Pollination of *Disa filicornis* (Orchidaceae) through deception of mason-bees

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Disa filicornis (L.f.) Thunb., a Cape orchid, was found to be pollinated by mason-bees (Apoidea: Megachilidae). Pollinia are placed on the ventral side of the thorax when bees straddle the anther. After extraction from the anther, the pollinia undergo a curvature of 90° which ensures correct orientation relative to the stigma. The flowers do not produce a nectar reward, but the large number of pollinia carried by bees suggests that bees have a low ability to learn to avoid the flowers. This deception of bees allows the orchid to achieve a high pollination success.

Disa filicornis (L.f.) Thunb., 'n Kaapse orgidee, word bestuif deur messelbye (Apoidea: Megachilidae). Polliniums word op die ventrale kant van die toraks geplaas wanneer die by wydsbeen oor die helmknop gaan sit. Na ekstraksie uit die helmknop buig die polliniums deur 90° wat 'n korrekte oriëntasie tot die stempel verseker. Die blomme produseer nie nektar nie, maar die groot aantal polliniums wat deur die bye gedra word, dui daarop dat die bye 'n swak vermoë besit om te leer om die blomme te vermy. Hierdie misleiding van bye stel die orgidee in staat om 'n hoë mate van bestuiwingsukses te behaal.

Keywords: *Disa*, floral mimicry, mason-bees, Megachilidae, Orchidaceae, pollination.

Pollinators have been described for less than a handful of Cape orchids (Marloth 1896; Garside 1922; Steiner 1987). This is a serious gap in our knowledge of the general biology and evolution of these plants. Knowledge of orchid pollination systems is particularly useful for gaining insight into the function of floral characters.

The pollination biology of *Disa filicornis* (L.f.) Thunb. (Orchidaceae) was investigated on 16 November 1991 at a site in Baviaanskloof, near Wellington. The area had been burnt two years previously and about 100 plants of *D. filicornis* were in flower. The inflorescence, with between one and five flowers (Figure 1A), is typically produced in the first two years following fire. The flowers are usually

