CENTRAL COAST BEEKEEPERS NEWSLETTER

January 2021

ISSUE NUMBER 56

NEXT MEETING FEBRUARY 24, 2021

There will be no formal club meeting in January. We will have our first club meeting February 24th at 6:30pm via Zoom (details below). Hopefully, some of you will be able to virtually attend the Lane County Beekeepers January zoom meeting featuring Dr. Ramesh Sagili from Oregon State University on the 19th *(get access to the link by emailing nancy.ograin@gmail.com and she will send a zoom link / invite to the meeting).*

PRESIDENT'S MESSAGE

By Stu Willason

Welcome to 2021! First, I'd like to give a big thanks to Becca Fain who did an outstanding job with the club in 2020 considering all the turmoil in the world last year. She made the most of a difficult year.

Hopefully, sometime relatively soon, we will get back to some level normalcy and have in-person meetings at the Newport library. Until that day arrives, we will combine zoom meetings, meetings at member's houses and we will try to piggyback along with other clubs like the January event with Lane County Beekeepers. Thus, the schedule is somewhat in flux and will need to be flexible because of local and state mandates related to the virus. We will forward meeting updates and hopefully a schedule via our monthly newsletters as 2021 unfolds.

So far, this winter has been quite warm and the bees seem to be taking advantage of it. The beehives in our apiary are still packed with bees and have been bringing in pollen on the sunny days. With the warmer winter it seems that *Varroa* has also done well. We treated all of our hives with oxalic acid vapor in December and will probably treat again this month. We still have a few mites on our sticky boards but the numbers have been greatly reduced because of our winter treatments. So, be sure to check your beehive sticky boards for mites. Any treatment now may go a long way to ensure the success of your beehives come spring.

For the February zoom meeting there will be two main topics. First, we want members to share photos and stories of their beehives, apiaries and beekeeping experiences. So forward your photos, management techniques and ideas to the club's email address by Wednesday Feb 10. I will put all member's photos in a slideshow presentation and you will have a chance to tell a brief story about your photo(s) during the meeting. It should be fun! **So please email us your photos!**

Second, we will list some of the beekeeping questions that came up during the roundtable discussions from the 2020 October Oregon State Beekeepers conference. Club member Max Kuhn *(now a Master Beekeeper)* was one of the experts on the 4 person panel. It will be an informative opportunity to discuss a few of the questions from hundreds of beekeepers across Oregon and hear answers from the experts.

The club will not be selling bee packages or nucs this year. However, there are a couple of excellent local alternatives where bee packages and nucs can be purchased *(eg both companies listed below are selling packages for $160)*. We will let everyone know if we find other competitive sources for bee packages.

Shonnards Nursery

Corvallis

GloryBee

Eugene

https://glorybee.com/content/bee-weekend-2021

The Western Apicultural Society of North America is offering a free "Mini Conference" focusing on mating behavior and drone congregation areas on Jan 20, 2021, 7-8:30 p.m. *(Mountain Standard Time)*. Best of all, it is FREE. Here is the link: Mini-Conferences – Western Apicultural Society

If you haven't already done so, now is a great time to renew or start a new membership for 2021. Membership is **still only** $15 per person or $25 per family. This year all paid members will receive an embroidered patch commemorating our bee club which we will distribute during in-person meetings later in the year. Your membership supports our club efforts which include direct financial support to the Oregon State University Bee Lab for their research. Your checks along with the included membership/renewal form should be sent to the address on the form. CCBA Membership Form .pdf If you are renewing, you can also use PayPal by sending it to the club's email: centralcoastbeekeepers@gmail.com.

Thanks for continuing to participate in club activities. We all look forward to getting back together in person in 2021! Stay safe and healthy!

Keeping Bees in January/February

Todd Balsiger

Tips for January and February In late February, an opportunity may present itself to check for Varroa populations doing the standard ½ cup of bees. If the weather is uncooperative, then try a sticky board in conjunction with a treatment like Apivar or oxalic and see what falls, and make inferences from that. At this time of year, I believe it is recommended to treat at 1 percent (3 mites per half cup of bees). Back in the days when we used Apistan strips (fluvalinate), February was one of the two months recommended to treat for Varroa (August being the other). If you skipped the late November/early December treatment of oxalic, or even if you didn't, consider using a product like Apivar (amitraz). Multiple people have said Apivar works best in early spring when there are fewer mites compared to the fall when there are lots of mites. I remember Harry Vanderpool saying Apivar doesn't work well when infestations exceed 3 percent (9 mites per half cup of bees, the threshold for fall treatment). Jan Lohman and Matt Hansen said they use Apivar in almonds and don't treat again typically until June (Jan) or July (Matt). Oxalic is an option at this time, but there is brood, so I will leave it at that. The use of oxalic is a discussion for another time, and more research needs to be done. Brood is being raised now and food stores are being consumed. Ventilation is important at this time of year to prevent water from collecting under the lid through condensation and then dripping down on the bees. It is much more difficult to keep yourself warm if you are wet. Same applies to bees. Some beekeepers (especially commercial beekeepers using pallets) have holes in their brood boxes which addresses this concern. Others, including myself, have lids designed with vent holes in the corners. Ventilation can be accomplished by simply putting a large nail under the corner of a lid. Watch food reserves. Heft hives for weight. It is very frustrating to see strong, healthy hives starve at this time of year. Springtime is when hives typically starve. This should be an ongoing springtime concern. Don't feed syrup yet unless we get 60-degree weather in late February. Randy Oliver recommends Baker's fondant, hard "candy boards," or even granulated sugar over newspaper. Be concerned about the prospect of strong winds at this time of year. If you break the propolis seals by opening hives and don't secure the lids back down, then don't be surprised to find your bees exposed to the elements following a wind storm. Don't ask me how I know.

