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SPEAKERS

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

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. All right, folks, welcome to another segment of Two Bees in a Podcast. Today's segment, Amy, is incredibly timely. If you're listening out there, my team and I and Amy and her team and Dr. Cameron Jack and his team as well, we often meet for breakfast once a week. That happened to be the day that we are recording this segment and at breakfast this morning, we were talking about how overwhelming it must be for honey bees to be in hives surrounded by all of these pheromones produced by workers, queens, the brood of these other odors that might be from honey, pollen, wax, etc. And we were just kind of joking about how much of a stimulus it must be to be receiving all these chemical cues. Well, today, we're actually bringing someone on to the podcast to talk about just that. We're joined by Dr. Bradley Metz who's a research assistant in the Department of Applied Ecology at North Carolina State University in Raleigh, North Carolina. And he and colleagues recently published a manuscript that we're going to link in the show notes, but the manuscript is entitled "Honey Bee Nursing Responses to Cuticular Cues Emanating from Short-term Changes in Larval Rearing Environment." To kind of put it in more of layman's terms, essentially, they're looking at how larva pheromones can communicate needs to workers. Bradley, thank you so much for joining us on Two Bees in a Podcast.

Guest 02:20
Thank you, it's nice to be here.

Jamie 02:21
It's great to have you. And like I said, it's so timely that we have you because we literally spent 30 minutes talking about that this morning, and I look forward to getting into the details of your study with

you soon. But before we do that, Bradley, this is your first time on the podcast, and we'd love to allow our listeners to get to meet our guest. So could you tell us a little bit about yourself, how you got into honey bee research in the first place, and how you ended up where you are?

Guest 02:46
Yeah, sure. When I was an undergraduate, I was a lab rat from day one. So I spent most of my time in the animal sciences department working on AIDS-wasting syndromes and insulin-like growth factor signaling. Now, to break that down a little bit, really all we're looking at is cell-to-cell chemical communication and how those fail, and how that determines what a cell does and how its responses are. So for many years I was doing that kind of research and studied immunology thinking I was going into medicine. Frankly, I wanted to get outside more and was interested in and started increasingly becoming interested in organism-to-organism communication, and shopping that kind of attitude to medical schools and medical research and neurobiology doesn't get you anywhere. So I found somebody who kind of had a similar mind at the time at Texas A&M, and she was a pheromone biologist studying honey bees. And so you can kind of guess that as someone who has spent their life studying multicellular organism intercommunication, studying communication between bees within the superorganism isn't a huge stretch. So that was my graduate work. This paper is focused a lot on work that we did late in my graduate study and with a colleague, Dr. Ramesh Sagili as part of his postdoc, and all of this work covers this pheromone communication between bees, particularly brood pheromone. So meandering from that, I ended up here at Raleigh working with Dr. Dave Tarpy doing partially more applied work. In addition to a research program on honey bee queen and drone mating and reproductive health, I run this client-funded, client-driven research clinic where we do queen and drone analyses for reproduction and disease. It's the Honey Bee Queen and Disease Clinic. So I sort of play a jack of all trades, master of none these days.

Jamie 04:56
Bradley, that's actually neat. We have had David Dr. David Tarpy on our podcast before, and we talked about that clinic. So it's really neat to find out that you're the one who's kind of running it. That's really neat. I love the service. It's a really neat applied extension that you guys are doing for beekeepers, it's coming out of research that's coming out of the Tarpy lab and others. So that's really neat that you're involved in that directly.

Guest 05:18
Thanks. I mean, we find it's really a profitable thing in both directions, because so often, again, as you can tell from my background, I'm a bit nerd first, beekeeper second so there are a lot of things that I don't think about in those ways. So when beekeepers call me to ask questions or have me analyze samples or want to design a little study, we learn so much about what the right questions are so we can help get more appropriate answers. So I think it's a pretty neat program. So I'm glad to hear it's out there and known.

Amy 05:52
Yeah, so as Jamie mentioned, you've recently published a paper and you're looking at the cues of larval presence. So, I guess that communication between honey bees and how they coordinate with

each other to care for honey bee larva. As Jamie mentioned, again, we had breakfast this morning, and we were talking about this, and it's just absolutely fascinating. There are so many pieces and so many parts. And so we were wondering if you could maybe describe the purpose of your research and discuss how honey bees actually coordinate with each other to take care of the larva.

