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# Press Release


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# Deceptive flowers, duping insects: How parachute flowers lure their pollinators into a trap

**A doctoral researcher at the University of Bayreuth has discovered an unusually cunning imitation strategy in the plant kingdom.**

Many flowering plants attract insects which pollinate their flowers. This is only in this way that they can ensure the survival of their species. A twiner native to southern Africa, Sanderson´s parachute flower (*Ceropegia sandersonii*), has a particularly cunning strategy for attracting flies for pollination.

Its way of ensuring pollination is a complicated ploy involving fraud and imprisonment. These "crimes" in the plant kingdom have now been exposed by Annemarie Heiduk, a doctoral researcher in biology at the University of Bayreuth. Scientists from Bayreuth, Salzburg, Bielefeld, Darmstadt, London, and Pietermaritzburg helped her gather the evidence. The international team has now presented its research findings in the latest issue of the journal *Current Biology*.

Annemarie Heiduk M.Sc.,
Photo: private.

## An irresistible fragrance: scent surprisingly similar to honeybees under attack

The victims of this scam are freeloader flies of the genus *Desmometopa*. To attract such flies, the parachute flowers produce a complex fragrance that is irresistible to these two millimetre large insects. The reason is that *Desmometop*a flies always have a healthy appetite for honeybees. However, they don't hunt down the prey themselves. It is rather spiders and insect predators that attack and kill the honeybees. The flies are then able to detect the prey within a few seconds and feast on the fluid leaking from their bodies while the predators are eating them. They thus steal food from the predators. For this reason, biologists also refer to the flies as kleptoparasites.

A mixture of substances emitted from the glands of the struggling or dying bees helps the flies to find their favourite prey. "These substances (we also refer to them as 'alarm pheromones'), which are released in moments of great distress, have a scent that is as about as appetizing to the flies as the aroma of a Sunday roast is to humans", explains Annemarie Heiduk. The Bayreuth scientist has demonstrateed that the parachute flowers produce no fewer than 33 substances that are also emitted by honeybees that have been fatally attacked. Together, these substances produce a floral scent so deceptively similar that it tricks the flies with nearly perfect chemical mimicry. To the surprise of the flies, instead of enjoying a feast, they plunge into the plant's pitfall flowers.

Ceropegia sandersonii scrambling at the base of a shrub. It can hold pollinating flies prisoned in the enlarged basis of their pitfall flowers.
Photo: © Ulrich Meve.

## Trapped without food: flies caught by the flower

The *Desmometop*a flies, notorious food thieves, have now been doubly deceived: not only do they find no dying bees, they do not even find any nectar or other substances produced by flowers (e.g. pollen). The flowers of *Ceropegia* contain absolutely nothing for the flies to eat. They are known as "deceptive flowers", allowing themselves to be pollinated by the insects they attract without rewarding them with food. In addition to this trick, there is also the ensuing imprisonment, as the plants trap the flies in their flowers for around 24 hours. This ensures that the flies – searching for both food and a way out – do all the work when it comes to pollination. As a result of this activity combined with food deprivation, the flies are quite weak when they are finally allowed to fly away. As hungry as they are, they are magically drawn to the alluring, deceptive scent of neighbouring flowers, where they end up back at square one.

## Deceptive pollination strategies by no means uncommon

"These types of deceptive plants that manipulate their visitors and abuse them via pollination without reward are not all that rare," explains PD Dr. Ulrich Meve, who is supervising Annemarie Heiduk's dissertation together with Prof. Dr. Stefan Dötterl of the University of Salzburg. "Today researchers estimate that there are around 15,000 such plants. However, the parachute flower, which is found in xerophytic shrublands and belongs to the genus *Ceropegia*, employs a particularly surprising strategy."

Ceropegia sandersonii twining in an acacia.
Photo: © Ulrich Meve.

For years, the Dr. Meve has been investigating the phylogeny and systematics of *Ceropegia* and other members of the milkweed family together with Prof. Dr. Sigrid Liede-Schumann at the Institute of Plant Systematics. He recalls that the importance of flies as flower pollinators is often underestimated. "In fact, around 15% of all plants that are pollinated by animals rely on pollinating flies for their sexual reproduction. This puts flies right behind the bees – which have a monopoly on pollination for 20% of flowering plants – as the second most important pollinating insects," explains Dr. Meve.

## Successful research in Bayreuth and Salzburg

Annemarie Heiduk figured out the deceptive tricks of *Ceropegia* using technically demanding methods of investigation. To analyse the scent of the bees and flowers, she employed gas chromatography linked to mass spectrometry (GC-MS) and carried out electroantennographic detection (GC-EAD) on the pollinators. She tested the effects of individual scent compounds on the flies outdoors (biotests) in Bayreuth, Salzburg, and KwaZulu-Natal, a province of South Africa. It was discovered that the antennae of the *Desmometopa* flies can perceive nearly half the substances that are contained in both the bee scent and the flower's mimicked scent.

Heiduk was supported by a grant from Bavaria's Elite funding programme and is a member of the University of Bayreuth Graduate School. Here she is active in the Programme for Ecology and Environmental Research. In addition, she is conducting research at the University of Salzburg together with Prof. Dötterl, who also used to work at the University of Bayreuth. "The interaction between plants and animals in reproduction promises many more exciting discoveries, including fraud and deceit," said Heiduk, a graduate of the master's programme Molecular Ecology at the University of Bayreuth and the Elite degree programme Macromolecular Science. "Our new study is sure to inspire further inves-

tigation of unexplained pollination strategies in the plant kingdom. The genus *Ceropegia* alone contains around 250 species that are known or believed to use mimicry tricks to ensure their pollination."

## Publication:

Annemarie Heiduk, Irina Brake, Michael von Tschirnhaus, Matthias Göhl, Andreas Jürgens, Steven D. Johnson, Ulrich Meve, and Stefan Dötterl,
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# The University of Bayreuth at a Glance

**The University of Bayreuth is a young, research-oriented campus university. The University's founding mission in 1975 was to support interdisciplinary research and teaching and to develop interdisciplinary research priorities with which it could strengthen its own profile.**

Its research programmes and programmes of study are frequently updated and cover the natural sciences, law, business and economics, languages and literature, and cultural studies.

A good instructor-to-student ratio, high performance standards, interdisciplinary collaboration, and academic excellence have allowed the University to maintain its strong position in the rankings. The University of Bayreuth is included among the best young universities in the world in the Times Higher Education (THE) worldwide ranking "100 under 50".

The University of Bayreuth has been an international leader in African Studies for many years; the Bayreuth International Graduate School of African Studies (BIGSAS) is part of the Excellence Initiative by the German federal and state governments. High Pressure & High Temperature Research carried out at the Bavarian Research Institute of Experimental Geochemistry & Geophysics has also established a strong reputation worldwide. Polymer research at the University is a frontrunner in the funding ranking published by the German Research Foundation (DFG). The University of Bayreuth has a tight international network of strategically selected university partnerships.

There are currently around 13,500 students enrolled in 146 different programmes of study offered by the University's six faculties. With around 1,200 members of the academic staff (of whom there are 235 professors) and roughly 900 non-academic staff members, the University of Bayreuth is one of the region’s largest employers.