Episode 145 PROOFED

Wed, Jan 17, 2024 4:05PM • 30:04

SUMMARY KEYWORDS

foraging, bees, honey bees, comb, excluder, beekeepers, colony, nectar, pollen, honey bee, brad, landscape, queen excluder, dance, waggle, foragers, frames, demand, podcast, research

SPEAKERS

Stump The Chump, Jamie, Guest, Amy, Serra Sowers

Jamie 00:10

Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere. In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast.

Amy 00:43

Hello, everybody, welcome to this episode of Two Bees in a Podcast. Today, I'm joined by Brad Ohlinger, who is a PhD candidate studying honey bee communication at the Department of Entomology at Virginia Tech in Blacksburg, Virginia. Today, we have invited him on to talk about one of his recent publications called "Dance-communicated distances support nectar foraging as a supply-driven system." And so before we get into that, Brad, we're happy to have you on today.

Guest 01:18

Yeah, thanks for having me on. I really appreciate the invitation.

Amy 01:21

So we've been releasing episodes since 2020, and we always bring on a guest. The first thing we ask them is to tell us just a little bit about yourself and how you got into honey bee research.

Guest 01:32

Yeah, so I started at Albright College in Reading, Pennsylvania. It's a small liberal arts college about 10 minutes from where I grew up. There, I got really into behavioral ecology, evolution, and social behavior. So I decided that I wanted to study social insects. I had my pick, I mean, there are plenty of social insects, but I decided to go with honey bees because they had all of the interesting behaviors that I was into. But they allowed me to also answer and research applied questions along with those interesting behaviors and actually feel like I'm having an impact on the real world. I went to Bloomsburg

University of Pennsylvania, where I did some work on honey bee foraging behavior for my master's. Now, I'm at Virginia Tech, like you mentioned, where I'm using dance decoding to investigate honey bee foraging in Virginia landscapes. The idea behind this project is to gain insights into how we can possibly manage our landscapes better for honey bees and other pollinators.

Jamie 02:34
So Brad, we're happy to have you on the podcast today. You're talking about a research project that uses a very basic research method on dance communication. A lot of people out there are aware of honey bees, how they use dance communication, but they're not so familiar with the details. Before we kind of get into the meat of your actual research project, could you give our listeners an overview of honey bee dance communication?

Guest 02:57
Yes. So the waggle dance is how a successful honey bee forager communicates the distance and direction to good food in the landscape to their nest mates. They also communicate nest sites with communication, but I'll focus on foraging for the sake of this podcast. The way they do this is with a figure eight pattern of movement, which consists of two phases. One is the waggle phase where they shake their body back and forth and run across the comb. The other is the return phase where they turn around, they pivot around, and then start another waggle phase. The waggle phase is actually the information-rich portion of the dance. So the duration that they waggle for during that portion of the dance tells the following bees how far in the landscape to go to find food. The direction that they run on the comb relative to vertical tells the following bees which direction to go in the landscape relative to the sun. Another important point of emphasis is they only dance for the best sources of food in the landscape. I'm going to shout out Lauren McHenry in our lab. She likes to compare the waggle dance to a Yelp review. So if the food's really good, they'll dance really vigorously, and they'll do more of those waggle phases to get a bigger audience. If it's only kind of good, they'll dance less vigorously and with fewer waggle phases. If it's not good at all, then they won't dance at all. So it's a really important behavior that allows them to not only identify food sources but also allocate their foraging efforts, according to the quality of the different options that are available in the landscape.

Amy 04:33
Yeah, so, Brad, we've had a couple of people on the podcast to discuss the dance communication. I will say, as a honey bee educator, I feel like the waggle dance is probably one of the most complex topics to teach. It's really hard to teach the waggle dance and just understand it. But you know what, maybe I'll use the Yelp review as something in the future.

Guest 04:55
Yeah, it's a fun example. Yeah.

Amy 04:58
So in your article, you also mention that honey bees adjust their behaviors based on resource supply and demand, which I guess would make sense. But can you elaborate more on this?

Guest 05:09

Yeah, so I guess it'll help to first introduce supply and demand more broadly. So in the human economy, supply and demand determine the value of goods and services or the prices that a human consumer would pay for a particular item. But honey bees don't have money, right? So what they adjust is their cost or their price -- foraging distance. It's costly to fly. When we think of a foraging economy, you have a landscape that has floral resources in it that fluctuate in their availability or their supply, and then, also, the nutritional demands of the colony fluctuate. Sometimes, they really need pollen, sometimes they really need nectar. They'll adjust the cost that they take on to get those items according to those economic forces.

