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SPEAKERS

Guest, Stump The Chump, Amy, Jamie, 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. Hello, everyone, and welcome to another segment of Two Bees in a Podcast. We are talking today about a topic that's a really a kind of immediate interest to me. Amy, you and I were at the American Beekeeping Federation Conference a few weeks ago, and I saw some research report, the American Bee Research Conference on shipping queens and the impact that that might have on sperm longevity and quality, all this stuff. And it just kind of leads to a lot of questions about queen quality and how shipping affects that. We're able to take a step further in this episode because today we're interviewing someone about shipping queen cells, and the research associated with that. And that particular someone we're happy to have with us is Ellen Topitzhofer. Ellen, thank you so much for joining us on Two Bees in a Podcast. Everyone, Ellen is a Senior Faculty Research Assistant from the Honey Bee Laboratory in the Department of Horticulture at Oregon State University. And Ellen, you are soon to be the Honey Bee Extension Associate in the Department of Entomology at the Dyce Laboratory for Honey Bee Studies at Cornell University. So you've got a lot of changes in your life happening very soon.

Guest 01:54
Yes, I'm super excited to start at Cornell later this year.

Jamie 02:00
It's exciting to see what you're going to do when you're there. And Amy had wanted to interview you to talk about this topic that she's seen you present and discuss before. And it's all about shipping queen

cells. And so Ellen, before we get into that, we'd love to just spend a little bit of time getting to know you. So one of the first questions we always ask all of our first time guests on this podcast is to tell us a little bit about yourself and how you got into beekeeping in the first place.

Guest 02:26
Sure thing. I became interested in honey bees just through school. I took a social insects course as an undergraduate, and I got very starry eyed about honey bees, particularly honey bees as a system for research. I then went to pursue a master's degree with Dr. Ramesh Sagili in the honey bee lab at Oregon State University. So about a month after I moved out there, Ramesh actually had a pretty awesome idea of sending me down to the almond pollination in California. He had a couple of projects going on out there. So I went there down there, took samples, and I was at this point, just super green as a beekeeper. I mean, the very first time I opened a beehive was down there in California. And I shadowed a couple of commercial beekeepers, as per the recommendation of Ramesh. And man, it was great. If I have any advice for any young researchers listening to this podcast, it's definitely, try to shadow some producers, some beekeepers. I learned so much just from them. So anyway, I got kind of thrown into it, got my master's degree. Then I started working for the Bee Informed Partnership, also in Oregon. Dan Wines and I started the Northwest Tech Transfer team in 2014. And that was a whole nother huge experience for me, I got to work with a lot of different commercial beekeepers from all over the Northwest. And by the time I left, which is about four years after I started, I kind of looked back into the database. And I think that, at least, with the total number of colonies that I took samples from was about 12,000 colonies. So I had gained a lot of technical experience. Then I went on to be a Faculty Research Assistant at Oregon State University in the honey bee lab again, and I have an independent research component with this position. And so what I'll be talking about today, with shipping queen cells, is part of that research component of my current appointment here at Oregon State.

Amy 04:38
Gosh. I'm so jealous of all your experience the honey bees. Something that I want to do is definitely go out to almond pollination. So I'm hoping that will happen in the next couple of years. So I actually heard you present on shipping queens at the American Beekeeping Federation in, I think it was 2022 and that was in Vegas. Is that where you did your talk?

Guest 05:02
Yeah, that's right. We did a one year trial in 2021 with the overall goal of assessing the viability of shipping queen cells, and by shipping, I mean air shipping. And then yeah, we presented those results at the ABF conference that following January.

Amy 05:21
Yeah, I remember just being completely intrigued by your project. And so I was just wondering, before we get into the methodology of it, can you give us a little bit of background on this project and how it came about?

