Animals keep eating precious plants—we used 'smell misinformation' to keep them away

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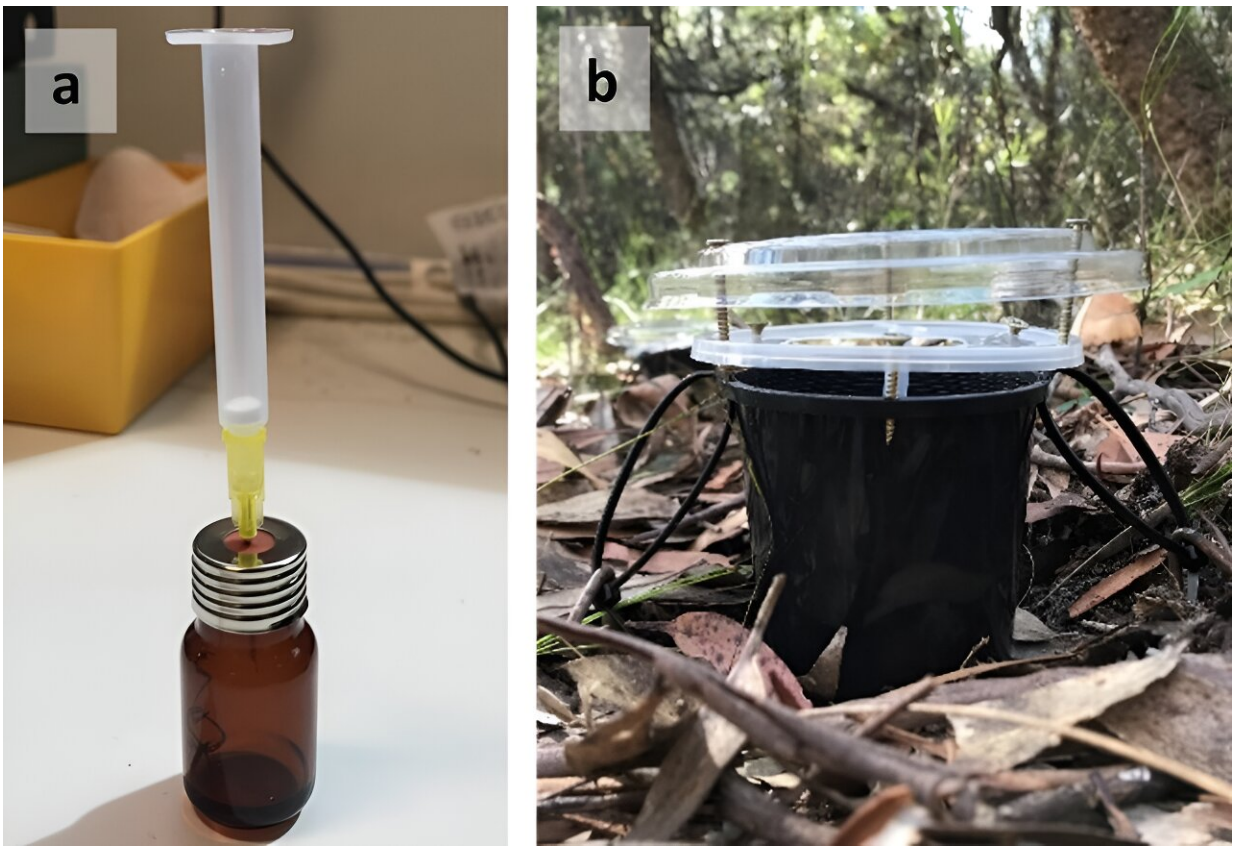

We deployed the virtual neighbour vials in custom-built contraptions that secured vials to the ground and provided protection from the weather. Credit: *Nature Ecology & Evolution* (2024). DOI: 10.1038/s41559-024-02330-x

In places where we need to protect valuable plants—whether for ecological or economic reasons—local herbivores can cause significant damage.

Current solutions often involve killing the problem animals. But this is increasingly unacceptable due to animal welfare concerns and social pressures. Physical barriers such as fences can be expensive, and aren't always practical. We need other options.

