

WILD PARSNIP POLLINATION IN TWO HEMISPHERES

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When plants colonize new places they usually arrive without any of their natural enemies and pollinators. The wild parsnip is native to Europe, as is its principal herbivore, the parsnip webworm, a flower-feeding caterpillar. Both species have been accidentally introduced into North America and New Zealand. In North America, wild parsnips first appeared in the 17th century and parsnip webworms were accidentally introduced approximately 250 years later. In contrast, wild parsnips arrived in New Zealand in the mid-19th century and parsnip webworm arrived very recently, in 2004. Pollinator attraction and herbivore defence are both mediated by floral chemistry. Prior to the arrival of its major herbivore, wild parsnips in New Zealand produced lower levels of chemical defences (volatiles). The goal of our study was to determine whether, in the absence of their primary enemy, wild parsnips in New Zealand are more attractive to pollinators.

To test our hypothesis, we determined 1) which insect species are effective pollinators of parsnips; 2) which volatiles are attractive to these pollinators; and 3) whether plants in populations with no history of webworm attack produce more of these attractive compounds. We programmed cameras mounted over floral structures (umbels) of parsnips in the U.S. and New Zealand to take photographs of insect visitors every 5 minutes. At the same

time, we collected volatiles from another umbel on the same plant and identified the compounds. After the plants set seed, we correlated visitation frequency (as determined by the photographs) with seed number to determine which visitors were likely responsible for pollination.



Fly with pollen visiting a parsnip umbel

We found that in both countries parsnips are pollinated predominantly by flies, particularly species in the family Syrphidae. In both places, plants that produce higher quantities of a few specific volatiles (sesquiterpenes and aliphatic esters) have higher pollinator visitation. That New Zealand parsnips produce more of these attractive volatile suggests that, in the absence of their major enemy, wild parsnips may configure their chemical signals more for attracting pollinators than for deterring herbivores.