I see you: Honey bees use contagious and honest visual signal to deter attacking hornets

Study is the first to demonstrate a contagious warning signal that resists fake news in social insects

December 7, 2020

University of California - San Diego

Summary:

What do honey bees and deadly hornets have to do with issues surrounding 'fake news?' New research is providing new details about honey bees and their defenses against preying hornets. Using a common iPad, researchers conducted the first study that demonstrates that a contagious warning signal counters 'fake news' in social insects.

FULL STORY

An Asian hornet sets its sights on a busy honey bee hive. If all goes according to plan, the hornet's attack will result in a haul of bee larvae, precious nourishment to pilfer and feed to its own hornet young.

But over time, predator-prey evolution has equipped some honey bees with a potent defense mechanism against such an attack. A signal from colony guard bees lets hornets know that their attack plans have been exposed, and also sends an alarm across the bee colony communicating that urgent reinforcements are needed due to the impending danger. This "I see you" (ISY) visual signal involves guard bees shaking their abdomens laterally and increases as the threat intensifies.

Hornets are ferocious bee predators that have invaded multiple countries around the world. Yet even the giant "murder" hornets that have generated much concern of late have come to recognize the ISY signal as a warning to back off. They are well aware that ISY can lead to a counter attack in which a mass of bees surrounds the hornet, forming a "heat ball" with a deadly mix of heat, carbon dioxide and stinging for the hornet inside.

University of California San Diego biologists studying Asian honey bees (Apis cerana) and hornets (Vespa velutina) have produced new research that deconstructs this ISY signal and shows for the first time that it is visually driven and contagious across the bee colony. The findings are described Dec. 7, 2020 in the Journal of Animal Ecology. A key point of the new study is that the bees can only succeed if they have sufficient numbers to effectively execute a heat ball.

"The beauty of the ISY signal is that hornets are only deterred if enough defending bees quickly gather to synchronously produce the signal, thereby showing the hornet that further attack is futile," said study senior author James Nieh, a professor in the Section of Ecology, Behavior and Evolution in UC San Diego's Division of Biological Sciences.

But how to gather this defense? Nieh says the ISY signal is contagious and attracts other defenders who immediately copy the signal and rush towards the signaler, even if they cannot directly see or sense the predator.

"Hornets give off smell and sound but we found that the visual of a hornet alone can elicit the signal, which was not known," said Nieh. Previous speculation held that guard bees might produce a pheromone to alert others in the colony of the impending danger. "Using just a contagious visual signal is better because guards who are too far away to smell or hear the hornet can immediately head towards the threat. In some ways, it's like a fast chain reaction," said Nieh.

Nieh says the concept links to the issue of "fake news" since animal communication often contains errors, and a false ISY alarm could rapidly spread within the colony.

One solution to the problem of false information spread is that the bees are very selective about what they consider a true threat. Using an iPad to display videos, researchers Shihao Dong, Ken Tan and Nieh found that the visual appearance and motion of the hornet alone could trigger ISY signals. Visual displays of a harmless butterfly, on the other hand, elicited no response. The second and most important safeguard against false reporting is that bees are even more choosy about what they consider to be a real ISY signal.

"We played back videos of bees performing ISY signals at different speeds, but only the correct bee image at the right speed caused other bees to respond. This helps keep the signal spread honest," said Nieh.

It is still true that a bee could occasionally "cry wolf" but Nieh thinks that evolution has limited these errors because nestmates must work together to fight these powerful predators and colonies prone to errors would suffer. Nieh and his colleagues are now testing the details of the visual cues behind ISY. They are developing animations that display related visuals that can be tested, such as whether a harmless butterfly can be depicted as threatening, or whether offshoots such as a hornet displayed without wings could be enough to trigger ISY.

Nieh believes that the findings provide a cautionary tale about fake news for all of us.

"Individuals in a honey bee colony are completely interdependent. They can't go out and make it on their own. Cooperation is paramount, especially when faced with a large, heavily armored predator like hornets," said Nieh. "A couple of hornets can kill thousands of bees in a single day. Yet through teamwork that correctly produces synchronized, massed ISY signals, they can get the hornet to back off without harming a single bee. Maybe that's a lesson for us all."

Story Source:

Materials provided by **University of California - San Diego**. Original written by Mario Aguilera. Note: Content may be edited for style and length.

