

Non-pollinators use the volatile chemicals emitted by Mediterranean orchids

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Abstract
Orchids and their pollinators offer great examples of the role of chemical ecology in plant-insect interactions. Depending on the species considered, pollinators are attracted more or less specifically by volatile compounds emitted by orchids. We describe here a field olfactometer device that allows us to test behavioural choices performed by insects (collected locally and very recently) when confronted with volatiles emitted by orchids under natural conditions, and thus to avoid experiments performed with stressed animals and/or transplanted plants. Non-pollinators tested here were 1) small

grasshoppers that eat the labellum of *Ophrys araneola*, 2) crab spiders that capture insect visitors of *Orchis simia*, and 3) *Camponotus aethiops* ants that exploit nectar produced by *Epipactis helleborine*. In all these cases, non-pollinators were significantly attracted by the volatiles emitted by the orchids concerned. These results demonstrate that non-pollinators, like pollinators, may also use chemical signals to exploit food sources associated with orchids.

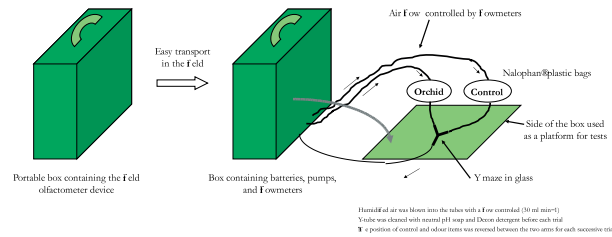


Aims of the study

- Test the use by the non-pollinators of the volatiles emitted by different orchids
- Perfect a field olfactometer device

Field olfactometer device

- The field olfactometer device allowed us to test behavioural choices performed by insects (collected locally and very recently) when confronted with volatiles emitted by orchids under natural conditions
- We avoid experiments performed with stressed animals and/or transplanted plants
- Protected species may be used (under authorisation) since tested plants and insects were maintained in a good state after the experiment



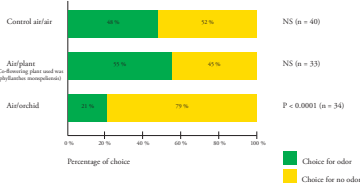
Results

1) Herbivory by grasshoppers on *Ophrys araneola*

Herbivory by grasshoppers concerned 25.0% (+20.7) (Mean + SD) of flowers and 28.7% (+ 12.1) of individuals of *Ophrys araneola*

-> Influence on the number of flowers

Test in field olfactometer



Grasshoppers were only attracted by the volatiles emitted flowers of *Ophrys araneola*

-> Non-pollinators used the volatiles emitted by orchids to exploit it (here vegetal tissues)

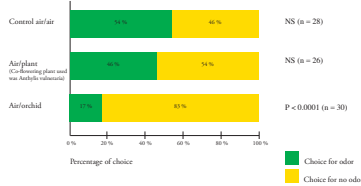
2) Predation by crab spiders on *Orchis simia*

• Observation of several captures and numerous attempts of capture by crab spider (*Misumena vatia*)

• Reduction of the rate of pollination in plants where crab spiders were previously observed

-> Influence on the rate of pollination

Test in field olfactometer



Crab spiders (*M. vatia*) were only attracted by the volatiles emitted flowers of *Orchis simia*

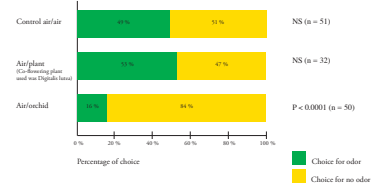
-> Non-pollinators used the volatiles emitted by orchids to exploit it (here visitors used as prey)

3) Nectar exploited by *Camponotus* ants on *Epipactis helleborine*

Certain ant species (as *Myrmica* sp.) exploit nectar and transport pollinia *Camponotus aethiops* ants (tested here) also exploit nectar without transporting pollinia

-> Influence on pollination and on pollinator reward

Test in field olfactometer



C. aethiops ants were only attracted by the volatiles emitted flowers of *Epipactis helleborine*

-> Non-pollinators used the volatiles emitted by orchids to exploit it (here nectar)

Conclusion

Non-pollinators may have an important effect on the number of pollinated flowers
Non-pollinators used the volatile chemicals emitted by the orchids to exploit them
Such a situation seems generalisable, as it was demonstrated in different species of non-pollinators and orchidist

As demonstrated only in fig/fig wasps and plant/herbivores relationships, non-pollinators (like pollinators) may also use chemical signals to exploit food sources associated with orchids

Field olfactometer device appeared well suited to investigate insect/plant relationship in natural conditions