Guest 06:26
Sure. I'll sort of unpack the title of this paper because we're being extremely careful for scientific purposes about what we found and what we're looking at. But what we were on the track for is looking for something called larval begging. So you probably mostly know the classic begging behaviors of, say, baby birds, mouth open, feed me, feed me, feed me. This isn't something that you necessarily find very common, particularly, in insects and certainly not in terms of chemical communication. So for us, this paper represents a series of bioassays that we were attempting to uncover whether or not a well-known pheromone, in this case, brood ester pheromone that the larvae produced, is in fact, a begging signal. There are a lot of components to that in order to prove that it is a begging signal. You have to prove that there's a behavior that the larvae are performing, behavior in this case, broad sense, whether they're moving, whether they're releasing a chemical, whatever, that they're doing that primarily in response to being deprived of food. You have to show that they are deprived of food, naturally, and then you have to show that the nurses or any bees can perceive this change or this behavior and that they do something about it that's related to the initial deprivation or the initial problem. That all is very roundabout but you require all of those steps to say, yes, this is a larval begging signal. This is a larval starvation signal and the reason why this paper has such a long title is that we did not find that. This is in part a negative results paper. It's a very interesting one that not only shows the processes of science and eliminates a major social hormone or social pheromone from contention for this, but it is, in fact, a negative results paper. I threw out a term there, maybe I should define it a little bit, and it is brood pheromone. Since you guys are talking about being a wash, honey bees being a wash in pheromones, so what brood pheromone is brood, we know brood is eggs, larvae, and pupae, right? This is a pheromone produced by, primarily, the larvae, young and just pre-pupae in particular. In this case, from a structural standpoint, it's kind of an oily substance, right? If you would get it in a little bottle, it would look pretty much like a perfume oil. And it is lightly fragrant, although, not terribly so to us. And it is, without getting into the structures, it bears a lot of similarity to breakdown products of fatty acids that you would find in pollen. I am making no actual connection to the origin of this stuff. But they express it onto their cuticle and the adults will perceive it, typically during an inspection or feeding bout.

Jamie 09:52
I think that comment just leaves me with so many things. This idea that you can purchase or have a jar of brood pheromone that's got a little bit of an odor, Amy, are you thinking like, new perfume or new cologne?

Amy 10:05
How do you even collect that?

Jamie 10:07
Yeah, Bradley, I love this idea. You're like, "It's got a bit of an odor to us, but not so much."

Guest 10:12
Yeah, so a lot of my graduate work was really centered around characterizing brood pheromones. So I spent a lot of time blowing very small amounts of chemicals through a very long straw. It's called gas chromatography. But the components themselves, like I mentioned, they are breakdown products of fatty acids or triglycerides that are found in pollen, they are some of the most common fatty acids in nature. So you can buy this stuff very cheaply and formulate a synthetic brood pheromone. Probably not commercially or probably not publicly, but from the scientific vendors and things like that. So it's not terribly onerous to get a small vial of this stuff and take a look at it.

Jamie 10:55
I wonder if perfume makers listen to our podcasts that are scratching their heads now about the new thing. Anyway, before we go too far, what would wearing this do for others? People would want to feed you all the time. Anyway, I'm going to keep chasing this rabbit if I don't stop, but Bradley, I do want to kind of narrow it down. You mentioned that it's a non-volatile blend of fatty acids. And we looked it up in the paper, it's brood ester pheromones. So one of the first things, let me tell you a bit about my misconceptions prior to reading your study, and how I think we're going to end up talking about killing some of these misconceptions of mine. Up until seeing your study and talking with you about this, I was kind of under the impression that brood would actually release a volatile pheromone that tells workers that are passing the cells, "Hey, I'm hungry, come in here and see me," and you just mentioned that it wouldn't necessarily be volatile, it would be more like upon inspection of a cell, a worker would detect this non-volatile blend of fatty acid esters, this brood ester pheromone, BEP, as you have an acronym in your paper, and that might trigger the response. So could you elaborate a little bit on this?

Amy 11:07
You'd have all the bees trying to feed you.