Beehive fences can help mitigate human-elephant conflict

by **Hannah Thomasy** *(Excerpts from article published in MongaBay a non-profit conservation news service)*

- *Crop-raiding by elephants can devastate small farmers, leading to food insecurity, lost opportunity costs, and even death, as well as negative attitudes towards elephants, but finding effective and inexpensive solutions has proven extremely difficult.*
- *Beehive fences—surrounding crops fields with beehives attached to fence posts and strung together with wires—may serve as a humane and eco-friendly way to protect crops from elephants.*
- *Repeated farm-level trials have demonstrated benefits to farmers of using beehive fences, including fewer elephants approaching their fields and, for communities willing to manage the bees, production of "elephant-friendly" honey. However, the strategy doesn't work everywhere: it requires management by farmers and willingness of bees to occupy at least some of the hives, and appropriate length and positioning to dissuade elephants from just walking around them.*
- *Beehive fences have benefited farmers in several East African countries, and projects elsewhere have begun to test them as well, but several uncertainties, including their success at a scale that doesn't just displace the elephants to the first unfenced farm, suggest they should still be used with other techniques as part of a toolkit to reduce human-elephant conflict.*

Human-elephant conflict poses major threats to the well-being of both humans and animals. Crop-raiding by elephants across Asia and Africa can be devastating for small farmers, leading to food insecurity, lost opportunity costs, and even death. Crop-raiding and property damage can also result in negative attitudes towards elephant conservation and retaliatory killings of elephants.

A camera trap photo captured after midnight of an elephant bull turning away from the beehive fence (one of the hives is on the left). Image courtesy of Southern Tanzania Elephant Program (STEP).

Finding effective and inexpensive solutions has proven extremely difficult. Farmers guarding their fields at night lose sleep and put themselves in potentially close proximity to hungry elephants. Killing “problem” elephants is not only inhumane, but is also ineffective at reducing human-elephant conflict. Electric fences, while effective in theory, often fail in practice because they are costly and difficult to maintain.

Bees to the rescue

More recently, conservationists have explored the use of beehive fences as a humane and eco-friendly way to protect crops from elephants. Zoologist Lucy King of the NGO Save the Elephants told Mongabay the idea came from Kenyan farmers, who noticed that elephants avoided foraging in trees that contained beehives.

A beehive fence under Sagalla Mountain in Kenya. Hives are supported by posts and connected by wires, so that pressure on the wire disturbs the nearest occupied hives along the fence. Thatched roofs protect the hives from direct sunlight.

In the late 2000s, King and several Save the Elephants colleagues conducted a pilot study to determine if beehive fences could protect farms in Kenya. They placed locally constructed beehives on fence posts every 8 meters (about 26 feet) and connected them with wires. If an elephant tried to enter between the hives, it would knock into the wires, causing the hives to sway and disturbing the bees. In this study, the researchers found that elephant raids were reduced by almost half on a farm with a beehive fence compared to an unprotected farm.

Since then, King and her colleagues have conducted two sets of field trials in Kenya. The first set of trials, published in 2011, found that beehive fences were better at protecting crops than traditional thorn bush barriers. The second set of trials, published in 2017, reported that 80 percent of elephants that approached the beehive fences were deterred from entering the farms. However, this second study did not report data from control farms – those not protected with beehive fences – so we cannot know if this represents a significant improvement.

Beehive fence in Kenya protecting maize (corn) from elephants that approach looking for a high-calorie meal. Image by Lucy King.

Currently, King and her colleagues at Save the Elephants are studying or implementing beehive fences for crop protection in 15 countries in Africa and four countries in Asia. The beehive fence concept has generated high levels of interest and acceptance among farmers in Africa and Asia. In Kenya, participating farms more than doubled over the course of field trials as farmers requested to join, and in Thailand, over 80 percent of cassava and sugar cane plantation owners reported that they were interested in trying beehive fences.

Kennedy holding jar of elephant-friendly honey produced by his community from management of the bees in the beehives. Image courtesy of Jane Wynyard / Save the Elephants.

Beehive fences can provide many benefits to a community. In addition to humanely deterring elephants from entering farms, bees provide pollination services (which could increase crop yields) and honey (which farmers can sell to diversify their income). King and colleagues also found that even long-term use of beehive fences does not seem to negatively impact wild bee diversity.

Problems and solutions

Although these trials seem to show great success overall, beehive fences have yet to be implemented at a broad scale. Wildlife veterinarian Richard Hoare, a member of the IUCN Human-Wildlife Conflict Task Force states that, “the sample sizes of farms in bee fence projects claiming success are too small to be extrapolated to general use.”

Furthermore, beehive fences don’t work everywhere, and several factors can decrease their efficacy, including the design of the fences, the species of bee, and bee activity. A trial in Zimbabwe did not find any difference in crop damage between farms with beehives and those without. However, this may be because hives were hung on poles and not connected with wire. In other words, elephants could easily pass between the hives without disturbing the bees.


The STEP team in southern Tanzania discussing the beehive fence including the costs and benefits of shielding hives from direct sun in the form of makuti thatch roofs. Image courtesy of STEP.

Efficacy may also be affected by the species of bees that live in different regions. King says that the honey bees kept in many parts of Asia – called *Apis cerana indica* – are much less aggressive than African bee species and are less effective at deterring elephants.

Even for beehives inhabited by the same species, not all hives deter elephants equally. A trial in Gabon found that while high-activity hives were very effective at protecting fruit trees from elephants, low-activity hives (and empty hives) were less effective. Unfortunately, this same study found that bees in very high-activity hives may produce less honey and be more aggressive than bees in low-activity hives.

Challenges inherent to beekeeping have affected the effectiveness of some beehive fence projects. Conservationist and biological anthropologist Katarzyna Nowak told Mongabay that in many places in Africa, beekeepers simply provide hives and must wait for bees to come colonize them, sometimes resulting in low hive occupancy and consequently, less effective beehive fences. Furthermore, it can be hazardous to work with hundreds of stinging insects. African bees can be very aggressive – during one trial, two goats were stung to death, and people could not work in nearby fields when a hive was knocked down.

