CENTRAL COAST BEEKEEPERS NEWSLETTER

Oct., 2024

NEXT MEETING Oct. 19, 2024

Important Notice: Our meetings are now on SATURDAYS and LOCATIONS VARY. Please see the updated schedule below for dates and locations.

PRESIDENT'S MESSAGE

By Jeremy Egolf

Resiliency ("the capacity to withstand or to recover quickly from difficulties") isn't a word I often see associated with backyard beekeeping, but it's inherently embedded in much that we do. Whether we're testing and treating for varroa mites, choosing locally bred bees, or planting native flowers that bloom in early spring or late summer for apis mellifera and the regional pollinators, we're really focused on encouraging resiliency in the face of the challenges our little friends face. What brought this to mind is the recent double hurricane whammy that hit the southeast United States (my niece made it through OK), and how amateur beekeepers can't solve the large systemic problems, but we can contribute in our small way to enhancing our own regional viability in the face of predictable uncontrollability.

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For example, the highlight of our September meeting was Randy Oliver's talk, "Concepts in Varroa Management", for which see the detailed report herein. One of the foundations of varroa management is breeding resistant bees, an area in which Randy has had some success. This newsletter includes references to Russian bee breeding, pollinator-friendly vegetation for utility-level solar photovoltaic installations, varroa treatments, as well as further material on the tropilaelaps mite.

In my own small world, we note with pleasure that the early autumn rains are greening the grass (some pollen is still being collected). Based on the avid consumption of fava bean nectar by fog belt bumble bees as well as our honey bees, we planted some 200 square feet of fava beans, and the initial planting are already emerged a couple of inches above the soil. I'd started a formic acid treatment back in September based on the mite presence of about two per hundred bees; my sense that I was outdoing it was effectively suppressed by Randy Oliver's recommendation that this is a fine time to be fighting the mites; the plan is to hit them again with oxalic vapor over the end of year holidays. Excess supers have been removed from our hives and frames are being refurbished for the coming spring. Hives are being hefted to calibrate for honey consumption, and insulation, feeders and "moisture boxes" will be added soon.

The above words remind me that our October meeting will feature the venerable Dewey Caron speaking on "Winter Hive Preparations." See you there!

The Year's Program

All meetings 1:30 p.m. October 19 and November 16 are at the OSU Extension office in Newport.

Saturday, October 19: Dr. Dewey Cary (Emeritus Professor of Entomology and Wildlife Ecology, University of Delaware, and Affiliate Professor, Department of Horticulture, OSU): "Winter Hive Preparations"

Saturday, November 16: Annual Meeting (Election of Officers, Plans for Next Year)

Randy Oliver, “Concepts in Varroa Management”

Randy opened with a discussion of the risks posed by varroa, emphasizing the mites as vectors for deformed wing and paralytic viruses: varroa management equals infectious vector management. The talk was structured as a pyramid, with a broad foundation of preventive measures (cultural efforts, biologically resistant stock), leading through physical, mechanical and biochemical management, monitoring, treatment with biopesticides, and, if all else fails, synthetic miticides.

Sealed brood is the venue for mite reproduction, and, with global warming, shorter winters will lengthen the period of mite increase and consequent intervention to minimize the mite population. The need for treatment varies per season - treatments should be applied if there is more than 1 or 2 mites per half cup of bees in the spring, 6 during the summer. The most accurate means of monitoring is the alcohol (or Dawn detergent!) wash of samples taken from non-brood frames - gentle sloshing is better than vigorous back-and-forth shaking. Two miticide treatments of 90% effectivity barely keep mites under control in northern California, with four such treatments necessary for almond pollinators.

Mite infestations increase exponentially, so treatment is most effective *before* swarm season, when there is the highest proportion of eight day old larvae, and also late in the year (after brood rearing) when the colony’s mites are all exposed.

Randy reviewed several methods of mite mechanical/cultural control. Least effective were to encourage small (worker rather than drone) cells and allowing to swarm (which just spread the mite population). Screened bottom boards (to allow the mites to drop from the colony) are of questionable value. More effective are drone brood trapping and sugar dusting twice a week, but sugar dusting must be repeated in a dedicated manner all through the year, making if extremely effective. Thermal treatments may be more effective. Most effective were spring colony splitting with queen cells, followed with an oxalic acid and glycerine dribble at 18 days. Alternatively, brood separation (with oxalic acid treatments) and recombining is very effective.

