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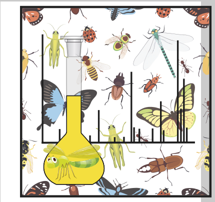

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Chemical and Functional Complexity in Flower Fragrance

Florian P. Schiestl*

**Correspondence:* Prof. Dr. F. P. Schiestl, E-mail: florian.schiestl@systbot.uzh.ch
Institute of Systematic and Evolutionary Botany, University of Zurich,
Zollikerstrasse 107, CH- 8008 Zürich,

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Beside colorful displays, flowers also attract pollinators by using volatile chemicals. Since the invention of high-resolution capillary gas chromatography, thousands of flower bouquets have been analyzed chemically, with the insight that floral scent is stunningly complex, with thousands of floral scent compounds known today. But what are the functions of this chemical diversity? Important advances in answering this question were gained by the coupling of gas chromatography with electrophysiology, enabling the screening of volatile blends for those compounds that are actually detected by pollinators. This led to the discovery of novel, pollinator-attracting compounds, and indirectly showed that many floral chemicals have other functions, such as anti-microbial or herbivore deterrence. Floral scent works in combination with color, and often encodes highly specific signals, because plants usually emit chemically unique bouquets of volatiles.

An example is the unusual floral scent compound 1,4-benzoquinone, specifically emitted, together with more common compounds, by *Echium* flowers. This compound, which is known as a deterrent compound in other insects, is used by *Hoplitis adunca* bees (viper's bugloss mason bee) specialized on *Echium* (viper bugloss) for pollen collection, together with the blue color of the flowers, to reliably identify their host plants.

Floral scent also enables floral mimicry, the imitation of attractive but deceptive signals.[1] Some flowers imitate the intraspecific sexual signals of pollinators, and trick them into attempted copulations with the flowers, thereby enabling pollination. An Australian orchid employs a unique compound, chiloglottone, for such sexual mimicry. Upon its discovery in 2003, chiloglottone represented a new class of natural products and its biosynthesis is currently still unknown, but interestingly dependent on UV-B light.[2]

An example for an 'honest signal' is the relatively common compound phenylacetaldehyde, synthesized in plants from phenylalanine. The amount of this compound is associated with the volume of nectar available in flowers, and therefore encodes information about the profitability of a given plant for pollinators.[3] **In conclusion, the combination of high resolution gas chromatography with electrophysiological detection has led to the identification of new, unexpected compounds and gave new insights into the role of chemical signals in pollinator attraction in general.**

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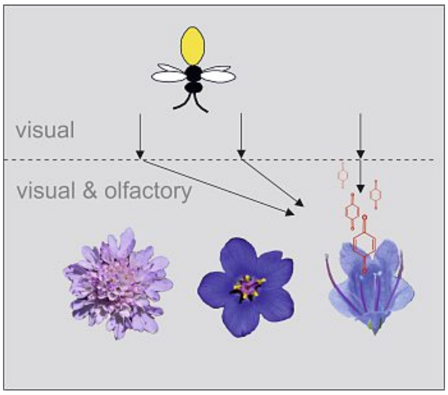
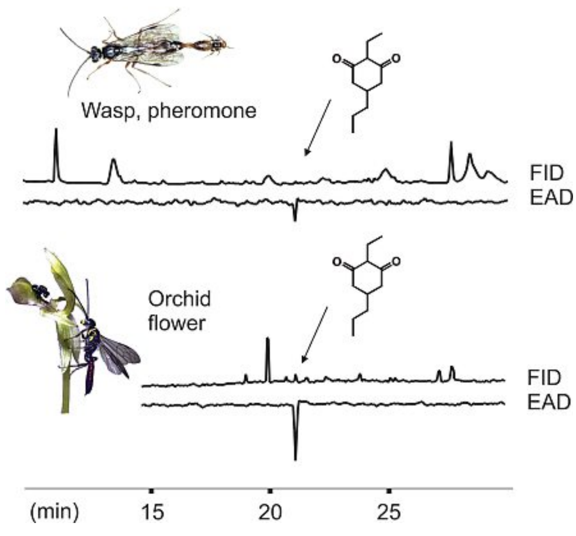


Specificity in pollinator attraction through floral scent in *Echium* flowers. The specialized bee *Hoplitis adunca* is attracted by the blue color of the flowers from a distance, but uses the specific scent compound, 1,4-benzoquinone to identify its host plants at close range.



Sexual mimicry through floral scent in the Australian orchid genus *Chiloglottis*. The pollinator of this orchid, the wasp *Neozeleboria cryptoides,* uses a single compound, 2-ethyl-5-propylcyclohexan-1,3-dione ('chiloglottone'), as sex pheromone. The females of this wasp are wingless and call with the pheromone for a male, which picks them up and mates with them (photograph above). The orchid *Chiloglottis trapeziformis* produces the same chemical to lure the males into attempted copulations with its flowers, leading to pollination (photograph below). The figure shows gas chromatograms (FID, flame ionization detector) with electroantennographic detection (EAD) using a male wasp antenna.

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Please contact: Dr. Veronika R. Meyer, Unterstrasse 58, CH-9000 St. Gallen
Tel.: +41 71 222 16 81, E-mail: VRMeyer@bluewin.ch