Guest 12:11
Sure. And also, a clarification, maybe I skipped a little bit ahead here but you mentioned a volatile brood pheromone. The reason why we call this brood ester pheromone now, and you may hear me slip because I'm now showing my age, sometimes I will just say brood pheromone, is because now there are two. There is brood ester pheromone, which is non-volatile, and then there's volatile brood pheromone. So you're not wrong when you say that brood do release a volatile pheromone or semiochemical that bees are perceiving, but the classic model for this non-volatile pheromone brood ester pheromone, and actually this is the same for queen pheromone as well, so it's the same general process, both of these non-volatile pheromones, which is perhaps a misnomer, they have a headspace, which means they'll evaporate into the air about 10 millimeters, I want to say, which is really close to the distance between a larval head and the top of the cell. So one way that we believed that brood pheromone was being sensed and the mechanism by which we thought, if brood pheromone or brood ester pheromone was going to be the starvation signal, they would perceive it is when you see a nurse walk over a larval cell, they antennate the tops of the cells, right? The antenna, they kind of tap either the edges of the cell or they wave over top of the brood, at which point they'll dip their heads very briefly into a cell, right? This is what we term an inspection when they dip their hands very briefly and

I'm not sure we know specifically what goes on in those inspections, but presumably, they are checking the larvae for the presence of food or other cues of distress. Very, very rarely it's something like, if I want to do the math, maybe 1 to 5%, something like that, they will initiate what we call a feeding bout, which we only define as the length of time the head is in the cell. You can find that food has been deposited later but again, you don't necessarily know what's going on there. The assumption is that the nurse is presenting brood food to the larva or depositing it on the floor of the cell if the larva was very small and perhaps, doing other things, antennating, licking, grooming that larvae itself. Again, similar to what's happening in the queen right? But during these processes, she's going to come in direct contact with larval cuticle and be well within the headspace of the brood pheromone or brood ester pheromone and pick it up and get it on her. Just like with queen pheromone, during those retinues she picks up and she licks and she grooms the queen, she licks and she grooms herself, the worker gets queen pheromone on her own body. When she's then interacting with other bees, they do prophylaxis, the exchange of food, they're always rubbing each other down, they're grooming each other, they're antennating each other, they're passing these pheromones to each other, again, in lesser and lesser amounts, but over time, that actually spreads through the entire colony. So brood ester pheromone and queen mandibular pheromone or queen pheromone, I mean, even though they're non-volatile, some amount of them get to every member of the colony without them being directly exposed to it. Now, you contrast that to the volatile brood pheromone or other volatile pheromones, say, Nasonov, or alarm pheromone, these things you can smell from across the street, right? If you've ever played this game, where you open up Nasonov allure or you crack some alarm pheromone, maybe you guys don't do this, I do this for fun, and people will take a step back. I mean, even beekeepers, they say, "Whoa, what is that smell?" And it's a great time for everybody. So those are the mechanisms there behind those pheromones. I think we have a new activity to do during lunchtime, Jamie.

Jamie 16:36
I know, so many things coming to mind.

Amy 16:38
I know. I know. I mean, you're talking about all these behaviors, and I am completely fascinated. And I feel like we could sit here and talk, I don't know, we could talk all day about this. I mean, we were talking about it this morning so thank you so much for explaining this. Now, I'm wondering, so back to the study, can you tell us a little bit about how you actually conducted this study? So I'm looking at like nursing responses, and then the cues from the larva, and so how did you look at this? I mean, how did you look at the nursing responses? How did you look at larva? And you were kind of talking about the behavior of the larva and how it has to show that there's a behavior happening to show that it's hungry or needing food. I mean, how do you as a researcher even look at this to decide what that is and what's necessary?

Guest 17:31
Yeah. So that's a really interesting question. And that's certainly one of the main reasons that I pushed to publish, again, what is, essentially, a paper that doesn't show our hypothesis, right? One thing you know about academics is that there is a little bit of a negative pushback on producing output or journals that don't prove you right. But one of the reasons was we spent a lot of time making what we call a

bioassay, which is a way to determine that the bees are doing what we think they are, to do this paper. And so what we have reported are essentially three different measurements of the larvae in the colony. At the nursing level, we essentially just video recorded two side-by-side patches of larvae for hours and hours and hours, and I watched them. So we had them in an observation hive, I would cover one set of larvae with a mesh so the bees couldn't get to them for an hour, two hours, four hours, and so on. And the other side was covered with a mesh bees could get through. We take those meshes off, we record the larvae, we just watch, we count every visit, we count every time a bee dips a head in or passes by, and how long if they dip their heads in. So we got a sense of how much nursing effort was going into larvae after they've been deprived or not. It's actually published in a separate study, but it is the same process. And what we then did was tried to take that out of the hive into the lab. I used little round plates with small, round holes in them that were really close to the honey bee size. And then I would start putting various products, pheromone lures, fake larvae, which we never successfully made happen, and that kind of thing, in these little plastic boxes with nurse bees to see if we could convince the nurse bees to actually feed something that wasn't a larvae and was outside the context of the colony. So when you're isolating a signal from the noise, the goal is to remove as much natural context as possible. What is the minimum environment we can get to convince the bee to perform the behavior, in this case, feeding, which we never actually found? We were never able to get nurses to feed fake larvae. And I'm not sure if anyone subsequently has been successful with this. But clearly, the bees are smarter than us in this regard. So that's why when you look at the paper, you see the measurements that we were looking at. The behaviors that we're looking at are associations over larvae and movement of the nurses rather than looking for feeding because we were never able to do that.