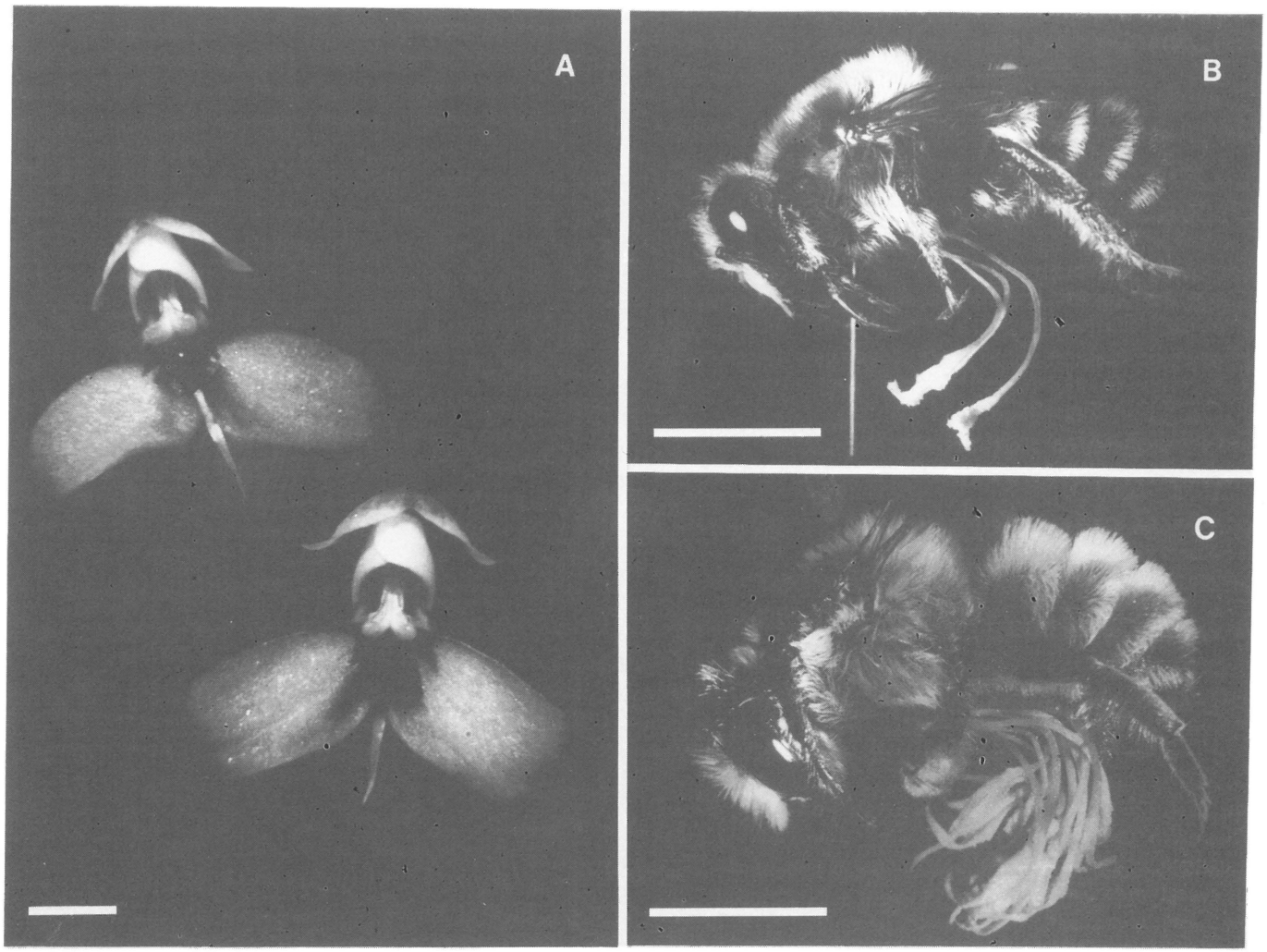

Figure 1 **A.** Inflorescence of *Disa filicornis*. **B.** *Chalicodoma karooensis* (Megachilidae) with pollinia of *D. filicornis* attached to the thorax. Note the 90° curvature of the pollinia as well as the irregular surface at the tips of the pollinia where massulae (pollen clumps) involved in pollination have been torn away. **C.** Another bee of the same species with 13 attached pollinia. Scale bars: 5 mm.

purple-pink, although white forms are not rare (Linder 1981).

Four male mason-bees carrying pollinia, positively identified as those of *D. filicornis*, were caught while foraging for nectar on *Moraea tripetala* (L.f.) Ker Gawl. (Iridaceae) which was flowering amongst the orchids at the study site. Three of the bees, identified as *Chalicodoma karooensis* Brauns. (Megachilidae), carried thirteen, nine and six pollinia, respectively, attached to the ventral side of the thorax between the first and second pair of legs (Figures 1B & 1C). The fourth bee, a smaller *Chalicodoma* species which has not been identified, carried a single pollinium of *D. filicornis*. Other bees, including carpenter-bees and honey-bees, were caught at the study site, but they did not carry pollinia.

Although bees were not observed visiting the orchids, the presence of pollinia of *D. filicornis* on the ventral side of the thorax indicates that bees straddle the anther when alighting on the flower. Pollinia undergo a curvature of 90° after being extracted from the anther, a curious phenomenon which ensures that the ends of the pollinia project forwards (Figure 1B) and thus contact the stigma without being impeded by the rostellum which juts out above the sessile stigma.

No nectar is produced in *D. filicornis*, as is the case with other species of *Disa* which lack a spur (personal observation). This lack of a nectar reward does not prevent bees from repeatedly visiting *D. filicornis*, as illustrated by one of the captured bees which had accumulated thirteen pollinia on its thorax (Figure 1C). This effective deception of bees results in high levels of pollination success for the orchid. I examined one flower from each of 33 plants at the site and found that 27 (82%) had both pollinia removed and 21 (64%) had pollen deposited on the stigma.

There are three possible reasons why bees would visit a nectarless flower. Firstly, the flowers may mimic a sympatric nectar-producing species. Mason-bees could have confused flowers of the orchid with the similarly shaped and coloured flowers of a species of *Polygala* (Polygalaceae) which was growing nearby. Secondly, the orchid may exploit the instinctive nectar-foraging strategy of the bees (see: Little 1983; Dafni 1987), in which case the resemblance to the flowers of *Polygala* is coincidental. Thirdly, bees may be drawn by a female sexual attractant produced by the flowers, as all the bees found carrying pollinia were male. Further detailed experimental studies are needed to distinguish between these hypotheses.

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