Due to hazards like these, Hoare notes that the beehive fence technique, "will most likely only work in rural communities with a previous culture of beekeeping." Indeed, Nowak says that it's very important to take community history and preferences into account on these projects. "It's as much about how people receive the particular deterrent method – and therefore maintain it – as it is about the efficacy of it," she says.

Farmers extracting honey from hives in the beehive fence. Communities with beekeeping interest are good candidates for beehive fence programs. Image courtesy of STEP.

Another problem is that hives and the honey within them are subject to theft – sometimes by other humans, but often by honey badgers. Colonies often abandon a hive after a honey badger attack. However, simple additions like cages or motion-activated lights have shown promise in reducing honey badger impact on beehives.

King says one of the biggest threats to beehive fence projects in more arid areas is actually climate change. "With climate change, the rainfall has become so erratic that we're getting erratic flowering seasons, so the bees are being affected," she says. "We're losing colonies because they're not holding on through the dry seasons…I don't know what it means for our project long-term."

Some of the challenges of keeping bees — like hive maintenance, attacks by honey badgers, bee stings, and problems with hive occupation during the dry season — could be solved by using a stimulus that mimics bees rather than actual bees.

Some trials have shown that buzzing bee sounds seemed to disturb elephants – one study found that 94 percent of African elephant families quickly left the area when the sound of disturbed bees was played. In India, news reports have detailed minor reductions in elephant fatalities in train collisions by using bee noises near the train tracks (although it's unclear if this small decrease merely represents random variation that occurs year-to-year). Another study found that chemicals contained in bee alarm pheromones seemed to cause elephants to hesitate or retreat.

The human-elephant conflict toolbox

The moral of the story is that no single technique is 100 percent effective. Researchers acknowledge that several strategies should be used to foster the peaceful coexistence of elephants and people. "I'm a huge fan of what we call the human-elephant conflict toolbox," says King. "There's a variety of options you can use to keep elephants out of your farm and to live better with elephants. Without question, beehive fences should be one of those tools, but it's not necessarily a silver bullet for the entire problem, nor are any of the others."

Overall, King says that beehive fences have been quite successful and word of that success has spread. "We have people queuing up for beehive fences, literally coming to the research center and emailing me from all over the world, requesting these."

Big Bumblebees Memorize Locations of the Most Rewarding Flowers

They perform learning flights to study their surroundings.

By

Mary Jo DiLonardo

Published January 4, 2021 11:25AM EST

Sometimes size matters. Bigger bumblebees spend time learning the locations of the most nectar-rich flowers, so they can easily find them again, new research finds.[1] In contrast, smaller bees aren't quite as picky.

After drinking from a flower, bumblebees decide if it's worth visiting again. Then they perform what are known as learning flights to study the location around the flowers.

"If the flower is rich in nectar, a bee will be very keen to return and therefore invest in learning its location," study co-author Natalie Hempel de Ibarra, associate professor at the University of Exeter's Centre for Research in Animal Behaviour, tells Treehugger.

Bumblebees will slowly fly around the flower, then fly away from it, looking back at its location. It will memorize the flower and the views all around it. On its next trip, the bee matches what it sees with the views it already memorized. This takes it back to the flower's location.

"We have found that larger-sized bumblebee foragers are not only more likely to perform a learning flight when they find a rich flower as compared to a low-rewarding flower, but also to hover around the flower for longer. This in turn allows them to look back more at the flower and to memorise it better," Hempel de Ibarra says.

"This investment in the learning flight pays off during subsequent foraging flights where the bee can shorten its travel time and go directly to the locations of the best-rewarding flowers."

Smaller bumblebees do the same thing but aren't as choosy in their flower selection.

"They also conduct learning flights when departing from a flower on which they obtained a nectar reward," Hempel de Ibarra says.

"We find that in contrast to the large bees they readily accept lower and higher rewards and are less selective when investing in the learning flight. They spread their efforts more evenly."

Watching Bees at Work

For the study, researchers set up an experiment in a greenhouse where they could watch captive bees visit artificial flowers containing varying concentrations of sugar solutions. A downward-facing camera captured the bees' learning flights. The recordings included the bees, the flowers, and cylinders that marked the flowers' positions.

The flowers had sugar solutions ranging from 10% to 50% sucrose. When the concentration was greater, the larger bees spent more time circling the flowers and making learning flights.[1] When the concentration was smaller, the length of time the bees spent looking at the flower and flying around it tended to drop.[1]

Smaller bees spent the same amount of effort learning where the flowers were, no matter whether the concentration of sucrose was low or high.[1]

The contrast likely reflects the different roles of the bees in their colonies, the researchers said.[1]

"Large bumblebees are able to carry larger loads and explore further from the nest than smaller ones. Small ones with a smaller flight range and carrying capacity cannot afford to be as selective and so accept a wider range of flowers," the researchers concluded in the study, published in the journal Current Biology.[1]

Small bees are often involved with more tasks inside the nest, only going out to forage if necessary when food supplies are running low, says Hempel de Ibarra.

Benefits of Bees of All Sizes

Having both large and small bees foraging means they cover more ground and serve different purposes.

“Big bees can cover a larger area and find higher-rewarding flowers further away. Investing in flower learning and using its navigational capabilities a bee can identify the most effective travel route for its foraging trips,” says Hempel de Ibarra.

“Smaller bees, however, do not travel far away, and they should focus on the area closer to the nest. They can return to the nest more easily without having to invest as much in navigation. Discriminating less between flower rewards, allows smaller bees to fill up the crop more quickly.”

