

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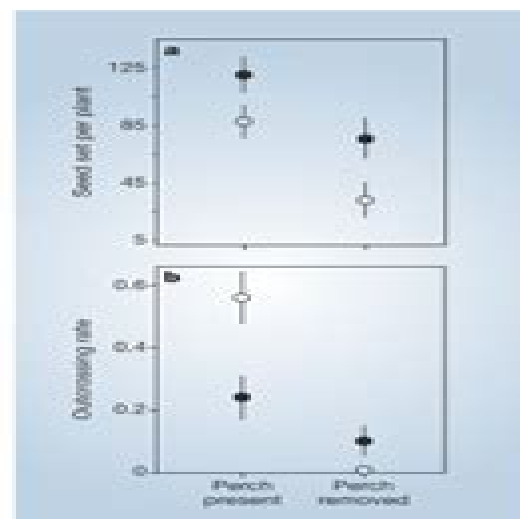


Figure 2 The specialized bird perch of *Babiana rigens* increases mating success. **a**, A fraction of each of two plant populations (A and B, represented by filled and open circles) located about 5 km apart had the bird perch removed (in 11 of 25 and 19 of 38 plants, respectively) and the seed set and outcrossing rate were compared with those of unmanipulated plants. **a**, Perch removal decreases seed production per plant (treatment: $F_{1,33} = 15.05$, $P < 0.001$; no significant treatment $\times$ population interaction; $F_{1,33} = 0.16$, $P = 0.692$). **b**, Perch removal increases the mean ($\pm$ 95% confidence interval) frequency of self-fertilization (population A, $P = 0.005$; population B, $P < 0.007$). Genotype scoring at five allozyme loci was used to determine the outcrossing rates, with the following sample sizes for each population: families from A, 20; families from B, 30; seeds per family from A, 8.4; seeds per family from B, 8.5. A family is the collection of seeds from one maternal parent. For details, see supplementary information.

Aids To Botany

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