Half or more of the mites hide in brood, particularly during the early season, so mite washing tends to undercount the population. The most reliable monitoring technique is to choose bees from a non-brood frame and shake them into a tub; the older bees will fly away. Drones should be removed from the tub. Then, collect half a cup of bees, use 90% alcohol (or Dawn detergent!) to wash the bees, GENTLY SWIRLING to loosen the mites, NOT shaking vigorously. A magnifier is useful for affirmatively counting the mites thus released. The maximum acceptable mite count during the spring is one or two per cup of bees, six during the summer.

Mites will drift with bees from colonies with heavy infestations, so it is essential to minimize the mite population in all colonies. Robbing guards will not reduce mite immigration. As a professional beekeeper, Randy mite washes every colony in his apiary during the early summer.

Much of the session dealt with his straightforward and easy to use Varroa model (available here https://scientificbeekeeping.com/randys-varroa-model/ - with tutorials on Youtube). It is especially valuable to analyze the effects of various treatments through the colony annual cycle. In late winter, formic acid or apivar are recommended; thymol around August; and Oxalic Acid or hopguard in October.

Estimated effectiveness of various treatments are embedded in the model notes, but can also be consulted in the Honey Bee Health Coalition's varroa treatment decision tool. Of several regional models, the generic is most applicable for the Oregon coast. It is customizable for local micro-environments and even individual colonies. It is very useful for trade studies of when to apply treatments of particular effectiveness.

Randy's richly detailed talk (the presentation -updated - and the Zoom recording, which includes examples of how to use his varroa model) are on our website: https://www.ccbaor.org/presenters-2024/

Tropilaelaps Department:

Videos

The last two issues of this newslettercarried articles about Tropilaelaps. Here are links to a couple of Youtube videos featuring Dr. Samuel Ramsey (whose work our last issue profiled) speaking on the subject.

This one is from the Honeybee Health Coalition:

https://www.youtube.com/watch?v=-JH9RAZzrAg

And this one was produced by Apiculture New Zealand:

https://www.youtube.com/watch?v=p34t9JKadqI&t=4s

Managing Varroa and Tropilaelaps Mites in Your Apiary

Mark Gingrich, Pennsylvania StateBeekeepers Association, Aug 14, 2024

A Varroa mite, left, and a Tropilaelaps mite. Pennsylvania State Beekeepers Association

Almost every beekeeper today is familiar with Varroa mites, external parasites of honey bees that to a large degree dictates how we manage colonies, no matter the size of our operation. They were first detected in the United States in October 1987 in Florida. They rapidly spread across the country over the next two years. By 1995, the pest was documented in every state.

The Varroa mite is indigenous to Asia, where it's a parasite of the Asian honey bee, Apis cerana. In its native habitat, the mite doesn't have a serious impact on the Asian honey bee because the bees have natural defenses that evolved over time. However, when the Varroa mite reached Europe in the 1970s and subsequently North America, it had disastrous consequences for the European honey bee, Apis mellifera. The Varroa mite is now considered a global threat to bees.

Australia was the only continent on the planet that didn't have Varroa until they were detected there in June 2022 at the Port of Newcastle in New South Wales. In response to the outbreak, Australia has tested more than 130,000 hives for the mite and destroyed more than 25,000. However, some say that the time lag between when the mite arrives and when it becomes apparent to authorities makes it difficult to eradicate.

The initial strategy was to control the mite by euthanizing all hives discovered to be infested, but that plan was abandoned after the scale proved to be hopeless. As of September 2023, Australia has abandoned efforts to eradicate the mite and is instead focusing on a plan to help beekeepers and other industries prepare and manage it. This includes a national education program, training and requiring beekeepers to inspect their hives and report any detections. Sadly, Varroa has now established itself on every inhabited continent on Earth.

When I began keeping bees, we talked about tracheal mites, Acarapis woodi. Although I was aware of them, Varroa were not all that big a deal at that time. Tracheal mites are less than 0.2 millimeters in size and can only be seen with a microscope. These pests can be spread between hives and apiaries when bees drift between them or come from infested colonies. Mated female mites leave the breathing tubes where they develop and attach themselves to the hairs of a passing bee, entering the bee's trachea through the thoracic spiracles. Tracheal mites feed on bee hemolymph (fluid of the circulatory and lymphatic system similar to blood). In beekeeping today, tracheal mite levels are statistically insignificant.