Jamie 05:57
So, Brad, this is really fascinating. So all of this is ultimately what started pushing you and your team of colleagues in the direction of the project that we're discussing. Could you give us a little bit about the motivation and the background of this particular project?

Guest 06:11
Yes, so we were decoding all these waggle dances, and we had these distances, which as I explained before, are sort of like a proxy for a cost or analogous to prices in a human economy. We also knew that nectar and pollen are nutritionally distinct resources. So we thought that supply and demand might influence them a little bit differently. So if you think about honey bees and how they collect nectar, they collect nectar continuously to build large stores of honey for overwintering. It's their carbohydrate source. Whereas pollen foraging, they collect modest stores of pollen intermittently during periods of high brood production because it's the protein source. So we came in thinking that since the demand for nectar is continuous, then honey bees should respond consistently to changes in the supply of nectar. As a result of that, because they always increase the foraging distance or the cost when supply goes down, we'd see longer nectar foraging distance than pollen foraging distance because they don't always need pollen. So why travel farther to get pollen when the demand is not there? That was kind of the foundation for the study.

Amy 07:24
I guess my question is, how do you know what you're looking at? How do you even go into this data collection? How do you know that bees are looking for nectar or looking for pollen? How do you know how far they're going and where do they end up?

Guest 07:40
Yeah, so what we do is we record the dances of actively foraging colonies that are housed in observation hives that have a glass wall. So we see what's going on on the dance floor. We can categorize the bees as pollen foragers, those foragers that have pollen in their pollen baskets or corbiculae, and then nectar foragers are those that don't have pollen in their pollen baskets. There's a lot of work that has gone into finding the relationship between the waggle run duration that we then extract from the dances. The way that previous researchers have figured out this relationship to waggle run duration and distances, they train bees to feeders at different distances. It's called a calibration experiment. So we came into our study knowing who the pollen foragers are, who the nectar foragers are, and what the relationship between the waggle phase duration and distance is. As a result of that, we are able to infer a likely distance for each of the dances.

Jamie 08:47
So, Brad, I want to follow up on that, because I've heard people talk about that before. You can correct me if I'm wrong because I'm just trying to recall it off memory. Is it about 750 meters per one second?

Guest 08:57
Yes. So that was an earlier calibration. My advisors have developed a universal calibration that's supposed to be predictive across landscapes. I think it's around 800 meters in that calibration.

Jamie 09:11
That's interesting. That's ultimately where I was heading with my thought. I was aware of the one second equals 750 meters. So for the listeners out there, that's that little middle waggle part of the figure eight dance, the waggle dance, right? So if they spend a second doing that, it's somewhere around, you're saying, Brad, around 800 meters. I love the fact that you said it was a universal calibration because that was my very next thought. Do people who try to interpret distances from dance communication have to calibrate it for their particular study? I'm guessing since you're suggesting this is universal, that that's not the case.

Guest 09:48
Yes, that used to be the case and it takes a lot of effort. So the universal calibration has been a game changer for waggle dance decoding. It makes it a lot easier to do these types of studies.

Jamie 09:58
Interesting. So that's now about one second equals 800 meters.

Guest 10:02
Yeah.

Jamie 10:02
Perfect. That's cool. All right. So with that background, because that was a point of clarity I wanted to follow up on because I've always found that very interesting, what did you find? You told us how you did it. I love the fact, you know, Amy, you were asking him about how do you know how far they go. I think probably our listeners will go, "Gosh, you have to mark these things and you have to go wait for them to show up?" But, Brad, you guys are really just reading what the bees are telling you on the surface, on the face of the comb. Right? You are interpreting the dance as if you were yourself a bee. So what did you find through all this tremendous amount of data collection?

Guest 10:37
Yeah, the term we like to use is we're eavesdropping on their conversation. So that's kind of a fun way to think about it.

Jamie 10:43
That sounds better than spying on them on the dance floor. That's a little creepier.

Guest 10:48

Yeah, definitely. What we found is that nectar foraging distances were 14% farther than pollen foraging distances, which is exactly what we would expect if the nectar foragers are consistently responding to changes in supply, always going farther when it is necessary. Whereas pollen foragers are only going farther when they want the pollen/when there's demand for the pollen. And we also observe the same trend across months. I think 85% of months where there was a significant difference between pollen and nectar foragers, nectar forager distances were farther. So it's very consistent. Our results are very consistent with nectar being a supply-driven system, and pollen foraging being a demand-driven system.

Amy 11:37
So I've got a question just about worker bees and how long they forage. So how many days do they forage, typically?

Guest 11:43
I think it's about a week, typically. That's around the average duration of a forager's foraging career.

