frontiers in Plant Science

ORIGINAL RESEARCH
published: 20 January 2021
doi: 10.3389/fpls.2020.611877

# Flower Production, Headspace Volatiles, Pollen Nutrients, and Florivory in *Tanacetum vulgare* Chemotypes

*Elisabeth J. Eilers[1]*, Sandra Kleine[1], Silvia Eckert[1,2], Simon Waldherr[1] and Caroline Müller[1]*

[1] *Chemical Ecology, Bielefeld University, Bielefeld, Germany,* [2] *Biodiversity Research/Systematic Botany, University of Potsdam, Potsdam, Germany*

Floral volatiles and reward traits are major drivers for the behavior of mutualistic as well as antagonistic flower visitors, i.e., pollinators and florivores. These floral traits differ tremendously between species, but intraspecific differences and their consequences on organism interactions remain largely unknown. Floral volatile compounds, such as terpenoids, function as cues to advertise rewards to pollinators, but should at the same time also repel florivores. The reward composition, e.g., protein and lipid contents in pollen, differs between individuals of distinct plant families. Whether the nutritional value of rewards within the same plant species is linked to their chemotypes, which differ in their pattern of specialized metabolites, has yet not been investigated. In the present study, we compared *Tanacetum vulgare* plants of five terpenoid chemotypes with regard to flower production, floral headspace volatiles, pollen macronutrient and terpenoid content, and floral attractiveness to florivorous beetles. Our analyses revealed remarkable differences between the chemotypes in the amount and diameter of flower heads, duration of bloom period, and pollen nutritional quality. The floral headspace composition of pollen-producing mature flowers, but not of premature flowers, was correlated to that of pollen and leaves in the same plant individual. For two chemotypes, florivorous beetles discriminated between the scent of mature and premature flower heads and preferred the latter. In semi-field experiments, the abundance of florivorous beetles and flower tissue miners differed between *T. vulgare* chemotypes. Moreover, the scent environment affected the choice and beetles were more abundant in homogenous plots composed of one single chemotype than in plots with different neighboring chemotypes. In conclusion, flower production, floral metabolic composition and pollen quality varied to a remarkable extend within the species *T. vulgare,* and the attractiveness of floral scent differed also intra-individually with floral ontogeny. We found evidence for a trade-off between pollen lipid content and pollen amount on a per-plant-level. Our study highlights that chemotypes which are more susceptible to florivory are less attacked when they grow in the neighborhood of other chemotypes and thus gain a benefit from high overall chemodiversity.

**Keywords: terpenoids, gas chromatography-mass spectrometry (GC-MS), Asteraceae, protein:lipid-ratio, insect behavior, Phalacridae, chemodiversity**

OPEN ACCESS

***Edited by:***
*Robert R. Junker,*
*University of Marburg, Germany*

***Reviewed by:***
*Aphrodite Kantsa,*
*ETH Zürich, Switzerland*
*Hannah Burger,*
*University of Konstanz, Germany*

****Correspondence:***
*Elisabeth J. Eilers*
*elisabeth.eilers@uni-bielefeld.de*

***Specialty section:***
*This article was submitted to Plant Metabolism and Chemodiversity, a section of the journal Frontiers in Plant Science*

***Received:*** *29 September 2020*
***Accepted:*** *23 December 2020*
***Published:*** *20 January 2021*

***Citation:***
*Eilers EJ, Kleine S, Eckert S, Waldherr S and Müller C (2021) Flower Production, Headspace Volatiles, Pollen Nutrients, and Florivory in Tanacetum vulgare Chemotypes. Front. Plant Sci. 11:611877. doi: 10.3389/fpls.2020.611877*