Plant- and plot-level intraspecific chemodiversity shape herbivorous and flower-visiting arthropod communities.

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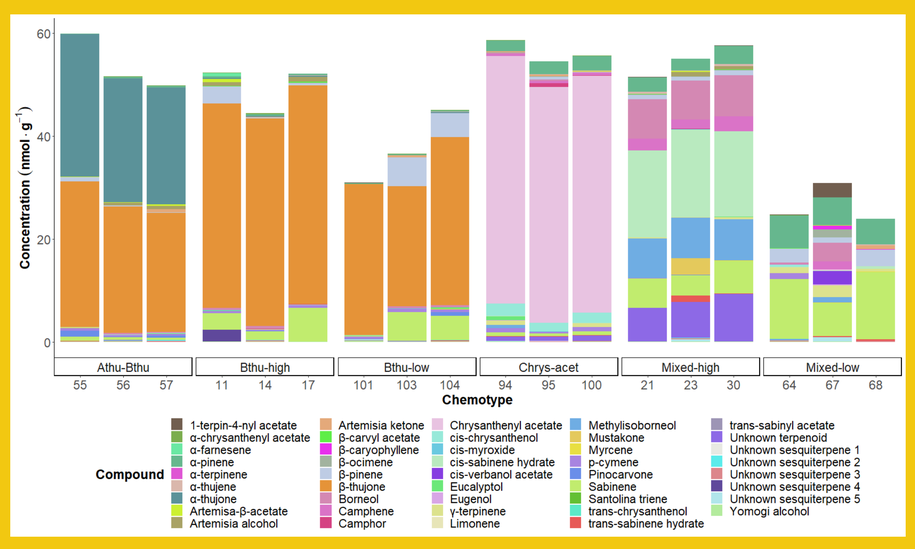
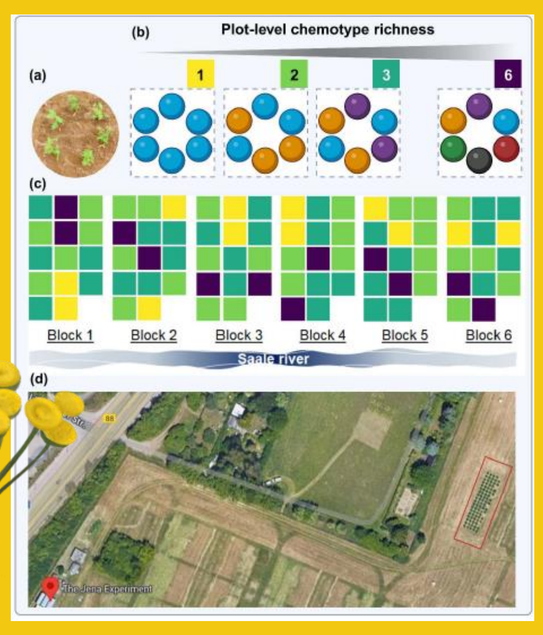
Background

The diversity and composition of blends of **specialized metabolites** can differ strongly between individuals of a species (plant-level), as well as between groups of plants of the same species growing together. Little Is known about how this diversity contributes to the shaping of plant-associated insect communities. In this work, we used *Tanacetum vulgare*, which is highly variable in terpenoid composition, to test plant- and plot-level effects of **chemical diversity** on herbivore and flower-visiting **insect communities** in a multi-year field study.



Six **chemotype** lines were established, each with three biological replicates

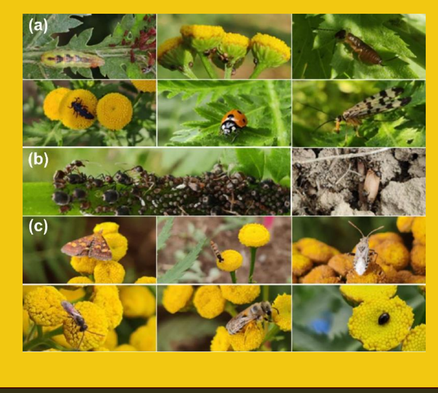
Study design



A field study was established with 84 plots, each assigned a combination of 1, 2, 3 or 6 chemotypes per plot. The study was established in the Jena Experiment field site in 2021 and still ongoing.