Amy 11:51
The foraging career. Very cool. So, I get to ask the million-dollar question. I don't know if you have an extension appointment, or whether you give talks to beekeepers' associations or anything like that, but I'm wondering when you are speaking to beekeepers about your research, what are they asking you? Are there any implications for beekeepers? I mean, I assume that there may be something as far as what they can look for in a colony and whether they need to feed or not.

Guest 12:23
Yeah, I guess the implication for beekeepers is that bees will invest the effort that they need to, to find resources so long as they need them. As a beekeeper, that means increasing the amount of resources that are available around your apiary. Make it so your bees don't have to work hard. So that could be planting flowers or selecting landscapes that seem to be of high quality with lots of floral resources. There are also plenty of supplemental nutrition options like pollen patties and putting feeders on their colonies. So I guess the implication is just for beekeepers to be cognizant of the effort that their bees are putting into foraging.

Amy 13:09
So, Brad, you're a PhD candidate right now. What other projects are you working on? I think another question that I have is just what is in store for the future with this research?

Guest 13:22
Yeah, so I've worked on several other projects throughout my PhD. Each of those projects uses waggle dances in different ways. So the first chapter of my dissertation is a feeder experiment that looks at the effects of neonicotinoid imidacloprid on honey bee foraging and recruitment. We found that the sublethal dose of imidacloprid decreases their foraging, but not their recruitment behaviors. And then, the second chapter of my dissertation is a project that looked at not just how far honey bees are going, but also where in the landscape they are going. In particular, we focus on local pastures and hayfields here in Blacksburg. We found that honey bees are foraging in the pastures throughout the foraging season. However, they are not visiting them more than you would expect given their distance from the

colony, which suggests that they could be a potential management target for increasing the quality of honey bee forage within that particular land site. Now, we're working on a dancer coding study to see if colonies that are located in close proximity to each other, if they exploit different patches in the landscape. So we have three colonies located at three different sites. There's also some data that we have from previous studies that we're hoping to pull in to see if bees that are located with each other stay out of each other's way in the landscape or if they exploit the same patches.

Amy 14:57
Sounds like you're gonna have a couple of busy years ahead of you.

Guest 15:00
Well, actually, I'm going to be finishing up in May.

Amy 15:04
Well, sounds like someone else is going to be really busy after you.

Guest 15:07
Yes. Yep.

Amy 15:09
So thank you, Brad, so much for being on our podcast today. I'm excited to see where your research goes. Is there anything else that you wanted to add today?

Guest 15:18
I want to shout out, I guess, Maggie Couvillon and Roger Schürch, my advisors. They're also co-authors of this paper. Their input was critical for me to be able to write this paper. I would also like to thank you guys for having me on the podcast. It's been a lot of fun. I really appreciate that.

Amy 15:49
So, Jamie, I think I really liked this study because it looked at supply and demand. That's something that, obviously, in the human/people world, we think about pretty often. So that affects everything that we do. So it's just really interesting to see an actual project on honey bees looking at that supply and demand related to what they're foraging, the nectar and pollen.

Jamie 16:12
Well, I think it's a very important topic. People kind of lose sight of this, sometimes. Honey bees make really good decisions when they forage. They're very energetically driven. So he called it supply and demand. When I was at the University of Georgia, years and years ago, my supervisor at the time, Keith Delaplane, had kind of looked and thought about this as well. He thought about it as kind of an energetics thing. Honey bees are going to try to collect nectar as close to the hive as possible because the further they have to fly, the more energy they expend to get energy. How much energy are you willing to expend to get energy? So what Brad was showing is they will fly further for nectar when they absolutely have to because some energy is better than no energy at all. But they won't do that for pollen and are probably using pollen to make other decisions, like whether or not we want to rear brood this time of year, things like that. So it's very interesting to me how far they'll fly. Now, listen, there is a

threshold over which they're expending more energy than they're getting from nectar. So there is a distance beyond which they won't fly, which is why you hear people talk about, in the literature, seeing bees flying up to 10 kilometers, somewhere up to five miles or further when they're going for nectar. But it doesn't benefit them to fly 15 miles or 20 miles because it's costing them more than they're getting. Brad's research kind of reinforces this whole supply and demand, this whole decision-making where they approach their desire to get nectar a little bit differently than their desire to get pollen.

Amy 17:49
Yeah, absolutely. I think that just goes to say there's always research that needs to be done, right? I mean, I know that Brad is graduating in May, but there's always research, especially with honey bee behavior.