Amy 20:34
Sure. How many larvae did you look at? I mean, how many capped verses uncapped cells do you need to look at?

Guest 20:40
I want to say we did somewhere between 50 on each patch, there were 500 the total patch and I want to say we looked at 10% of the larvae on each patch each rep. So, a lot. It's been a few years, but it was me and a student and we spent up his entire hourly budget just watching these videos. We had cellophane over the computer monitor, and we had the larvae marked when we planted a marker and just did it. And these videos were four hours long. So yeah, we were getting pretty loopy by the end of it.

Jamie 21:20
I love science. Alright, so I'm going to ask you a very science question, and then I think Amy's going to follow with a beekeeper-oriented question since, of course, most of our listeners are beekeepers. And my question is, so what's next? What would be a logical next step for you and your team following this publication? What's the next project that makes the most sense to help you get additional answers?

Guest 21:47
So this is actually a really neat question because, as I said, you mentioned this volatile brood pheromone. And you might know it as ocimene. I mean, right now it has just a single component. One

thing that has come out fairly recently, Zhi Zhang out of China showed some pretty convincing evidence that volatile brood pheromone is, in fact, the very starvation signal we were looking for. Went through a number of similar bioassays that we performed to answer similar questions, and it seems a lot more convincing, there's always questions, but it's a fairly convincing paper that would show the signals that we were looking for in this for brood ester pheromone are actually mediated by a different brood pheromone. So you'd say, "Okay, job done. Great. We did it." Yeah. Okay. But now, we have brood ester pheromone, which we haven't gotten into all of the other things that pheromone mediates, and why we considered it important. That's a topic for another time. We have queen pheromones, which do a lot of similar things. We have volatile pheromone, which all three of these have overlapping effects. And what they do, really, is they serve to coordinate the collective behavior of the colony in terms of reproduction, in terms of food collection, and larval feeding. Remember, one of the big things that a colony does, the main reason it collects pollen is for larvae, right? And so on top of that, it's storing nectar and honey for future populations, but the current needs, those are pollen. So regulating that requires information transfer in real-time, but also predicting the future because these bees don't live very long. They're not necessarily foraging for themselves. It requires coordinating those pheromones and how those signals overlap, intersect, and modulate each other. So the science side of it, to me, says, now we need to learn where each of these is redundant, where they're independent, where do they contradict? Because I look at this in a lot of ways, like a language. So we're trying to build sort of the Rosetta Stone if you will, of what do bees mean when these things happen?

Amy 24:21
Well, I'm ready to take the Rosetta Stone class. So whenever you release that, that would be great. Whenever we have breakfast meetings in our lab, a lot of times, researchers will go into their projects, and they're extremely important and it's really cool just to know all this information. But ultimately, my question for, all of the researchers are does this apply to beekeepers and how does it apply to beekeepers? So can you just share a little bit about how it can apply to beekeepers?

Guest 24:53
Yeah, and I'll give you two things about this. One, I think, will be more high-minded but the very proximal, "what does this matter?" is that if you look at our paper and you look at our bioassay here, you'll notice that an hour of nutritional deprivation was enough to change pheromone signaling and change colony response. We didn't find that larvae were begging in this way. But we did find that colony-level foraging response was changing because brood ester pheromones were changing. So when you're performing your manipulations, smoking your hives, not that I'm against that, I grew up beekeeping in Texas, but inspecting and leaving frames out, swapping frames back and forth with different larvae, different ages, different topographies, different experiences, you are fundamentally changing and breaking the communication and integration structure of that colony. That's not necessarily a bad thing. We're doing those for a good reason. But it's something that you really need to be aware of because even these very short depravations for larvae really change what their future lives can look like. And so, I think one of the simplest things, I think it's generally good beekeeping practices anyway, is really only get in there and manipulate a hive if you have to. And so that's kind of the core of it. And I think a better understanding of how bees communicate is really key to better beekeeping as well. On the other hand, and this isn't necessarily a success story, but one thing that we have done,