Sam Ramsey, a nationally recognized speaker and assistant professor of ecology and evolutionary biology at the University of Colorado, Boulder, is the leading researcher of mites. He received his B.S. in entomology from Cornell University and his Ph.D. in entomology from the University of Maryland, College Park. He was our speaker at the fall conference a few years ago. There are now reports that Tropilaelaps mites have established populations in Ukraine. Dr. Ramsey warns that their presence is the biggest wake-up call to the rest of the world about this parasite. Ukraine exports bees to Canada, so North America might not be too far behind.

Tropilaelaps are both deadlier and harder to kill than Varroa. When the mites reached India, entomologists estimated that they killed between 50% and 100% of the colonies they infested. A similar death toll in the U.S. would have a devastating impact on not only beekeeping, but also on agriculture.

Our industry struggles to manage Varroa, and we collectively agree that we are nowhere near ready to deal with this new pest. Much like Australia is learning to deal with Varroa, the United States will almost assuredly be dealing with Tropilaelaps in the future. One of the criticisms that SB 1198 has received is a perceived vagueness in some of the language. If this law passes, it will be further defined by regulation after its passing. The vagueness is intended to give the state some ability to manage Tropilaelaps and other yet-to-be-determined pests when they arrive.

[CCBN Editor's note: Pennsylvania SB 1198 is described as "An Act amending Title 3 (Agriculture) of the Pennsylvania Consolidated Statutes, in plants and plant products, providing for plant and pollinator protection; conferring powers and duties on the Department of Agriculture and Secretary of Agriculture; establishing the Plant and Pollinator Protection Committee and the Plant and Pollinator Protection Account; dissolving the Plant Pest Management Account; providing for violations and penalties; and making repeals." Poking around the internet, we turned up The National Caucus of Environmental Legislators here: https://www.ncelenviro.org/]

Bees and Solar Electrification

The good folks at the Honeybee Health Coalition have expanded their portfolio of recommended practices by recently issuing their “Guidelines for Developing Pollinator-Friendly Utility-Scale Solar Projects: https://honeybeehealthcoalition.org/wp-content/uploads/2024/09/HBHC-Solar_091324.pdf

It’s probably not particularly helpful to most (any?) of our readers, but worth being conversant for landholders with space for a couple dozen ground mounted solar panels, or in the event you have reason to talk to your utility managers or county planners and want to educate them. The emphasis is on vegetative mixes (and sheep grazing) compatible with solar “farms” and their maintenance over the years.

Varroxsan is Now Available:

Varroxsan (strips impregnated with oxalic acid) is now available, but more expensive than vaporized oxalic acid (around $1.20 -$1.50 per strip, depending on quantity). According to Mann Lake’s website, one strip should be used per 2.5 deep frames covered with bees, or one strip per 5 medium frames, making it a quite expensive treatment for a healthy colony. Per Randy Oliver, it is less messy than hopguard, for those who want to experiment with it.

EPA issues advisory for substances used to control varroa mites in beehives

[From Michigan State University's admirably active extension service, we have this summary of the recent EPA advisory.]

Language and contents in this article are taken directly from the Advisory on the Applicability of Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Federal Food, Drug and Cosmetic Act (FFDCA) for Substances Used to Control Varroa Mites in Beehives by the United States Environmental Protection Agency (U.S. EPA). A summary of the advisory is available at U.S. EPA Advisory on the Applicability of FIFRA and FFDCA for Substances used to Control Varroa Mites in Beehives.

Advisory on the applicability of FIFRA and FFDCA for substances used to control varroa mites in beehives

The U.S. EPA issued an advisory to clarify what pesticide products and active ingredients are registered under FIFRA to control varroa mites (*Varroa destructor*) in beehives, what tolerances or exemptions from tolerance under FFDCA are applicable, and how the Agency views use of unregistered products to treat beehives for one's own personal use. EPA is also affirming that use of registered pesticides must comply with FIFRA labeling requirements, that pesticide residues in honey must comply with any federal tolerances under FFDCA, and that states may have more restrictive requirements that must be followed as well.