Bumblebees aren’t the only insects that perform these learning trips. Honeybees and wasps also make learning flights and ants are known to perform learning walks.

“Learning flights are an important behaviour that is displayed by each individual forager bee,” says Hempel de Ibarra. “Understanding them can tell us a little more about which flowers bees like to visit.”

More ways to outsmart the enemy

Honey bees fend off giant hornets with animal feces

Honeybees spread animal dung on the entrance of their hives to effectively ward off giant hornets

December 9, 2020

University of Guelph

Researchers discovered honeybees in Vietnam collect and apply animal dung around hive entrances to deter deadly nest raids by giant hornets. This finding is the first to document the use of tools by honeybees. Researchers found the hornets spent less time and did less chewing at hives with moderate to heavy dung spotting. They were also less likely to launch mass attacks on the more heavily spotted hives.

Honey bees apply animal feces at the entrance of their hives.

Heather Mattila / Wellesley College

What's the best way to ward off giant hornets if you're a honeybee? Animal dung, according to a first-ever University of Guelph study.

U of G researchers have discovered honeybees in Vietnam collect and apply spots of animal dung around hive entrances to deter deadly nest raids by an Asian hornet (Vespa soror) whose North American cousins have been dubbed "murder hornets."

This finding is also the first to document the use of tools by honeybees.

An invasive species in North America that came originally from Asia, giant hornets are almost as long as a golf tee and pack about seven times as much venom in a single sting as an ordinary honeybee.

Murder hornets (V. mandarinia) were discovered in 2019 in British Columbia and Washington. The arrival of the venomous insect to North America has raised concerns about human safety as well as threats to local honeybees and ecosystems.

U of G Prof. Gard Otis, who has studied honeybees in Vietnam for decades, said the hornets could ultimately carry out similar honeybee hive raids in North America.

"Giant hornets are the biggest wasps that threaten honeybees. They are one of their most significant predators," said the environmental sciences professor.

Otis conducted the study with lead author Heather Mattila, who completed her PhD at the University of Guelph in 2006 and is now a biology professor at Wellesley College in Massachusetts. Other co-authors were former U of G grad students Hanh Pham and Olivia Knight, as well as Ngoc Pham and Lien Nguyen in Vietnam.

Published recently in the journal PLOS ONE, the study was conducted in Vietnam, where U of G researchers studied V. soror.

These two species are the only hornets that recruit nestmates in organized attacks that can lead to nest breaches, said Otis. The hornets raid the nests, killing the bees and carrying away larvae and pupae to feed their own developing brood.

The researchers found that honeybees have developed a pre-emptive defense by collecting animal dung and applying it to hive entrances.

"This study demonstrates a fairly remarkable trait these bees have to defend themselves against a really awful predator," said Mattila.

She said unlike their Asian counterparts, honeybees in Canada lack similar defenses. That means North American beekeepers would have to rely on destroying the hornets' nests, or hope that climate or other factors will limit the hornets' spread.

Referring to Apis mellifera, the honeybee species commonly found in Canada, Mattila said, "They haven't had the opportunity to evolve defenses. It's like going into a war cold."

Otis began the project after asking beekeepers in Vietnam about dark spots at hive entrances of Asian honeybees. As part of a successful beekeeping development project funded by the Canadian government, he ran fall workshops from 2007 to 2011 in rural villages with high levels of poverty.

During one visit, an experienced beekeeper explained that the substance was buffalo dung. All the beekeepers that Otis worked with linked these hive spots with hornets. "Dung collection is a behavior never previously reported for honeybees, and no one had studied the phenomenon," he said.

In 2013, the U of G team received US$25,000 from the National Geographic Society for the study.

The researchers gathered dung from water buffalo, chickens, pigs and cows, and placed it in mounds near an apiary. By the end of the day, some 150 bees had visited the piles, particularly collecting more odoriferous manure of pigs and chickens.

The team marked individual bees to identify them at their hives. Minutes later, they recorded videos of the marked bees applying the material at nest entrances.

The hornets spent less than half as much time at nest entrances with moderate to heavy dung spotting as they did at hives with few spots, and they spent only one-tenth as much time chewing at the hive entrances to get at the bees' brood. They were also less likely to launch mass attacks on the more heavily spotted hives.

The researchers are unsure just what deters the hornets, although they suspect the insects are repelled by the smell of the dung. Dung may also mask odors emitted by the bees.

To further understand the hornets' behaviors, the researchers extracted the chemical pheromone applied by hornets when marking their target hive. When the pheromone was applied to the bees' entrance, it prompted honeybees to apply dung to the hive.

Many scientists disagree over whether certain animals -- let alone insects -- use tools.

To qualify as tool users, animals must meet several criteria, including using an object from the environment -- in this case, dung. The bees clearly use the material to alter the hive with purpose, said Otis. And they shape and mould it with their mouth parts, which he said meets the test of holding or manipulating a tool.

Beekeepers in Vietnam normally control hornets by standing guard and swatting away individuals, preventing them from escalating their attacks.

"If you allow them, a group of hornets assembles, attacks the colony and takes over. The beekeepers control them every day by moving among their hives and whacking hornets."

Otis said he was terrified at first about working near the giant hornets. The hazmat suits typically worn for protection by researchers in Japan were impracticable in Vietnamese heat, he added. Within a few days, the team learned the hornets were not defensive when they were in the apiary and away from their own nest.