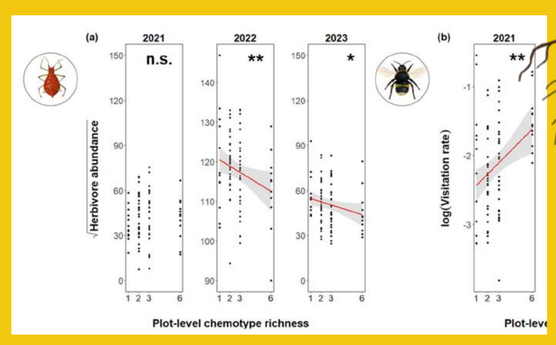
Insect observation

Insects were observed in 26 sampling rounds from 2021 onwards, with focus on herbivores (bottom left), predatory insects, ants and flower visitors (bottom right).

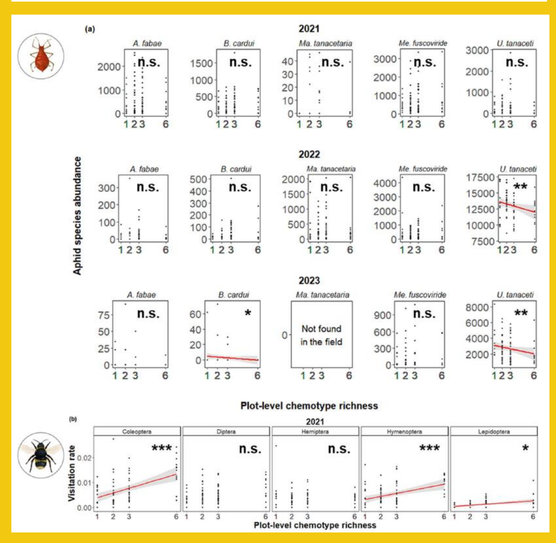


Main findings

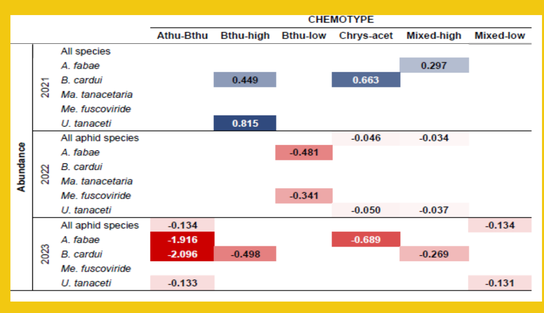
Cumulative annual insect abundance responded strongly to plot-level chemotype richness. It negatively related to herbivore abundance, whereas flower visitor abundance was positively impacted.

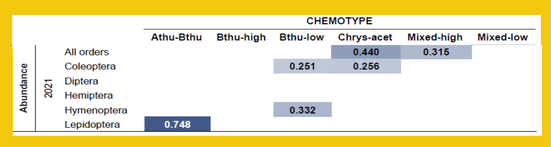


Herbivore patterns were driven by a specialist aphid, whereas **flower visitor** patterns were stable across multiple relevant insect orders.



Plant **chemotype presence** in a plot had strong effects on insect abundance, with effects shifting from attractant (blue) to repellant (red) over time in herbivore species, whereas chemotype presence only had attractant effects on pollinators (blue).





Why does it matter?

Understanding variability in plant-associated insect community dynamics is an important field in ecology. Although specialized chemical composition has long been postulated as a driver of plant interactions, little is known about how blend diversity and chemotypic diversity affect such interactions.

We now show that the number of chemotypes in a plot affects herbivorous and flower-visiting insect communities, in ways that **align with evolutionary processes** that may have selected for patterns of chemical diversity that we see in nature. For plants, it makes sense to maintain what repels antagonists, and attracts mutualists, and this relationship with direct interaction partners is evident in our data.
Interestingly, indirect interaction partners, including ants and predators, seem to have less straightforward patterns, and their dynamics are likely governed by other processes.

Take home

Interactions between insect communities and plants are incredibly complex. We are only beginning to understand the role of blend composition in determining interactions on plants. It's an exciting time to work in chemical ecology!

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