and this was something that gave me a lot of pries, tiny thank yous to do this and really believed in this was trying to take pheromone products, in particular, as far as possible. So it's doing everything she could to find what applicable use this could be for a beekeeper and generate the patent and the product for it. Brood ester pheromone did not succeed in that journey as a product. But you know that there are queen lures that exist today that do not replace the queen, but can serve to stabilize packages, and we use them for shipping drones and things like that. And one of the things I would encourage really any beekeeper to look into and any researcher to look into is how can they learn enough about the products, the pheromones, and the things that they're looking at to build a way that we can manipulate it. At the very least, see if that breaks down and fails, right? If we can have a product that's helpful, we should use it, and if it doesn't, we should know that this is not something that we can be meddling with.

Jamie 27:48
All of that about manipulating frames, I'll tell you, when I was learning to keep bees from my mentor years ago, what he was really worried about is he was really worried when combs stayed out of hives and the larvae were exposed to UV light. They're really white critters, they probably don't have a mechanism to handle UV light really well, and I just think about what working colonies does. And then you just introduced this whole new potential concept where all pheromonal communication is broken, there are new signals that are happening in a hive as a result of us having entered it, and I just really like that idea. It's just really neat. It's really fascinating. And I think that there's probably a lot there that you guys are going to be able to do in the future. And I'll even add one more thing to it. My team and I do a lot of in vitro rearing work where we remove 12-hour-old larvae from colonies altogether, and they get no social cues or context at all. They're not telling other worker bees that they're hungry. We're the ones providing the food, and we do it once a day. I just wonder about all those social contexts that are missing, the pheromones that they are producing that aren't being perceived on the other end by a worker bee. Gosh, there's just so much to know about this so it's neat to see that you and your team are cracking away at it.

Guest 29:10
Yeah. That's fascinating to hear about that. That's always one area I've been really interested in getting into is in vitro work. From the signaling perspective, but just thinking about how that changes what the adult bee is like, different pulsings of food, different interactions, and those kinds of things, I think that'd be really telling to observe those in vitro bees as adults if, in fact, you can get them to be functioning adults on the regular.

Jamie 29:38
It's funny, you mention that. We had a PhD student here, Ashley Mortensen, in my lab and now she's gone on to be a bee scientist in New Zealand. That was her PhD project, it was looking at how in some assays in vitro reared adults behaved and performed under that whole concept of what happens when they're missing social cues. And so I really love this idea of how important pheromones are. I love the fact that you guys published something contrary to what your hypothesis was. But it's still important. I love the fact that it's got this applied context to it as well. We've got to be conscious of what we as beekeepers do as we're opening colonies, so it's just really neat to see the work. And folks, if you're out

there listening, we're going to make sure and link to the study in the show notes so that you can have a look as well. So Bradley, I really appreciate you joining us on Two Bees in a Podcast.

Guest 30:26
Yeah, thank you so much for having me. It was a great time.

Jamie 30:28
Absolutely. Everybody, that was Dr. Bradley Metz who's a research assistant in the Department of Applied Ecology at North Carolina State University in Raleigh, North Carolina. Thank you for listening to this segment of Two Bees in a Podcast.

Serra Sowers 30:44
Enjoying our episodes? Support our programming and the UF Honey Bee Lab by adopting a honey bee, queen, or hive. Your monthly gift can help support research and programming and help more people learn about honey bees. Check out our website at UFHoneyBeeLab.com for more information.

Stump The Chump 31:11
It's everybody's favorite game show, Stump The Chump.

Amy 31:23
Okay, welcome back to the question and answer time. Jamie, the first question we have today, this person is wondering if crystallized honey is a problem for bees or only for the beekeeper. And I guess I should ask, why does honey crystallize in the first place?

Jamie 31:38
Yeah. So, it's funny, I've never been asked this question before about it being a problem for bees. So we'll start from the beginning, Amy, just like what you suggest. So honey is a super saturated sugar solution. And I have to go slow when I say that because there's a lot of S's involved in that.

Amy 31:55
Say that five times in a row.