It is a violation of FIFRA if a person uses registered pesticides in a manner that is not in accordance with label instructions. Currently, EPA has registered 16 pesticide products, covering about 10 active ingredients, that can be used on beehives to control varroa mites. In registering these pesticides products, EPA has conducted comprehensive evaluations and determined the products will not cause unreasonable adverse effects to human health or the environment when used according to the label. While "one's own personal use" is not defined in federal regulations, using unregistered pesticides could result in a violation of FIFRA. Additional violations could exist if the colony or hive products are distributed and/or sold. Use of unregistered products as a pesticide that do not include label instructions or a designated application rate could also result in residues in the honey or other edible bee products (e.g., honeycomb, pollen). Hive products that are derived from hives where unregistered pesticides are used are not covered by a tolerance or exemption under FFDCA and represent an adulterated product. The sale or distribution of adulterated edible hive products is a violation of FFDCA.

EPA remains committed to supporting the compliance and enforcement efforts by states with primary enforcement authority to ensure compliance with FIFRA requirements.

The advisory addresses the following questions:

- Why is EPA issuing an advisory now?
- What are varroa mites and why are they such a concern for the beekeeping community?
- What does it mean to be a registered pesticide under FIFRA?
- What does it mean to be exempt from the requirements of FIFRA as a "minimum risk pesticide"?
- What does it mean to have a tolerance or tolerance exemption under FFDCA?
- Does an exemption under from the registration requirements under FIFRA automatically mean it is exempted under FFDCA from the requirements for a tolerance, and vice versa?
- Are there pesticides registered under FIFRA that beekeepers can use to control varroa mites in their beehives?
- Are there tolerances or tolerance exemptions set under FFDCA that cover the residues of the pesticide products listed in Table?
- Is it a violation of FIFRA to use a registered pesticide in a manner that is not consistent with its label?
- Is it a violation of FIFRA or FFDCA to sell or distribute food derived from beehives (e.g., honey, comb, wax, propolis, royal jelly, pollen) harvested from beehives treated with unregistered products?
- Is it a violation of FIFRA or FFDCA to sell or distribute the honey or other edible beehive products (e.g., pollen, honeycomb) harvested from beehives treated with unregistered products?
- Are there state pesticide laws that are different from FIFRA that may be applicable?
- What other efforts is EPA engaged in to help beekeepers address the varroa mite issue?

Conclusion

The information in this article is intended to help beekeepers understand the restrictions and requirements regarding pesticide applications in honey bee colonies, such as varroa mite treatments. For the most up-to-date information or for clarification, please refer to the Advisory on the Applicability of FIFRA and FFDCA for Substances used to Control Varroa Mites in Beehives by U.S. EPA.

Resources

- Advisory on the Applicability Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Federal Food, Drug and Cosmetic Act (FFDCA) for Substances used to Control Varroa Mites in Beehives
- EPA-registered Pesticide Products Approved for Use Against Varroa Mites in Bee Hives
- U.S. EPA Advisory on the Applicability of FIFRA and FFDCA for Substances used to Control Varroa Mites in Beehives
- Bee smart about in-hive pesticide applications! postcard from U.S. EPA
- Honey Bee Health Coalition's Tools for Varroa Management Guide

Acknowledgements

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Can Native Plants Mitigate Climate-related Forage Dearth for Honey Bees (Hymenoptera: Apidae)?

Published in Journal of Economic Entomology, Volume 115, Issue 1, February 2022, Pages 1–9, https://doi.org/10.1093/jee/toab202

Published online: 25 November 2021

Abstract

Extreme weather events, like high temperatures and droughts, are predicted to become common with climate change, and may negatively impact plant growth. How honey bees (*Apis mellifera* L. [Hymenoptera: Apidae]) will respond to this challenge is unclear, especially when collecting pollen, their primary source of protein, lipids, and micro-nutrients. We explored this response with a data set from multiple research projects that measured pollen collected by honey bees during 2015–2017 in which above-average temperatures and a drought occurred in 2017. We summarized the abundance and diversity of pollen collected from July to September in replicated apiaries kept at commercial soybean and corn farms in Iowa, in the Midwestern USA. The most commonly collected pollen was from clover (*Trifolium* spp. [Fabales: Fabaceae]), which dramatically declined in absolute and relative abundance in July 2017 during a period of high temperatures and drought. Due to an apparent lack of clover, honey bees switched to the more drought-tolerant native species (e.g., C*hamaecrista fasciculata* [Michx.] Greene [Fabales: Fabaceae], *Dalea purpurea* Vent. [Fabales: Fabaceae], *Solidago* spp. [Asterales: Asteraceae]), and several species of Asteraceae. This was especially noticeable in August 2017 when C*. fasciculata* dominated (87%) and clover disappeared from bee-collected pollen. We discuss the potential implications of climate-induced forage dearth on honey bee nutritional health. We also compare these results to a growing body of literature on the use of native, perennial flowering plants found in Midwestern prairies for the conservation of beneficial insects. We discuss the potential for drought resistant-native plants to potentially promote resilience to climate change for the non-native, managed honey bee colonies in the United States.

