Identifying the best bumble bee diets

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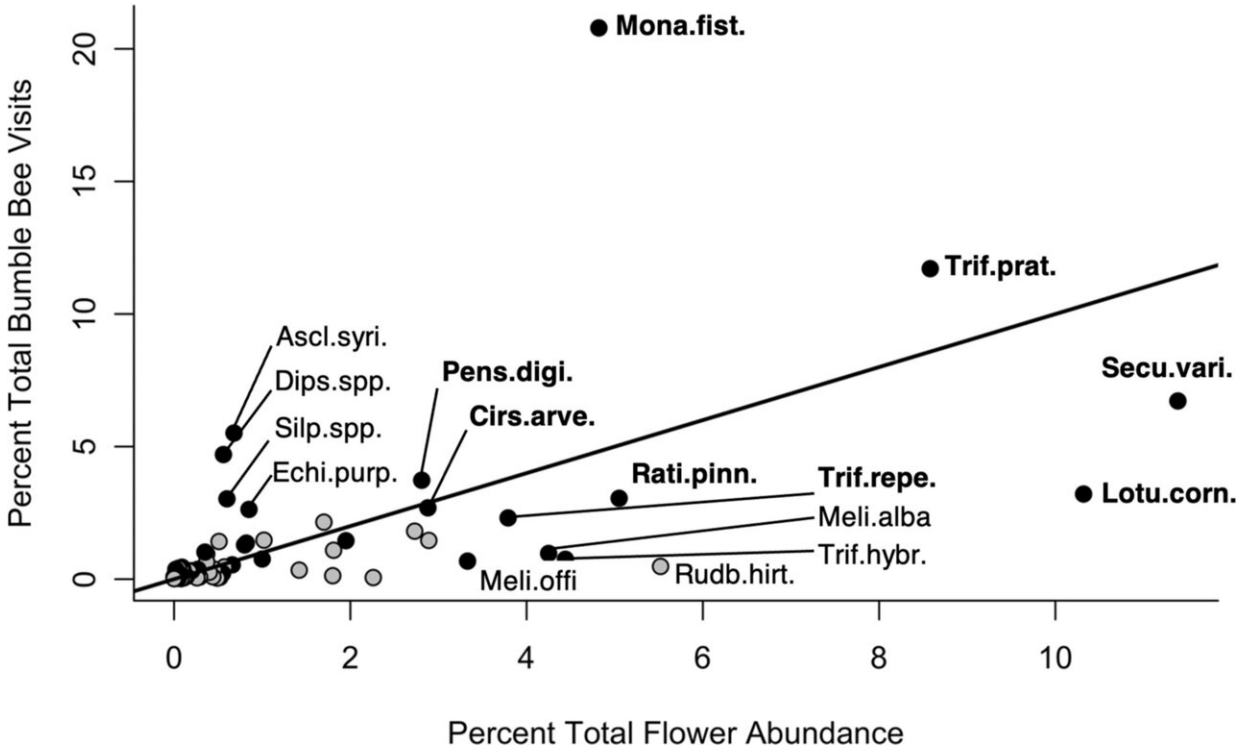

Bumble bee use versus availability of food plants. Use is the percentage of total aggregated bumble bee visits, and availability is the percentage of total flower abundance. Black circles indicate plant species that were visited by five or more *Bombus* species, and gray circles fewer than five. The black line indicates a hypothetical 1:1 relationship in which bumble bees use flowers in direct proportion to their availability. Labeled plant species are outliers according to the interquartile rule for percentage of *Bombus* visits, percentage of flower abundance, or both (in boldface). Ascl.syri., *Asclepias syriaca*; Cirs.arve., *Cirsium arvense*; Dips.spp., *Dipsacus fullonum/laciniatus*; Echi.purp, *Echinacea purpurea*; Lotu.corn., *Lotus corniculatus*; Meli.alba, *Melilotus alba*; Meli.offi, *Melilotus officinalis*; Mona.fist., *Monarda fistulosa*; Pens.digi., *Penstemon*

digitalis; Rati.pinn., *Ratibida pinnata*; Rudb.hirt, *Rudbeckia hirta*; Secu.vari., *Securigera varia*; Silp.spp., *Silphium* spp.; Trif.hybr., *Trifolium hybridum*; Trif.prat., *T. pratense*; Trif.repe., *T. repens*. Credit: *Ecosphere* (2023). DOI: 10.1002/ecs2.4425

A new study has identified the bee's knees of bumble bee dietary options in Ohio and the Upper Midwest.