Jamie 31:56
Yes. Super saturated sugar solution, that's the best I can do. Okay, the way that I usually teach it is that means that it is a liquid when it potentially wants to be a solid. That means you've got a lot of sugar dissolved in this liquid. That's why beekeepers are able to do things like make creamed honey because you can cause those sugar crystals to come out of the solution if you seed it with other sugar crystals and whip it and do a number of things. So as we all know, bees collect nectar that is way too much water. I'm going to over-generalize this. But generally speaking, nectar is about 80% water and 20% sugar and bees need to reverse that ratio. It needs to be roughly 20% water and roughly 80% sugar. And if you want to get very specific about it, beekeepers like to have honey in the 15 and a half to 18 and a half percent water range. And that's because honey in that range is pretty stable. If it's over 18 and a half percent water, it's prone to fermentation so a yeast can start producing alcohol in it. We all

know that happens. And of course, beekeepers and people have been taking advantage of this for years and years and years through a product called Mead. If the moisture content of honey drops below 15 and a half percent, the sugars will come out of the solution. It will do what we call granulate. And so when bees collect nectar to make into honey, they will tell you when the honey is in that correct moisture range, and they do that by capping over the honey. That's their way of saying this honey is, for lack of a better term, ripe. Now, there are some honeys that will crystallize in the combs. That means that they are naturally drier when the bees process it and so it will come out of solution and you'll get the sugar crystals forming right in the combs. I've seen that myself before. It all depends on what type of plant they're using. And incidentally, there are some plants whose nectar is more prone to fermentation, even when it's stored appropriately in the combs. And you can see that because the honey is bubbling right in the comb. The good news is bees don't care much at all if the honey granulates. They're still able to have that. So the individual asking this question is asking an interesting question. Is it a problem for bees or only for beekeepers? Well, it's a problem for beekeepers because when we extract the honey and we bottle it, if it's not at a sufficient moisture content, it may crystallize in the jar. But it's only a problem from the aesthetics perspective for beekeepers because you can take the lid off of that jar and gently heat that honey and it will go back to being a liquid. Now, the bees don't have the ability to do that in their colonies, but it doesn't seem to be a problem for them anyway. They will still use granulated honey. Now, the interesting thing, too, is the opposite end of that: Can they use fermented honey? Fermented honey is actually bad for bees, it's not a good thing for them. So they do their best to try to keep it below that humidity range that will ultimately cause it to ferment. But from a crystallization perspective, I mean, it's a nuisance for bees for sure, but it's not something that's detrimental to them.

Amy 35:18
That's pretty interesting. I'm thinking about when I bake sourdough, how you have to have a certain moisture content, and how good bees are at just knowing the moisture content that they need to get at.

Jamie 35:29
Amy, you're spot on. How do they know? How do they go, "Oh, yeah."

Amy 35:32
They don't have any sort of, yeah, they don't have any piece of equipment that tells them that. They just do it.

Jamie 35:38
They just say, "It's time to cap this over." Now that you've said that, that would be a great question for the Q&A because I would be completely stumped. How do they know when they've reached that moisture content? Can you imagine all of them tasting it going, "Nah, too wet. Nah, too dry."

Amy 35:53
Okay, so the second question we have for today, this person is wondering when do honey supers go back on. So I'm assuming that they've harvested honey, and then maybe put a super back on top? When would you put a honey super on and take it off? I'll ask it that way.