Jamie 18:01
Oh, absolutely. I really like the fact that he's getting into it. Normally, when we're talking to beekeepers on this podcast from around the world, there's often that demand for application. But sometimes, I just love to hear a good behavior study where we just learn something new about honey bees because they're really a never-ending source of fascination. Brad and his colleagues at Virginia Tech and elsewhere really show just that.

Amy 18:24
Absolutely.

Stump The Chump 18:29
It's everybody's favorite game show, Stump The Chump.

Amy 18:39
Welcome back to the question and answer time. Jamie, these three questions, I'm excited to ask you because I've needed to respond to these in my email, and now it's time to answer them.

Jamie 18:51
I hope I can answer them correctly so they can help the folks that you need to email.

Amy 18:55
Yes, yes, yes, yes. Okay, so for the first question, this individual noticed some drone cells at the bottom of their super, right above their queen excluder. So I guess they've got a ton of drone cells happening right above a queen excluder, and they've noticed a lot more recently than in the past. They've got a lot of dead drones in that area. It looks like some of them are stuck in the excluder. So, basically, they're wondering, what's going on with that?

Jamie 19:26
Yes, so, I actually had seen this many, many, many times before. My standard half configuration happens to be a single deep hive body with an excluder on top of it, and then a medium super on top of that. So, that's my standard configuration. Since I use that configuration, I have queen excluders and can kind of sympathize with the questioner here. There have been times where I've kind of started at the lid and was working my way down to the bottommost brood chamber, and when I would remove the

medium super from the queen excluder below it, I would find drone brood on the bottoms of the frames. Not in the combs in the medium supers, mind you, just between the bottom of the frames and the queen excluder. This has led a lot of people who've seen similar things with some supposition. Maybe workers are moving eggs, things like that. What I think is more likely happening is that there are two possible causes. Number one, the way the cells are built below the frames in the medium super, but above the queen excluder or such that the queen can stick her abdomen through the queen excluder and lay eggs into the comb there. So that's one option. Another option is that there's a space in the queen excluder that's bent just enough that the queen can go back and forth through it. Now, I've also seen queens go above excluders and get trapped. They were small enough to fit through a little opening, they go through it, they get bigger, and they get trapped. But in those cases, in those contexts, you don't typically see just drone brood between the bottom of the frame and the queen excluder. You also see brood physically in the medium super frames up in that box. So the questioner is only describing that drone brood below the bottom of the medium super frames, but above the queen excluder. I think in that particular case, the queen is potentially laying eggs just through the excluder. Normally, when I would run into that, I would just clean it all out. When I pop off my medium super, and I see that burr comb built at the bottom of the frames, I will always scrape it off. But the beekeeper does need to check and make sure there's not a place in the excluder that that queen is able to go back and forth through, because if that's the case, then you're only going to solve the problem and have the problem all over again. The reason he's seen drones or she's seen drones or whoever the questioner is seeing drones stuck in that excluder is because they are being born above that excluder, fully developing above that excluder and cannot get through it. So they'll try to go through it, they'll get stuck in the process, and die stuck in that excluder.

Amy 22:05
Yeah, I mean, so the other part of that question was basically that they haven't seen the queen. I was wondering, I wonder if there are any laying workers. But there are eggs and brood and jelly and honey. I assume, as those eggs underneath are developing, that they're developing into workers, which means that there is a queen in there, right?

Jamie 22:24
So I mean, those are really good thoughts and comments about what the questioner said. So if you're seeing worker brood in the bottommost box below the excluder, and then seeing a teeny little bit of drone brood above the excluder, it's possible that the queen's just able to oviposit through the excluder based on the burr comb. It's also conceivably possible that you've got some rogue workers running around in the nest who are laying eggs and that they themselves are able to lay eggs above the excluder. You don't see that quite as much in European-derived colonies that we have in the States and a lot of the rest of the world, but in African-derived honey bee colonies, you can see that quite a bit. You can get these rogue workers who are reproducing at the fringes of the nest. So in this particular instance, the first thing I would do is go into the bottommost brood box. If I see worker offspring, eggs, laying worker cells, normal size larvae in worker cells, capped pupi that are appropriately sized in worker cells, then I would believe that I have a queen. And if I'm finding drone brood just a little bit right above the excluder, I would just assume that she's able to oviposit up there and I wouldn't worry too much about it. But if you're not seeing that worker brood in the bottommost box or even in the upper box that would suggest the queen made it through the excluder, then you very well may have laying

workers running around the nest, in which case there are no limits to where they can lay because they can fit through excluders.

Amy 23:47
Yeah, absolutely. So for the second question that we have, we actually received a photo in our email, and so we'll be sure to share that in our additional notes. But Jamie, the question basically is the beekeeper is seeing these holes at the top, they're kind of like clear holes at the top of the frame. I guess that just started making me wonder, can bees eat through wax foundation? Or why would there be just open space at the very top of a frame?