"I got stung by one and it was the most excruciating sting in my life."

Story Source:

Materials provided by **University of Guelph**. Note: Content may be edited for style and length.

Insomniac Bees

Sleep-deprived honeybees exposed to neonicotinoids can't make it back to the hive

By Sara Novak | Dec 18 2020

You wake up after a long night of tossing and turning. Your eyelids feel like lead. You're thirsty and muddled and feel like you've been hit by a Mack Truck. String a few nights like that together and you become disoriented, walking into rooms and forgetting why or taking a wrong turn en route to the grocery store.

Insomnia weighs heavily on humans, and the same is true of bees. They depend on their circadian rhythms—their natural sleep-wake cycle—and when it's disrupted they become confused. For a bee, that doesn't just mean overeating or losing patience with a spouse. It means never making it back to the hive.

Honeybees, much like humans, need their sleep. Active during the day and quiet at night, they often enjoy nine hours of nightly rest. Also like humans, bees go through sleep homeostasis. Simply put, when they don't get enough sleep one night, they make it up the next. Their sleep cycle is a delicate dance of survival that they depend on to be successful navigators, reproducers, and foragers. Bees, for example, use their biological clock to be present in front of a flower at the very moment that it opens on a particular day.

Douglas McMahon is a professor of biological sciences at Vanderbilt University. He, along with postdoctoral scholar Michael Tackenberg, began studying honeybees and pesticides a few years ago to answer a simple question: Why do some honeybees seem to be getting lost on their way back to the hive? Their recent paper published in *Scientific Reports* found that the common class of pesticides called neonicotinoids built up in the bees' brains and disrupted their circadian rhythms.

“In the presence of the pesticides, their sleep was cut in half,” says McMahon. After just three days of low-level exposure, they became relative insomniacs, staying up late into the night.

Bees depend on local visual cues to find their way back when they’re foraging close to the hive, but once they get farther away, they depend on their circadian clock in relation to where the sun is in the sky to navigate back, like a compass. They know the direction back based on their angle to the sun. But neonicotinoid pesticides can disturb this fragile process.

“Neonicotinoids are nicotine derivatives,” says McMahon. “They interact with neurotransmitters in the bee’s brain, blocking important messaging.”

As part of the study, bees living in Vanderbilt University hives without exposure to any pesticides were brought into the lab. They were placed in individual test tubes and split into two groups. The first group was given bee candy made with honey and powdered sugar and the second group was given the same bee candy dosed with small, nonlethal amounts of the neonicotinoids, thiamethoxam and clothianidin. The dosed bees slept half as long, and when scientists looked at their brains, they were able to detect the buildup of pesticides.

Kirsten Traynor, a research associate focused on honeybee societies at Arizona State University, isn’t surprised that “neonics” were so disruptive to a bee’s sleep schedule. She says that when bees are out of sync with their normal daily routine, they also may not process the incoming nectar as quickly to turn it into honey. And, she says, these pesticides have been shown to impact a bee’s learning and memory. Importantly, this study focused on small doses of neonics rather than the very high doses used in other studies, a level that honeybees don't frequently encounter in the field.

Still, Traynor adds, the test situation used isolated bees in lab test tubes, which isn’t in line with their normally social behavior. She’d like to see future research look at circadian rhythm disruptions in a colony using new bee-tracking systems to see how it would work in a more natural environment.

Such research is critically needed, as these pesticides appear to be doing real damage. When bumblebees are exposed, for example, they seem to produce far fewer queens. Since queens are the only bumblebees that survive the winter and reproduce the next year, this could severely reduce their numbers.

Neonics have come under increasing scrutiny in recent years as native bee numbers continue to decline. By how much is not clear because we have very poor data on the distribution and range of native bees, says Traynor, and without a baseline, it’s hard to say how many have been lost.

But even though research has consistently shown that these pesticides are problematic, the EPA hasn't taken any real steps to reduce their use. The agency is currently reviewing four neonicotinoid pesticides, including thiamethoxam and clothianidin used in this study, to look at the risk they pose to pollinators as well as to human health and aquatic environments, with a final ruling coming in 2021. Under the Obama administration, a blanket ban halted their use in wildlife refuges, but the Trump administration promptly reversed the ban four years later. We're already far behind the European Union, which banned clothianidin and thiamethoxam as well as another neonicotinoid called imidacloprid in 2013.

What is clear is that these pesticides, even in small doses, are taking a toll on bees, especially neurologically. Exhausted after days without sleep, they're getting lost. "Think of the hive like an aircraft carrier, says McMahon. "They take off with enough fuel to get back, but if they get lost, they normally don't make it through the night."

Shedding light on the secret reproductive lives of honey bees

January 13, 2021

North Carolina State University

Research shows that there are trade-offs between sperm viability and the expression of a protein involved in the insect's immune response.

Honey bee health has been on the decline for two decades, with U.S. and Canadian beekeepers now losing about 25 to 40% of their colonies annually. And queen bees are failing faster than they have in the past in their ability to reproduce. The reason has been a mystery, but researchers at North Carolina State University and the University of British Columbia are finding answers.

Their latest research, published Jan. 8 in the journal Communications Biology, offers clues about what's behind queen bee failure, finding that when sperm viability is low, the expression of a protein known to act against pathogens such as bacteria and viruses is high.

