

Big lies for small flies: How *Ceropegia* deceives its pollinators

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The importance of flies as pollinators of many plants is beyond doubt. As far as known, all species of *Ceropegia* (Asclepiadoideae: Apocynaceae) are pollinated by (small) flies from diverse families such as Ceratopogonidae, Chloropidae, Milichiidae, Phoridae, Sciaridae, and Drosophilidae.

Ceropegia is characterized by highly complex pitfall flowers with various trapping devices (e.g. sliding areas, trapping trichomes) to catch, temporarily trap and finally release the pollinators. Since the flowers do not offer any reward to their pollinators they are supposed to be deceptive, but the models they mimic are unknown. The South African species *C. sandersonii* DECNE. EX HOOK, and the Chinese species *C. dolichophylla* SCHTLR. are pollinated by *Desmometopa* flies. These flies are kleptoparasites and feed on haemolymph or other secretions released by insect prey items of predatory arthropods. It is generally believed that the flies are attracted by volatile organic compounds which are set free from the prey item while it is being devoured. Honey bees caught by spiders are often crowded with *Desmometopa* flies feeding on fluids coating the exterior of the bee. Here, we identified the chemicals used by *Desmometopa* to find preyed upon honey bees, and by the two *Ceropegia* species to deceive *Desmometopa* and misuse them as pollinators.

Floral scents of *C. sandersonii* and *C. dolichophylla* as well as scents released by attacked honeybees were analyzed by gas chromatography coupled to mass spectrometry (GC-MS). Their capability in eliciting electrophysiological responses in *Desmometopa* was tested by electroantennographic detections, and bioassays revealed their attractiveness to these flies.

The flowers of *C. sandersonii* emitted compounds also released by honey bees, but none of the compounds found in *C. dolichophylla* resembled compounds released by the bee. Instead, compounds of *C. dolichophylla* are known from Hymenoptera other than honey bees. Electrophysiological and behavioural studies showed that several of the compounds found in the two *Ceropegia* species or the honey bee can be sensed by *Desmometopa* and are important for attracting the flies to the flowers/preyed upon honey bees. Overall, our study suggests that *Ceropegia* fools flies into pollinating its flowers through food source (e.g. preyed upon honey bees) mimicry.

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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Entomologica Austriaca](#)

Jahr/Year: 2015

Band/Volume: [0022](#)

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