Jamie 36:12
Yeah, so there's no exact science but, essentially, you want to super your colonies in advance of the major nectar flow. Experience and talking with other beekeepers help you know that information. Let me just give you an example. Where I'm from in Georgia, the major nectar flow would start picking up kind of in late April and go pretty strong through May. So I would know, just by experience, that my bees are going to start making honey kind of mid to late April. So I would want my honey supers on the second or third week of April just to make sure that I have them on in advance of that nectar flow so that I can catch everything the bees are bringing in. But let's just say that you're in a new area, or you just don't know for sure, what are some cues that you can use to tell you that bees are ready for honey supers? Well, when the nectar flow is starting, you will get a pronounced increase in flight activity at the nest entrance. So that's number one. Are my bees telling me something's happening in the environment because there are just a lot more of them flying? Number two, if I look closely at those flying bees, are most of them carrying pollen or not? You can have robust pollen flows, in which case 95% of the bees that you see foraging in this increased foraging peak are carrying pollen. That would tell me, "Well, it's probably more pollen coming in than nectar." But if you see a lot of bees flying at the nest entrance and they're not carrying pollen, then there's a good indication that they're probably collecting nectar. The third way that I can tell if nectar is coming in is while I'm working the hive if I pull a frame up, and I'm inspecting that frame, and I turn that frame to where it's oriented horizontally rather than vertically, and I can just lightly shake it. If bees are bringing in nectar, nectar is so wet and the hive is so warm that the nectar will rain out of the combs that you are lightly shaking while you're kind of orienting them horizontally. It will just rain out, it'll drop. So those days when I'm working beehives and there's stuff dripping on my pants, or I can see that frame turned sideways kind of lightly shaking it, see that nectar come ou, all of these are strong indications to me that the honey flow is happening. And then the fourth indication that I use is when I start seeing white wax. Almost always when bees are bringing in nectar, they'll convert a lot of that early nectar to wax because they're having to build out combs or they're storing nectar in places that get these white cappings. So when I look down on the frames from above, I'm starting to see a lot of white wax being used, and that tells me that there's a nectar flow. So those four things collectively suggest to me, "Hey, you better get a super on because you are missing incoming honey." I don't over super. So let's just go back to my example of being in Georgia. If I know that April 15 is my time, I might put on two medium supers. I won't put on four, even if, historically, I make four a year per colony. I might put on two medium supers, and then one or two weeks into the nectar flow, maybe three weeks into the nectar flow, my general rule of thumb is when I take the lid off of the hive and I look into the uppermost box if bees are blanketing eight or more of those frames, then I might add another super. But you have to learn your honey flows because later in the honey flow, you don't want to leave too much space on the hive. So you'll have to say, "Well, I know that, historically, I'm about a week or two out from the major nectar flow stopping. Maybe this extra super that's empty, I can take off so that the bees will concentrate their effort into the remaining supers." The last little trick that I can tell you about honey flows is ask your local beekeeper. People who've been in the area a long time will know it typically starts around this time and you'll want to make sure that your supers are on and ready in advance of that honey flow.

Amy 40:08

Alright, so the third question we have today is can you eat honey from hives treated with oxalic acid?

Jamie 40:15
I love this question because it's so easy for me to answer, and here's the answer. Every labeled product that you can use in a honey bee colony to treat for something will have information on the label about the withdrawal period or how long the treatments have to be off in advance of the honey flow, or if the treatments have to be off in advance of or during the honey flow. So the way that I'm going to answer that question is read the label and follow it to a tee. And if you follow it to a tee, the label will be written in a way to minimize the impact of that compound on the honey that you are collecting for human consumption. So whatever the label says about the use of the oxalic acid product you're using is what you should follow with regard to withdrawal periods and treating. The same is true for any product that you put in a beehive. And incidentally, I remember when I first started keeping bees, and I'll use Varroa as an example, back in the days, we weren't treating Varroa based on treatment thresholds, we were just kind of treating twice a year. That was the recommendation, treat in fall, treat in spring, treat in fall, treat in spring, treat in fall. Well, the spring treatment was a little bit problematic because I remember some of the treatments at the time had to be out of hives, I don't remember, four or so weeks before the major nectar flow. So if I knew, if you just do the math, if you know the nectar flow is starting April 15, for me, at the time, I would back up to March 15 and know my treatments had to be out by then. Well, if it was a six-week treatment, then I knew the treatment had to go into the hive on the first of February in order to stay in the hive six weeks in order to be able to be out of the hive four weeks before the bees start making honey.

Amy 42:05
Which is basically still winter.

Jamie 42:07
Exactly. So you weren't treating in spring anymore. So that's the key about labels. The labels will tell you all of that information so that you can ensure that you're producing a safe product for human consumption as well as control whatever it is that you're trying to control effectively.

Amy 42:24
Well, that was an easy way to answer that question. Follow the label. The label is the law. Right?

Jamie 42:29
Exactly.

Amy 42:30
I'm cracking up because yesterday, we have lab lunch every day, and we basically, as a lab get together and eat lunch every day. I think it was our lab manager Chris and he said something like, "The label is the law. Have you guys said that on your podcast at all?" And I'm like, "No, we've never said that on our podcast. Only every other episode." All right, so everyone, most of these questions I think we got on Facebook and Instagram. So if you have messaged us on Instagram or Facebook, and we

haven't answered your question, feel free to send us another message. We'll make sure to add it to our Q&A list for the podcast. So thanks so much for these questions and keep those questions coming.

Serra Sowers 43:14
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.