David Tarpy, a University Faculty Scholar and professor in NC State's Department of Entomology and Plant Pathology, says the study has important implications for beekeepers and their customers, the farmers who rely on honey bees to pollinate their crops.

"Beekeepers have identified problem queens as a top management concern, but what's causing the problem is largely invisible. Queens go bad, and we don't know why," Tarpy said.

Alison McAfee, a postdoctoral scientist at NC State and UBC, was the study's lead author. She explained that to have a healthy hive, honey bees depend on a healthy queen, the only female bee in a colony that can reproduce.

The queen mates with many males, but only early in life, storing all the sperm that she'll use in her lifetime in her spermatheca, an abdominal organ that looks like a tiny pearl. When the sperm begin to die, the queen can't produce as many fertilized eggs. That causes the colony's population to decline.

"Queens have the potential to live for five years, but these days, half the time queens (in managed honey bee colonies) are replaced within their first six months because they are failing," McAfee said. "If a beekeeper is really lucky, a queen might live two years. Beekeepers need answers about why their queens are failing.

"The more we can find out about what is actually happening within these failed queens, the closer we can get to understanding why this queen failure is happening in the first place."

In their research, McAfee, Tarpy and their colleagues found that queens that were failing reproductively had significantly fewer sperm than ones that were reproductively thriving. And a higher percentage of the sperm they did have were dead. The researchers also discovered that compared to reproductively healthy queen bees, the failed queens were more likely to have higher levels of two viruses -- sacbrood virus and black queen cell virus.

"The high levels of these viruses and poor sperm viability made us interested in seeing if there was a trade-off happening in the honey bee queen," McAfee said. "There's a classical hypothesis in reproductive biology that you can't do everything well, so there's a trade-off between immunity and being able to reproduce. It's been found in quite a few other organisms, including insects, that there are such trade-offs."

To find out if the same would be true with the honeybee queen, the researchers used a tool known as a mass spectrometer to gain a better picture of what was going on in the spermatheca of the healthy and failed queens. They identified 2,000 different proteins and determined which ones were linked to sperm viability.

One of the most significant proteins linked to sperm viability, McAfee said, was lysozyme. Lysozyme is an enzyme that's part of animals' immune systems.

"The queens with the highest sperm viability had the lowest abundance of lysozyme, indicating that they weren't investing resources in this kind of immune response," McAfee added. "That supports this idea that there's a trade-off between the queens being able to fight off infections and being able to maintain their stored sperm."

Tarpy said that the research could begin allowing researchers to find the cause of queen failure and find molecular tools that could "help identify bad queens upstream in the process before beekeepers use them and before they realize they're bad."

Right now, the cause of queen failure isn't clear. "The underlying mechanisms could be disease. They could be pesticides. They could be improper nutrition," he said. "We don't know, so we are working our way backward to identify the causes."

Once the causes are clearly understood, Tarpy added, scientists can then work forward "to help beekeepers keep mortality levels down to sustainable levels and thus keep their colonies thriving."

Story Source:

Materials provided by **North Carolina State University**. Original written by Dee Shore. Note: Content may be edited for style and length.

How You Can Help Count and Conserve Native Bees

Honeybees and their problems get the most attention, but scientists are using tactics learned from bird conservation to protect American bees.

By Michele C. Hollow

- Published Dec. 7, 2020Updated Dec. 9, 2020, 12:52 p.m. ET

In the last 20 years, the rusty patched bumblebee population declined by 87 percent because of habitat loss, use of pesticides and disease. This fuzzy bee, native to the continental United States, gets its name from the rusty patch on its back.

These bumblebees pollinate fruits and vegetables we eat, unlike the Gulf Coast solitary bee, which gathers pollen from only one plant — the Coastal Plain honeycomb head, a member of the aster family. You could say they're specialists, whereas, rusty patched bumblebees and honeybees are generalists.

Honeybees — a European import to the Americas — and their colony collapse problems get a lot of attention, but native bees that have their own ecological role are facing similar and perhaps additional threats. The decline among native bees is a known problem, and there are a variety of efforts to save them; however, the full extent of the problem is not well understood.

"While regional studies have tracked the decline of native bees," said S. Hollis Woodard, an entomologist at the University of California, Riverside, "there hasn't been a coordinated nationwide effort to monitor these pollinators."

Dr. Woodard and colleagues explained this problem in a paper published this month in the journal Biological Conservation, and proposed a new approach to monitoring native bees. But she and scientists at institutions across the United States are going beyond doing studies about the problem. They have also started an effort to collect better data on native bee populations, as well as efforts to conserve them, as part of the U.S. National Native Bee Monitoring Research Coordination Network. The project, supported by the U.S. Department of Agriculture, will train members of the public to look for and track wild bees.

"The data we collect will identify which conservation efforts are working," Dr. Woodard said.

Zach Portman, a taxonomist at the University of Minnesota Bee Lab who is active in the bee monitoring program but did not participate in Dr. Woodard's latest paper, said in a blog post for the network that a new methodology is needed for keeping track of native bees. Existing programs often get bottlenecked with large numbers of specimens that are difficult for conservationists to identify or to assess the populations of individual species.

"There are a lot of good possibilities that include monitoring habitats, monitoring focal plants to detect changes in ecosystems, or monitoring a smaller subset of species such as bumble bees," he said.

The bee monitoring network welcomes citizen scientists to participate, and partners them with experts who will identify photos and data the contributors collect, which Dr. Woodard hopes will avoid the problems highlighted by Dr. Portman.