Jamie 24:18
Yeah. So if you give bees pure beeswax foundation in the frames, when they are constructing their combs, they often will chew through sections of that pure beeswax and make holes in the comb. Or, if the comb gets damaged in some way, just through its life, maybe wax moths ate a small section of it, maybe while you're working with the frames and pulling things apart, you ripped open some small sections of the comb, if the comb is damaged, the bees might chew through that wax foundation as well and they won't repair it. They'll just leave it as a hole through the comb. So when you use pure beeswax foundation, where the foundation touches the top bar of the frame or the bottom bar of the frame or even sidebars of the frame, you can often get bees excavating holes in these areas as areas where they will actually traverse. They'll go back and forth through these holes. I do not see the same thing happening when there's plastic foundation in the combs. The bees won't chew through that hard plastic foundation. There is a product called Duragilt, which is thin plastic that's coated pretty heavily on both sides with beeswax. I haven't even seen them chew through that type of foundation before. I have seen them chew the wax off to that foundation, but not through it. So when you give bees pure beeswax foundation, there will be holes that pop up on the edges of your combs, as well as the middle of the combs. But this is perfectly normal. They tend to use these as areas that they can walk through to get to the other side, easily. I don't think it's a benefit or negative that the individual is seeing these holes. It's just the reality that you get when you use pure beeswax foundation.

Amy 26:03
Very cool. Okay, so for the third question, I've actually received this question quite a bit, so the question is, the beekeeper has found some blue fuzzy mold on their hive, and there a bunch of dead bees. So they're wondering, one, should they be concerned about this mold? What's going on here? And two, what do they need to do if they find a blue fuzzy mold in their colony?

Jamie 26:31
So I think it's important to know that there are really no molds that overrun and kill colonies. You are likely seeing a mold or some sort of fungus that's the result of the dead bees and not the cause of the dead bees. So in this particular question, the individual lost the colony. It appears they lost the colony over winter. They open up that hive and find the dead colony and there are dead bees in there and the bees are just covered in mold. So what I would do in this particular case is I would take out each frame, brush off the dead bees, and let the dead bees fall to the ground. If, for some reason, it was just thick mold that had overrun the combs, which you can see, sometimes, if there are lots of pollen stores in the comb, I might consider washing the combs with a water hose just to kind of remove a lot of that debris. I would err or sun dry it. I would be very comfortable using it on other colonies in the future. I would

freeze it if I didn't need it at the moment. But if I could use it at the moment, I'd put it straight into other hives and not worry too much about it. The only thing that I would hesitate just briefly when considering the scenario on is I'd like to know a little bit more about what killed the bees. If it was starvation, not a problem. If it's Varroa, not a problem because these things aren't transmittable. But if it was something like American foulbrood or something like that, you wouldn't want to move those combs into another hive. But most of the time when you see this, the bees have died either from starvation or Varroa over winter, in which case you could wash that mold off the combs. In some cases, most commercial beekeepers don't even do that. They'll simply reuse the combs instantly. But for a lot of folks who get concerned, you can rinse out the combs, let them air dry, as long as it's not too hot outside to melt the wax, and then you could reuse those combs straight and high without too much concern.

Amy 28:27
Yeah, so the other part of the question is the person said that they're from Minnesota -- I said that's so weird. Why did I say it like that? So they live up north and they insulated the hive. I'm wondering if you think that contributed to the mold, the insulation of the hive.

Jamie 28:45
Maybe after the bees were dead. I suspect it wasn't one of those things that was a problem while the bees were alive. Bees are really good at limiting mold growth when there's a functioning colony inside the box. They're able to keep the temperature warm, and thermoregulating, all of that really reduces the chances of mold growth. So my guess is that the bees died, and then mold does what it does. It just decomposes what's available for it to decompose. And I think that that's likely the scenario in this case.

Amy 29:14
All right. Well, thank you so much, and thank you to all of our listeners for sending in your questions. Don't forget to send your questions into our email or one of our social media pages.

Serra Sowers 29:25
Thank you for listening to Two Bees in a Podcast. For more information and resources on today's episode, check out the Honey Bee Research Lab website at UFhoneybee.com. If you have questions you want answered on air, email them to us at honeybee@ifas.ufl.edu or message us on social media at UF honey bee lab on Instagram, Facebook and Twitter. This episode was hosted by Jamie Ellis and Amy Vu. This podcast is produced and edited by Amy Vu and Serra Sowers. Thanks for listening and see you next week.