Guest 05:34

So to provide background on this project, I'm gonna back way up and just talk about queen cells for a moment. There's a pretty big market for queen cells, particularly for beekeepers who have colonies in the southern states. During the spring, beekeepers will buy cells from queen producers and install them in their spring splits. That's by far the most common way to use queen cells. There are also some beekeepers that will install cells in large, full sized colonies during the honey production season. So, in the later months, we call this supercell requeening because they put those cells in one of the honey supers. So queen cells are quite often used as a queen source. And here on the west coast, where it's more common to use mated queens as their queen source, I often get the question, "Why would I buy queen cells over mated queens?" You can source queen cells earlier than mated queens by about a few weeks. And that can make a pretty big difference for a beekeeper for their spring management if you can source queens a couple of weeks earlier. Another big advantage is that they are simply more economical. They're cheaper. Queen cells will go for, maybe I would say, $5 to $8 per cell. In comparison with mated queen prices, you have between $28 to upwards of $40 per mated queen. So there's a pretty big price disparity between the two products. And lastly, you can get a solid break in the brood cycle in colonies that you install queen cells, which presents a really nice opportunity for Varroa control, right off the bat with your spring splits. That is something that you can't get with mated queens. So we have a particular interest in looking at queen cells in general, we as in the OSU honey bee lab, but kind of narrowing it down even more so with "Why would you ship queen cells?" The obvious reason is that, as a queen producer, if you can ship queen cells, it allows you to expand your customer base outside of your local driving radius. When I spend time in some of the southern states, Texas, Louisiana, quite often cell producers that I interact with down there will only offer queen cells available for pickup or delivery by vehicle. And so by adding the ability to ship cells, you can go beyond that driving radius. It also allows you, as a queen producer, to extend your production season. You can start selling cells a few weeks earlier than mated queens like I mentioned, but you can also extend your production into the hot summer months. So I'm thinking California in July and August, when it is so hot. There are some other cool opportunities for shipping queen cells. If you're a queen breeder, shipping cells is a great way to share your genetic material with other breeders. So anyway, lots of unique opportunities to physically ship cells in the mail, at least, within the US.

Jamie 09:00
Well, Ellen, let me follow up on that idea, because I'm listening to you talk about all the benefits and why people ship cells around. But to me, like logistically, there's a lot that goes on. And if you guys are conducting a study on this topic, it seems like you'd have a lot of logistics to work out. So can you tell me a little bit about the actual methods related to your study? And while you're talking about that, I'm intrigued by this idea of shipping cells because, to me, they've got to be warmed or incubated in some way. So could you also highlight what's common practice for a cell that is moving through transit? So just to summarize again, a little bit about the design of your study, and then specifically about how cells are shipped in the first place.

Guest 09:42
Yeah. That's a great question, Jamie. For starters, this project was led by myself and Megan Mahoney, who's a commercial beekeeper and bee breeder in Texas and North Dakota. And the first thing that

Megan and I set out to do was to find the existing protocol for how to ship cells. Both of us were new to it when we started this trial. And so we both had experience shipping mated queens, which, as we learned, is different than shipping queen cells. And we worked closely with none other than David Miksa, who is a fellow Florida resident, and also happens to be the largest cell shipper in the country. And so we were really grateful that David was so helpful in setting us up with how he ships queen cells. We learned pretty quickly that it was a really highly detailed process. If you can ship cells, you can ship anything. That's basically what we learned from David. With his help, we were keyed in on how to do this. We wrote a how-to guide on how to ship cells, it's available on Project Apis m.'s website, free to download. The guide is about 20 pages long, just to give you a sense of how involved this process is, the process itself can be written in 20 full pages. So I will cover the basics just in talking today. But I highly encourage anyone who's new to shipping cells to reference this guide later, because I won't, there's no way I'll be able to cover all of the details here today. Basically, in a nutshell, if you're familiar with shipping mated queens, the key differences between shipping queen cells versus mated queens are the equipment. So queen cells need to be immobilized and that's best done with JZ-BZ plastic equipment. You put your queen cells in these cell protectors made by JZ-BZ, specifically the yellow ones are made for air shipping. And then you secure those cell protectors in these orange shipping bars, also made by JZ-BZ. Then, you put those shipping bars full of your now immobilized queen cells into a cardboard shipping box, which we use for shipping all types of queens. And then you put loose bee attendants inside the shipping box to incubate those cells while in transit. And so a big difference between shipping cells versus mated queens is these loose bee attendants. You end up putting a lot more of the bee attendants in for shipping cells versus mated queens. They cluster differently when they're in the cardboard boxes when they don't have a really high amount of queen pheromone output. This is just my guess, at least, as to why they cluster differently. And so part of the reasoning behind putting more attendants in there is just so that you are guaranteeing that they're all going to cluster around the cells. And then the other main difference between shipping cells and mated queens is that you also, at least, we encourage or recommend that you augment the shipping box, the cardboard box, and you add some more insulation in there. And you also add material that further immobilizes the queen cells. So the way that we did this is we put we put some layers of just insulated material, insulation board. And we outline this all in our guide in detail. We amend the shipping box, too. And so, generally speaking, shipping cells does take more time, more effort in preparation compared to mated queens.