It's a bit like the Great Backyard Bird Count, where birders of all ages conduct a count every February to collect data about bird populations.

"We've learned a lot from scientists in the birding community," Dr. Woodard said. "We are hoping people of all ages and backgrounds will participate in monitoring bees that are local to their areas."

The bee count will run through 2023, and the program encourages participants to sign up at its website or send an email to nationalnativebees@gmail.com.

"We've made collecting data easy," Dr. Woodard said. "Once you join, you'll get an email from a coordinator in your area and an app to use to upload photos and basic information of where the photos were taken."

Scientists working with the program then identify the bees in the photos and record the information for their database.

Dr. Woodard expects the program to evolve over time. The website will post new information and a series of events will be listed soon.

"This is a new direction for my lab," Dr. Woodard said. "It's exciting that we'll soon be collecting data from a wide variety of ecosystems across the country."

Researchers monitor bees by 'dressing' them in high visibility retro-reflective vests

December 18, 2020

British Ecological Society

A team have been trialing new, low-cost ways to monitor bee species in the UK, by dressing bees in high visibility retro-reflective vests.

A team of researchers from the University of Sheffield and The Bumblebee Conservation Trust have been trialing new, low-cost ways to monitor bee species in the UK, by dressing bees in high visibility retroreflective vests. This novel research will be presented at the British Ecological Society's virtual Festival of Ecology.

Researchers attached retroreflective tags to seven species of wild bee and to a commercially bred UK bumblebee subspecies. Then, the foraging behavior and 3D flight path of various bees was monitored using the web interface of a custom-built, real time tracking system.

Tracking bees in the wild is a critical part of understanding their ecology, allowing scientists to deduce their foraging and navigational behavior, as well as their nest preferences.

Currently, it is very difficult and expensive to monitor bee populations. Commonly used methods such as harmonic radars are biased toward larger species, such as bumblebees, which are large enough to withstand the weight of the radar's tag. As such, there are several unknowns regarding the behavior of the UK's smaller bee species.

Michael Smith, lead author and computer scientist at the University of Sheffield, said, "Finding the bee itself is difficult, and finding wild bee nests in the first place is massively difficult and time-consuming, especially for rarer or less-known species. This tool hopefully will make finding them far easier, making these studies a practical approach."

The system proved successful in monitoring seven wild species (over 100 individuals), across two field sites in the UK, including a wildflower patch at the University of Sheffield. This involved smaller-bodied species such as honeybees and the solitary leafcutter bees.

The tracking system was able to detect bees from up to 40 meters away and tags were still detected a week after deployment. The actual retroreflective tag is made of the same fabric as cycling high visibility vests.

Retroreflective materials such as high vis jackets are useful because when light hits them, it bounces back to the source. So, the researchers used a camera with a flash to take a photo of the bee, and the bee in its retroreflective vest appears as a tiny bright dot.

Michael Smith, said, of the pilot test, "We surprisingly found one of our buff-tailed bumblebees several meters up in a pine tree nearby, about 33 meters from the tracking system. It's not somewhere we would usually have looked, eliminating some human biases and motivating the system's use for re-observation studies."

In addition to their durability, the researchers found no significant difference in the length of foraging time or number of flowers visited between tagged and non-tagged individuals. These results suggest that methods such as this could be used to safely monitor bees across their lifespan.

The bees were captured with a net and transferred into a queen marking pot, commonly used by beekeepers, and then immobilized using cold air, allowing the tags to be safely and non-invasively deployed.

The tracking system is built out of off-the-shelf low-cost components and consists of a camera with a global electronic shutter, a flash and a Raspberry Pi computer. The electronic shutter allows for a very short exposure, which lets the light from the flash illuminate the scene, rather than the sun.

A machine learning model was trained to automatically identify a tag within an image frame and to learn the difference between real tags and various false positives. The whole system can then, in real time, detect the appearance of a bee in the field of the camera or discard false positives, such as a piece of pollen.

By using a system capable of real time detection, researchers can manually search for the bee and corroborate if the tracking system has correctly detected a real bee and find which individual has been detected.?

Richard Comont, Science Manager of The Bumblebee Conservation Trust, said "Being able to track bees from easy-to-find foraging sites back to the hard-to-find nest gives us the chance to find more nests, and nests much earlier in the life cycle. That means that it's much easier to establish nest site requirements, which can be taken into account when doing conservation work."

There are also some pending improvements which will upgrade this method. The range of the photo lens is limited to line of sight and a distance of 40m using the default wide-angle lens and flash. In the current prototype, tagged bees appear as identical white dots.

Michael Smith said "Given the wider changes in landscape management at policy level, being able to provide answers to foraging and nesting needs of key insect pollinators is increasingly important."

However, this work is a significant advancement, Richard Comont said "We currently know very little about the home life of bees away from captive colonies in labs -- a huge omission for this declining group."

Future research from the group will involve using the tracking system to find new nests and training the model to distinguish between colored filters on the retroreflective tags, allowing individual tagged bees to be identified remotely. The low cost of tracking systems such as this can allow for the scale-up of automated pollinator monitoring to address data gaps.

Michael Smith's poster will be available on-demand until the 18th of January 2021 at the Festival of Ecology. This work is unpublished and has not been through the peer-review process yet. This online conference will bring together 1,200 ecologists from more than 50 countries to discuss the most recent breakthroughs in ecology.