New research uses novel approach to study plant mimicry

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Batesian mimicry is a common evolutionary tool where unprotected species imitate harmful or poisonous species to protect themselves from predators. To date, nearly all examples of Batesian mimicry have come from studies on animals. A new study published today in *Botany*, provides a compelling example of plant mimicry between two New Zealand plants, *Alseuosmia pusilla* (known locally as small toropapa) and *Pseudowintera colorata* (commonly known as horopito or as a pepper tree).

A. pusilla is a commonly overlooked shrub that grows beneath the forest canopy. It is often mistaken as the much more abundant *P. colorata* because of its similarities in leaf size, shape, and pigmentation. Indeed, unless the plants are flowering or fruiting, the only quick way to be sure that a plant really is *A. pusilla* is to taste the leaf. *A. pusilla* is quite palatable, whereas the leaves of *P. colorata*, the chemically-defended plant, have a pungent, hot peppery taste that numbs the tongue when chewed. Since herbivores use leaf shape, size and colour to identify food, it is feasible that a palatable plant species might evolve to resemble an unpalatable species.

It has long been assumed that *A. pusilla* might avoid being eaten by insect or avian herbivores by mimicking the unpalatable *P. colorata*; until now, however, this assumption has lacked empirical evidence. The study published today provides the first detailed evidence that leaf shape is perfectly matched between an undefended species and a chemically defended unrelated species, a trait consistent with Batesian mimicry. The

leaves of *A. pusilla* were far more likely to resemble those on neighbouring *P. colorata* than those on distant plants. Furthermore, leaf shape changed similarly in both species along an altitudinal gradient. The study, novel in its approach, highlights the value of using quantitative morphometric methods when investigating leaf shape, especially in relation to plant mimicry.

"Given the huge variability of leaf shape, not only between species, but also within a species across a large growing range, we needed to develop a method that could accurately quantify leaf shape within a forest population of the two species; this is an approach that other research on plant mimicry has not attempted" says Karl Yager, a graduate student in the School of Biological Sciences at Victoria University of Wellington. "To do this, we compared the relative positions of 70 'landmarks' around the leaf perimeter for hundreds of leaves. More traditional approaches, such as comparing leaf length, width, and area, are insufficient to resolve subtle shape differences that might be used by a herbivore to identify its food."

This research represents an important first step in demonstrating Batesian mimicry in vascular plants. It also highlights the importance of using a 'spatially explicit' morphometric method to investigate leaf shape, and establishes a framework to measure and compare leaf shape within and between species over a growing range.

More information: Karl G. Yager et al, The significance of shared leaf shape inand, *Botany* (2016). DOI: 10.1139/cjb-2016-0049

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