By viewing almost 23,000 bumble bee-flower interactions over two years, researchers found that these bees don't always settle for the most abundant flowers in their foraging area—suggesting they have more discerning dietary preferences than one might expect.

Being large, strong and social bees that can fly for long distances, bumble bees are major contributors to pollination, particularly for agriculture—but like other pollinators threatened by habitat loss, climate change and disease, the numbers of some species are dwindling.

This new data can help guide planting decisions for professional and amateur conservationists alike, researchers say.

"Getting over 20,000 observations of individual identified bumble bees visiting particular flower species is pretty incredible for a dataset," said Karen Goodell, senior author of the study and a professor of evolution, ecology and organismal biology at The Ohio State University's Newark campus. "One of the keys for this project was having flower associations, as well as estimates of flower abundance, so we counted the flowers, too."

In no particular order, the top flower species preferred by an aggregate of bumble bee species in Ohio are milkweed, native thistles, morning

glory, purple cone flower, bee balm, beardtongue, red clover, vetch and rosinweed, or cup plant. Two other "bee magnet" plants in low abundance that were crawling with the fuzzy buzzers are Culver's root and wild indigo.

The study was published recently in the journal *Ecosphere*.

Of the 16 bumble bee species historically found in Ohio, researchers observed only 10 species, eight of which were abundant enough to include in the analysis—including the American Bumble Bee (Bombus pensylvanicus), which is under consideration for addition to the Federal Endangered Species List. As expected, the most frequently observed species—11,555 visits in all—was the Common Eastern Bumble Bee (Bombus impatiens), compared to only 31 observations of the American Bumble Bee.

In fact, despite the extensive sampling, the authors are confident in the range of preferred flowers for only the three most common species. For the five less common species, researchers didn't witness enough bee-flower interactions to fully account for what they eat. That sparseness of data on the rarer species speaks to the need for this comprehensive analysis, researchers said.

"It's really important to know what species we do have and what they like to eat, because any of them could become rare," Goodell said. "It's not like we're doing a fantastic job of taking care of our natural areas. The more information we have about their preferences, the better we can manage their habitat."

Research team members visited 228 locations in Ohio during the summer months of 2017 and 2018, for a total of 477 hours, and observed bumble bees interacting with 96 different species of wildflowers. The sites included unmanaged fields, restored roadsides and

meadows, and planted urban patches and hayfields.

The data analysis showed strong nonrandom patterns of bumble bee visits to flowers, meaning the bees selected specific plants in greater proportion than their availability would suggest. Researchers used a selection index to gauge bees' flower preferences that compared the frequency of bumble bee species visits to the flowers' overall percent abundance.

"What we were trying to get at was if all else is equal, what do they actually prefer?" said first author Jessie Lanterman Novotny, who led much of the project as an Ohio State Ph.D. student and postdoctoral researcher in Goodell's lab. "There were flowers that were less abundant that bees actively sought out—they didn't necessarily eat what was most abundant. There were also plants they avoided: No matter how many of certain flowers there were, they said, 'No thanks'."

The researchers identified a few plants that are highly abundant and commonly used in pollinator conservation plantings and seed mixes that bumble bees consistently ignored, including alsike clover, black-eyed Susan and prairie cone flower. Five of the eight bumble bee species also were strongly drawn to non-native plants, which poses a dilemma for conservation planters focused on preserving native plant species.

And it turns out the three most common species don't all feast at the same flower 'table'.

"We compared the flowers each bumble bee species used the most, and species only overlapped by one-third or less," said Lanterman Novotny, now a visiting assistant professor of biology at Hiram College. "Low overlap could relieve competition, so all these species can coexist together."

Additional co-authors included former Ohio State PhD student Andrew Lybbert, now at Methodist University, and Paige Reeher and Randall Mitchell of the University of Akron.

More information: Jessie Lanterman Novotny et al, Bumble bee banquet: Genus- and species-level floral selection by Midwestern Bombus, *Ecosphere* (2023). DOI: 10.1002/ecs2.4425

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