Recently, our team discovered that herbivores—plant-eating mammals—primarily use their sense of smell to tell which plants they want to eat or avoid.

In our study published today in Nature Ecology & Evolution, we show how we can use this reliance on smell to nudge wallabies away from vulnerable native tree seedlings. We artificially created and deployed the key smells of a shrub wallabies avoid.

Herbivore-induced headaches

Hungry plant eaters are a concern for conservationists, farmers and foresters alike. They can devastate revegetation efforts and post-fire recovery, destroying more than half the seedlings in these areas.

Every year, they cause billions of dollars of damage in forestry and agriculture. Herbivores also pose a risk to the long-term survival of many threatened plant species.

The most effective control strategies will likely work with a herbivore's natural motivations—understanding and harnessing what drives the animal to find or avoid certain plants.

Previously, research had primarily focused on what herbivores were

eating, but had never really asked *how* they find the food in the first place.

Our approach puts a new twist on "olfactory (smell) misinformation" or "chemical camouflage" approaches. In recent studies, these methods have substantially reduced invasive predators eating threatened bird eggs in New Zealand, and house mice eating agricultural wheat grain in Australia.

A landscape of smells

In navigating a scent landscape, herbivores use odor to recognize and select among plants and plant patches. Odor is key in guiding the foraging of marsupials in Australia, elephants in Africa and Asia, and deer in the United States.

With this in mind, we explored whether the smell of a plant they don't like could be enough to nudge animals away from highly palatable native tree seedlings.

A single eucalypt seedling surrounded by five virtual neighbours (a) and five real plant neighbours (b). Credit: *Nature Ecology & Evolution* (2024). DOI: 10.1038/s41559-024-02330-x

To test this idea, we focused on swamp wallabies foraging in a eucalypt woodland in eastern Australia. Studies have shown having too many swamp wallabies around can limit the number of eucalypt seedlings that survive to become trees. Swamp wallabies also have a fantastic sense of smell—they can find just a few eucalypt leaves buried underground among complex vegetation.

Using an approach we recently developed, we found the key scent compounds of a plant we know wallabies avoid—the native shrub *Boronia pinnata*.

We then mixed these compounds together to create "informative virtual neighbors". They were "informative" as our mix of compounds mimicked what a wallaby would recognize as *Boronia pinnata*, "virtual" as we were not actually deploying the real shrub, and "neighbors" as we placed these smells in the bush next to eucalypt seedlings we were trying to protect.

In our study, a virtual neighbor was a small glass vial with a few milliliters of the mixture, with a tube pierced through the lid so the smell could waft out.

Using odors instead of real plants is a type of olfactory misinformation—it sends a deceptive message to the animals.

Real and virtual neighbors

We also compared if virtual neighbors were as good as the real thing in protecting eucalypt seedlings from being eaten by wallabies.

Five virtual neighbor vials or real *Boronia pinnata* plants were spaced evenly around single eucalypt seedlings the wallabies would find highly palatable. (We also had two types of controls: a seedling with nothing around it, and a seedling surrounded by five empty vials.)

Using remote cameras for 40 days, we recorded how long it took wallabies to find and munch on the eucalypt seedlings.

The results were staggering. Seedlings were 20 times less likely to be eaten when surrounded by virtual neighbors than for both controls. This was equivalent to using real *B. pinnata* plants, but better because vials don't compete with seedlings for water and other resources.

A highly effective approach

The success of our study indicates we could use this approach as a new management tool—one that works by influencing the animals' behavior rather than trying to get rid of them.

We believe the concept behind developing virtual neighbors is directly transferable to any herbivore, mammal or otherwise, that uses plant odor to forage.

All herbivores avoid some plant species. With future development, we can deploy smelly virtual neighbors as a non-deadly and cost-effective tool to reduce the problems caused by overzealous herbivores.

More information: Patrick B. Finnerty et al, Olfactory misinformation provides refuge to palatable plants from mammalian browsing, *Nature Ecology & Evolution* (2024). DOI: 10.1038/s41559-024-02330-x

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