Amy 13:56
Ellen, I remember during your talk at the American Beekeeping Federation, something that stood out to me, actually, was the actual shipping process. Didn't you go and find out how far -- let's say our packages are getting rolled around, they're getting dropped on the ground, I remember that being something that you did in your in your methodology. So can you discuss a little bit about that and just in general, what were your findings on your projects?

Guest 14:24
Yeah, good question, Amy. Before I go into us finding out exactly how they were potentially treated while in transit, I'll first start with the first part of our trial. So Megan and I set out, we learned how to

ship them from David, and then we were like, "We're going to do a field trial." So Megan did send me cells from both her place in Texas and her place in North Dakota. So we have two location replicates here. Our main research question that we started with was, what's the ideal age for shipping age of queen cell? And so just to clarify, I'm going to reference queen ages throughout this talk, and beekeepers have different day references for queen ages. Quite often, they will count starting the day that they graft, but just for the sake of being as standardized as possible, I'm going to refer to the queen ages that we looked at based on a 16-day development cycle, meaning day one is the day that the egg was laid by the queen. And then day 16 is the day that she emerges from her cell. So we set out to test four different ages, four of the most mature ages that we felt were possible for shipping. So day 15, 14, 13, and 12. So day 15 is one day before they emerge. So it's pretty tight, because even with overnight shipping, they are going to emerge pretty quickly after they arrive to the customer. And then, all the way to day 12, as far as ages go. So Megan sent me shipments, again, from both Texas and North Dakota, we recorded temperatures inside every shipping box. It was 15 shipments total. We also recorded survival rates of all the cells and their different ages, and also how many queens emerged with wing damage, which is a common type of damage that beekeepers will often find with queen cells, whether they're shipped or not. So what did we find with this initial set of of shipments? We found that the oldest cells, 15 day-old cells had the highest overall survival rate. And almost all of the 12 day cells died during shipment. And then 13 and 14 day were in between as far as general survival rates. And also, another kind of interesting finding that we found is that the two intermediate ages, 13 and 14 day-old queen cells had significantly lower percent survival in the shipments that came from North Dakota compared to the shipments that came from Texas. So there was some sort of interaction effect, or some sort of effect that was potentially based on the location that they were sent from. So this prompted our next question, which is, why did the shipments from North Dakota have lower survival rates than the shipments from Texas? And we didn't have time to really directly test this question. But we did focus on two factors that may have influenced the survival rates and the wing damage that we saw. And those two factors were temperature exposure and agitation. And this, Amy, is where we really kind of dove into, realistically, what temperature exposure are these cells experiencing? And also realistically, how are they agitated in shipment? So, thinking about temperature first, the first factor that we tested, we recorded temperature in all of our shipping boxes from these field trials. And we found that all shipments experienced temperatures that are outside of your typical brood nest temperature range, which is about 92 to 95 degrees Fahrenheit. And this is to be expected, because we know from previous and also quite recent research that queens are experiencing pretty large fluctuations in temperature in their shipping boxes. So, it's kind of an unsurprising result. But when we were kind of diving into the real temperature data, when we looked at the temperatures that we saw from our shipments from North Dakota, again, the ones that were experiencing higher death rates, lower survival, versus the temperature data from Texas, we found that the shipments from North Dakota experienced temperatures outside of brood nest temperature far less than the shipments from Texas. This makes sense because Megan shipped these shipments from Texas in the early spring, so it makes sense that they were experiencing lower temperatures, just because, simply, it was not only just a different place, but it was also much earlier in the year. So this kind of supports the idea that temperature may not play a huge role in the elevated death rates that we saw in North Dakota. So from this temperature data, though, we pulled realistic temperature extremes to test new groups of cells in

our incubators here at OSU. What we ended up choosing is we exposed queen cells, again, from 12, 13, 14, and 15 day-old cells, we expose them to three different temperature exposures. One, we exposed cells at 104 degrees Fahrenheit for six hours, another group at 68 degrees Fahrenheit for six hours, and then the last group is 75 degrees Fahrenheit for 18 hours. And what we found with the results from all of these temperature trials is that all of the cells in all of the different age groups survived, and none of them had any wing damage. It is supporting evidence that queen cells are relatively durable to the temperature ranges that we at least tested, 68 degrees, 104 degrees, it's six hours, 75 degrees Fahrenheit for 18 hours. And by durable, really, I'm only saying it in the context of they survived, and they didn't have wing damage. So again, that's the limitations to what we tested.