[For the full paper (available online or as a downloadable PDF) search on the title above.]

Russian Bee Breeding:

Randy Oliver’s discussion of breeding bees resistant to varroa reminded me that Russian beekeepers have recently been confronting tropilaelaps mites. Poking around the internet, this article on “The state and prospects of using Central Russian bee colonies of the ‘Orlovsky’ type.” This variety is highly productive, apparently originating about 240 miles southwest of Moscow, and has been bred to succeed in remote and northern regions. The breeding program strives to both select for desired characteristics and to preserve gene diversity. The article is interesting both for breeding and for its writing style (and vocabulary building - “emtomophilic,” “nectariferous”) , as well as it’s late Soviet and post-Soviet socio-economic features (“subsidiary farms of the Magnitogorsk, Starooskolsky, Cherepovets metallurgical plants,” the existence of a state commission to certify breeding programs) and is worth a glance. I imagine (and hope) the Russian scientific beekeepers are thinking about breeding for mite resistance. Bring up google maps and stretch your knowledge a bit:

https://www.e3s-conferences.org/articles/e3sconf/pdf/2021/30/e3sconf_farba2021_01037.pdf

Drones for Drones?

Bees tracked with tiny radar chips and drones (Courtesy of the BBC)

Tiny radar chips are being fitted to bees to track their movements.

A team at The University of Oxford have been investigating how to help declining insect and bird populations. The new Biotracks technology tracks the harmonic radar tags attached to bees with a receiver carried on a drone in a bid to improve understanding of what is happening to pollinators. Team leader Dr Tonya Lander, from the university's department of biology, said they are hoping to share the equipment with other researchers.

University of Oxford - Tags are attached to the back of the bee in between its wings "like a rucksack"

University of Oxford - Dr Lander (right) and Prof Chris Stevens (left) have been investigating ways to solve the problem of declining insect and bird populations

It has been found that more than 85% of plant species are insect pollinated but 40% of insect species are at risk of extinction. "That means if they don't receive pollination, they'll set fewer or possibly no seeds, which means no fruit for us to eat but also no reproduction of those plants for the next generations," Dr Lander said.

In a video for the university's website, the team said there was an "urgent" need to locate insects, monitor behaviour, follow local movements and track swarm migration. "We have a radar transmitter sitting on the ground, a small tag attached to the back of the bee in between where the wings attach like a little rucksack and a receiver that's carried on a drone flying up above," Dr Lander explained. Speaking to BBC Radio Oxford, she said they "ended up inventing the smallest harmonic radar tag ever" so that the insects could carry it without affecting their behaviour.

Other challenges included the amount of weight and the kind of equipment that could be safely carried on the drone.

University of Oxford - LED lights around their camera reflect off the tag on the bee and backwards to the camera

A small circuit attached to the radar system converts signals into a higher frequency, which is then picked up "with a very sensitive receiver". "It illuminates the bee, then pings back a higher frequency signal, which we can locate with another radio receiver," said Associate Prof of Engineering Science Chris Stevens.

Prof Stevens described tracking small insects with radar as an "engineer's extreme sport". "Because it was so difficult. Biotrackers have been able to make it a working technology, a real technology that we can use today," he said. He said its benefit was that the tracking range could be extended from a few metres "to potentially an entire field". Dr Lander said the team had just put the technology in action but had not yet "moved to the stage of actually doing the biology". "Great things to come but we're at that transition point now," she said.

University of Oxford

Foraging the USDA Agricultural Research Service:

Nature Preserve Vintage Museum Collection, Modern Research Intersect in Century-Long Bee Study

September 25, 2024

At a tranquil nature reserve in South Michigan, an Agricultural Research Service (ARS) scientist and her collaborators connected olden wild bee sample collections and modern technology to better decode the ecological traits and habits pollinators, critical links to environmental stability.