Jamie 21:50
That's pretty fascinating. I wanted to ask specifically about one of the things you said, I keep thinking that the theme throughout your, "What did you do? And what did you find?" was 15 day-old are the best ones to ship. You saw that with temperature, you saw that with wing damage related to the agitation. So now, I'm a consumer and I'm thinking, "Well, a queen emerges at 16 days. So if you ship a 15 day-old cell, and it gets to me, I essentially, have to put them in the colony the same day or the hive the same day that I receive them." So how is that managed in the context of your findings?

Guest 22:25
Yeah, that's the limitation. It's a trade off, right? Based on our results, the most recommended age group is going to be 15 day-old cells because they do provide the highest survival rates and the lowest risk of wing damage. But, on the consumer end, on the customer end, you have to be ready to install those cells the same day you receive them. Also, what's at risk is if your shipment is delayed, even by a day, you suddenly find yourself with a very large amount of virgin queens, which you can install virgin queens in colonies, but your chances of your virgin queen being accepted in a colony versus a queen emerged from a queen cell is reduced. It's more difficult to have virgin queens accepted in colonies. So yeah, that's the trade off. It kind of brings up an interesting point, we actually just got approval to research, kind of continue our research on shipping queen cells, and part of our project for 2023 is going to be looking at finding an intermediate age between day 14 and 15 to test for shipping to give the beekeeper an extra 12 to 18 hours. We are exploring chilling schedules in an incubator in order to achieve this intermediate age. So anyway, that's something that that we'll be pursuing this year, in addition, just to evaluating the queens of shipped cells in colonies after the shipping effect, so yeah, it's exciting. I'm excited to continue looking at shipping cells again in 2023.

Jamie 24:57
Ellen, that's really fascinating research that you guys have done. We've had others on the podcast before talking about shipping queens in general. And as I said in the introduction to this particular episode, there's folks who are looking at that, but you and your colleagues were specifically looking at shipping queen cells. Is this a relatively new topic in the literature? Are there others who have studied this before that you're aware?

Guest 25:20

Currently, yeah, we are the only ones that are really diving into the technique of shipping queen cells, even though, as you mentioned, there's a lot of work being done on shipping mated queens currently. But I will mention that, while working with David Miksa in the beginning of our trial, we learned that he got started shipping queen cells by working with Dr. Steve Taber, with some of the work that Steve had done with the USDA, he had looked into shipping cells and did a lot of preliminary work with drop tests, etc, in the early 1990s, and worked with David on developing what's now the Miksas' shipping protocol that they still use today. So certainly, we're not the pioneers of figuring this out. It was certainly, it was built off of what's already been done with the USDA, but also definitely a lot of work that David Miksa and his whole company have put a lot of work into.

Amy 26:37
I think it's awesome. I love work that's done with beekeepers, with researchers, with just academia and the industry in general. So it's really fascinating to hear, and it's really great to hear that project stemmed from a beekeeper who's actually doing this. So the last question that I have for you, this is the question that I think our listeners are wanting to know more about. What does this mean, specifically for beekeepers? I guess there's one side of it for the beekeepers who are actually selling and shipping queen cells, but also for the beekeepers who are purchasing or have purchased queen cells in the past. So what is your recommendation for them? What does this mean for beekeepers? What are your overall thoughts on that?

Jamie 27:24
Ellen, that's really fascinating, you talking about your research. And I'm so grateful how applicable it is, especially to, well, I was going to say queen producers in general, but also the consumer because there's a lot of beekeepers who buy and use queen cells. And you mentioned your management guide on how to do this that you have published through Project Apis m., we're going to make sure and link to that through our show notes so that those of you listening out there who are interested more on best practices related to shipping queen cells can do that. But otherwise, Ellen, thank you so much for joining us on this episode of Two Bees in a Podcast.

Guest 27:24
Our results support the technique of shipping cells as a viable option for beekeepers. And there are a lot of advantages for incorporating shipping cells into your business model. And so I highly encourage beekeepers to to look into it, I highly encourage beekeepers to reference our guide, our technical guide that we have. This guide not only covers the technique of how to ship as a producer, but also covers a lot of guidelines regarding what you do as the recipients of queen cells, how you handle cells, transport cells, install them in colonies. I think kind of overall, definitely reference our guide, it's worth a read. The other thing is, I think our results also show that the standard cardboard shipping box that we use to ship queen cells and other queens, mated queens, in a lot of ways, an inferior product for shipping queen cells. Because we're seeing damage, we're seeing cells that are not only dead, but also have wing damage, which can, of course, really affect the cells viability when you put them in colonies, right? Because oftentimes, you're not exactly sure if the cells are truly dead. And you certainly won't know unless the queens have emerged whether they have wing damage or not. So it's something to think

about. The cardboard shipping box, it's not insulated, it's not shock absorbent. And I encourage beekeepers to support more research on shipping practices, and also push for a better shipping container option. Thanks so much for having me, Jamie and Amy. I'm a frequent listener of this podcast and so I'm super excited that I get to be one of your guests.

Amy 30:05
I thought that was really interesting, Jamie. I guess, before I got into the honey bee world full-time, I did not even think about the shipments of queens and cells versus mated queens versus all that. So it's fun to just kind of pick at everything and pick apart the industry. So what were your thoughts on the episode and the podcast?

Jamie 30:31
Yeah, I thought it was very good. I think that this project is a really good example of a scientist partnering with beekeeper(s) to address beekeeper questions. And in this particular case, there's going to be a very applied answer that comes out of it. And I'm really excited about that. In the United States, at least, I know we've got listeners from around the world, but in the United States, at least, there's a lot of movement of bees and queens and queen cells through the mail. I've never purchased cells. I've never purchased cells to use to requeen stuff. I've always purchased mated queens, but I do know, here in Florida, at least, a lot of commercial beekeepers do purchase and use cells. But even in that context, they often go and pick up the cells directly from the individuals that they're buying them from, and then go back and put them in their colonies nearly almost instantly. So it's really neat to hear about the movement of queen cells through the mail, how much damage can be done depending on the age, less so about the temperature, but more so about the vibrations. I think that was an interesting finding to me because I expected, personally, temperature to impact that significantly. But it seems like 15 day-old cells are pretty resilient. But you got a clock running. You buy a 15 day-old cell, and you've got very little time to receive and use it. So it's all a very interesting story to me. And I'm so grateful that it all culminated in a management guide that they have published that can provide ideas, best management practices, for folks who are interested in shipping cells around.

Amy 31:56
For sure. And we'll be sure to put that in our additional resources as well. But the other thing that I was kind of thinking about was, as a beekeeper, if I was going to reach out to a commercial beekeeper to buy queen cells, what does that process even look like? Do I make the recommendation of, "This is how old I want my queen cells"? Or do you think just in general, the commercial beekeepers will just say, "These are the queen cells that I have. We'll send them over to you." How do we actually know how old they are?

Jamie 32:27
My guess is that the consumer often doesn't have a request for age or say, "I'd like to make sure that they're in this range." I think it's probably all on the shoulders of the queen producers who are shipping queens. And I'd be interested after hearing this talk by Ellen, I'd be interested in polling those bee breeders who ship queen cells around to see what is the average age queen that they ship. I mean,

they're able to keep track of it because grafting and queen production is a very timed process. They know exactly the age of the individuals they're grafting, they know the age cells that are being produced and all that. So they're able to keep pretty close watch on that. But I'm curious how many of them follow these kind of best management practices that were outlined in the interview today, as well as just thinking about the logistics of putting these things in packages, and how much the physical package itself had to be altered to accommodate this. So it was really interesting to me, and I hope that this podcast both informs the breeders who are listening to us, as well as the consumers who are wanting to purchase these from breeders, and maybe suggest to breeders, "Hey, we'd like to make sure that our queen cells are this age and shipped this way just to ensure a greater success."

Amy 33:36
Yeah, absolutely. Well, I'm excited to see what projects they have in 2023. And maybe in the next couple of years we'll be able to have Ellen back on to discuss a little bit more about their findings.