Kelsey Graham, an ARS Pollinating Insect Research Unit scientist, co-led the collaborative, intensive wild bee study at the University of Michigan's E.S. George Reserve with a sampling period covering 1921 to 2018, which in tandem with advanced computer analyses revealed long-term bee population trends that may hold the keys to new and enhanced conservation approaches. "These studies point to clear indicators of an urgent need for diligent and consistent conservation efforts to protect bee diversity, which is crucial for our ecosystem health, human health and agricultural productivity," Graham said.

In a recent publication of Proceedings of the Royal Society B, Graham's research article "A century of wild bee sampling: historical data and neural network analysis reveal ecological traits associated with species loss," explains how the study reached inflection points along the way, finding alarming declines in species richness, evenness and overall bee community diversity. Researchers also found that 64% of the more common bee species exhibited a more than 30% decline in abundance. "In 1972 and 1973, the late zoologist Francis C. Evans detected 135 bee species, compared to our recent surveys in 2017 and 2018, which recorded only 90 species, with just 58 species present in both sampling periods," Graham noted. "These samplings indicate a substantial shift in the bee community composition."

To better understand why some species disappeared from the preserve, the ARS team and its partners leveraged neural networks, which determined that certain types of bees were more likely to vanish. Specifically, researchers discovered that oligolectic ground-nesting bees (meaning, bees that collect pollen from a few types of plants and nest in the ground) and kleptoparasitic bees (who steal food from other bees) are most vulnerable. In comparison, the study found polylectic cavity-nesting bees (or bees that collect pollen from various plants and nest in cavities) are more likely to remain at the preserve.

Similarly, the findings demonstrated that bees active for longer periods each year have a better chance of remaining in the community if they collect pollen from a variety of plants. In short, bees with certain traits, such as being picky about food, will continue to struggle compared to their more flexible counterparts. Scientists also noted the significance of climate response, as bee species in the contemporary sampling period had a more southerly overall distribution compared to the historic community, indicating communities are shifting in response to warming temperatures.

This study, Graham explained, exhibits the utility and importance of publicly available historical long-term data in deciphering complex indicators of bee population trajectories, findings that may have otherwise been obscured in a lesser scope and timeframe. “Combining traditional analysis techniques with neural networks helped us reveal shifts in geographic ranges and declines in bee abundance and diversity as they relate to species traits,” Graham said. “Such analyses help our understanding of bee population trends to inform the science and practice of bee conservation."

Apis Behavioral Economics Department:

Bees have irrational biases when choosing which flowers to feed on – just like human shoppers do

Published (on The Conversation): September 26, 2024 8:27am EDT

Just like people confronted with a sea of options at the grocery store, bees foraging in meadows encounter many different flowers at once. They must decide which ones to visit for food, but it isn’t always a straightforward choice.

Flowers offer two types of food: nectar and pollen, which can vary in important ways. Nectar, for instance, can fluctuate in concentration, volume, refill rate and accessibility. It also contains secondary metabolites, such as caffeine and nicotine, which can be either disagreeable or appealing, depending on how much is present. Similarly, pollen contains proteins and lipids, which affect nutritional quality.

When confronted with these choices, you'd think bees would always pick the flowers with the most accessible, highest-quality nectar and pollen. But they don't. Instead, just like human grocery shoppers, their decisions about which flowers to visit depend on their recent experience with similar flowers and what other flowers are available.

I find these behaviors fascinating. My research looks at how animals make daily choices – especially when looking for food. It turns out that bees and other pollinators make the same kinds of irrational "shopping" decisions humans make.

Predictably irrational

Humans are sometimes illogical. For instance, someone who wins $5 on a scratch ticket immediately after winning $1 on one will be thrilled – whereas that same person winning $5 on a ticket might be disappointed if they're coming off a $10 win. Even though the outcome is the same, perception changes depending on what came before.

Perceptions are also at play when people assess product labels. For instance, a person may expect an expensive bottle of wine with a fancy French label to be better than a cheap, generic-looking one. But if there's a mismatch between how good something is and how good someone expects it to be, they may feel disproportionately disappointed or delighted.

Humans are also very sensitive to the context of their choice. For example, people are more likely to pay a higher price for a television when a smaller, more expensive one is also available. These irrational behaviors are so predictable, companies have devised clever ways to exploit these tendencies when pricing and packaging goods, creating commercials, stocking shelves, and designing websites and apps. Even outside of a consumer setting, these behaviors are so common that they influence how politicians design public policy and attempt to influence voting behavior.

Like minds

Research shows bumblebees and humans share many of these behaviors. A 2005 study found bees evaluate the quality of nectar relative to their most recent feeding experience: Bees trained to visit a feeder with medium-quality nectar accepted it readily, whereas bees trained to visit a feeder with high-quality nectar often rejected medium-quality nectar.

My team and I wanted to explore whether floral traits such as scents, colors and patterns might serve as product labels for bees. In the lab, we trained groups of bees to associate certain artificial flower colors with high-quality "nectar" – actually a sugar solution we could manipulate.

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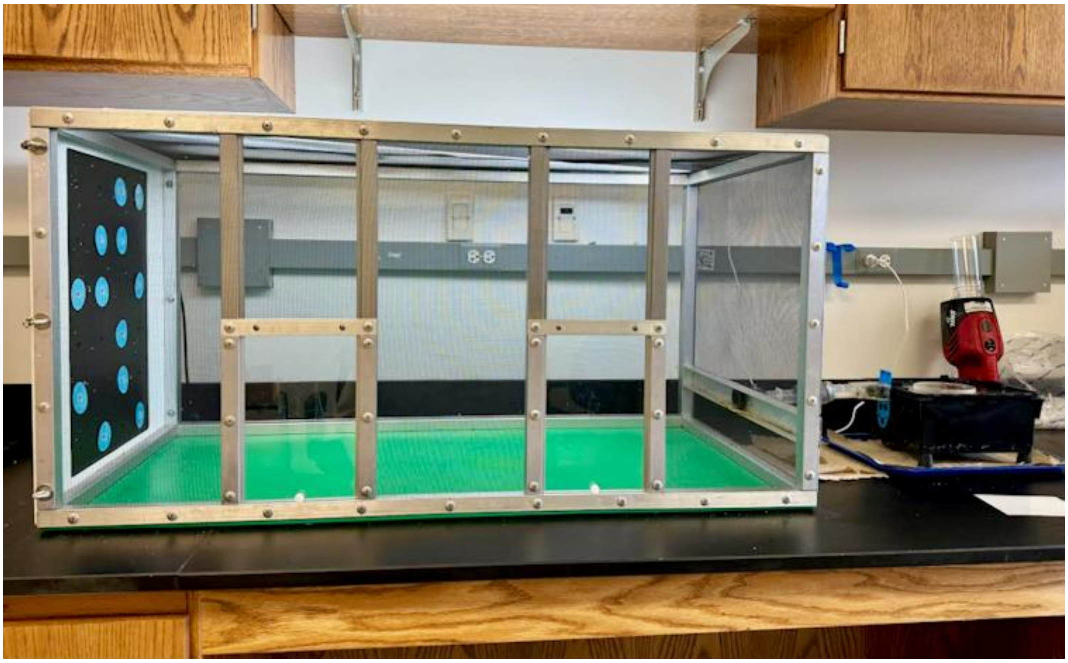

The bumblebee colony, right, is attached by tunnel to the foraging arena, left, where colored discs serve as artifical flowers. Claire Hemingway,

For example, we trained one group to associate blue flowers with high-quality nectar. We then offered that group medium-quality nectar in either blue or yellow flowers. We found the bees were more willing to accept the medium-quality nectar from yellow flowers than they were from blue. Their expectations mattered. In another recent experiment, we gave bumblebees a choice between two equally attractive flowers – one high in sugar concentration but slower to refill and one quick to refill but containing less sugar. We measured their preference between the two, which was similar.

At the center of each artifical flower is a tube the bee enters to access the sugar solution. Claire Hemingway, CC BY-SA

We then expanded the choice by including a third flower that was even lower in sugar concentration or even slower to refill. We found that the presence of the new low-reward flower made the intermediate one appear relatively better.

These results are intriguing and suggest, for both bees and other animals, available choices may guide foraging decisions.

Potential uses

Understanding these behaviors in bumblebees and other pollinators may have important consequences for people. Honeybees and bumblebees are used commercially to support billions of dollars of crop production annually.

If bees visit certain flowers more in the presence of other flowers, farmers could use this tendency strategically. Just as stores stock shelves to present unattractive options alongside attractive ones, farmers could plant certain flower species in or near crop plants to increase visitation to the target crops.

Club Information and Contacts

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