Stump The Chump 33:50
It's everybody's favorite game show, Stump The Chump.

Amy 33:59
Welcome back to the question and answers segment. Jamie, the first question we have today, there was a person who heard a talk that mentioned shipping queens or lack of shipping queens, but instead of shipping queens, they wanted to ship or they've heard of shipping drone semen. What's the deal with this? What is the purpose? Do people do this?

Jamie 34:20
Okay, so I will say I did not see that talk. I'm not even sure what meeting they were at, but I will answer the question with that kind of limited knowledge. So queens are shipped, first of all, all over the place. There are queen breeders who produce queens for beekeepers around the US and the way that is most common for the beekeepers to receive those queens is just receive them through the mail. When I was a kid and was keeping bees as a youngster, I received queens through the mail. It was a great joy of mine to be called to the post office and get my queen. I was always excited about that. But there is increasing research showing that there are some problems related to shipping queens. These temperature differences or variations that beekeepers' queens are getting exposed to from the bee breeder to the beekeeper through the mail might cause problems for sperm longevity in the queens and ultimately, queen longevity and function and productivity etc. So there's still a huge and will continue to be industry shipping queens all over the US, but my guess is if they were talking about shipping semen instead, they might be talking about doing that in lieu of shipping queens. But honestly, they're not shipping semen for the average beekeeper. Shipping drone semen around is usually a research tool. It's a way to share genetic material between research labs, or a bee breeder tool, where they will collect drone semen and ship it to breeder colleagues around the countr. Of course, it would have to be kept cold during the shipment. But I would argue, for the average beekeeper, shipping drone semen is essentially not something you'll ever encounter. It's a research tool or bee breeding tool. And it's used almost exclusively in those purposes.

Amy 36:04
I'm kind of wondering about international shipping because isn't it true that depending on where you are in the world, you can or cannot ship queens? So, for the breeders purpose, they would ship drone semen. Is that right?

Jamie 36:19
Yeah, so that's an interesting question. Most countries have rules about the importation of live honey bees into their country's borders. So, all I can speak to with some confidence is here in the US. In the US, we can't just bring in live honey bees from, essentially, anywhere kind of at this point. But there might be researchers, for example, who are interested in improving the genetic stock of a particular bee. And they might do that through USDA APHIS permitting to bring in something like drone semen. When you bring in semen as an example, you don't run a risk of importing small hive beetle or Varroa, or something like that. You're not importing some arthropod pests that might damage bee colonies, and you're able to check that semen to see if it carries viruses. So it can be a safer way to move genetic stock across borders for research purposes with a long-term goal of incorporating it into our breeding stock. So a lot of scientists around the world, under permitting, could move genetic material away around like that. And drone semen is kind of the easiest of the genetic materials to move around without physically having a live adult bees.

Amy 37:30
Okay. All right. So for the second question, this question is looking at viruses between native bees and Apis mellifera. When I say native bees, I guess this is in the United States, right? So the native bees versus the honey bee that we keep here, do the viruses come from the native bees or our honey bee that we keep? Which came first?

Jamie 37:55
Amy, I love this question. It's a chicken and egg argument right now. So I'm going to tell it to you from the honey bee's perspective, although the native bee people might disagree. And for those of you who are listening to us outside of the United States, we keep saying native versus honey bee. Honey bees are not native to North America or South America or Australia or many island nations around the world. So as a result, in the US, they're an introduced species. We do have multiple native bee species here in North America, about 4500 I believe. And here in Florida, for example, we have 320ish species of native bees. And so with that background, people have been studying honey bees, I would argue, far more prolifically, historically, than they have been studying native bees. And that's because of honey bees' importance to us. So for example, when honey bees are dying from some mysterious thing over the last 100-150 years, folks were trying to figure out what's causing it. And inevitably they'd find something like a bacterial disease that they would ultimately name American foulbrood or European foulbrood or a fungal disease that they call chalkbrood or viruses that they call deformed wing virus, etc, etc., right? So, because they found them first in honey bees, everybody's just always assumed that these are honey bee pathogens. And so, now, because of honey bee colony losses over the last 20 years, people have done a lot of research with native bee populations to see if they too are suffering.

And a lot of those folks who are doing that research are doing pathogen research and they're looking in native bees around the world and finding pathogens known to be associated with honey bees. For example, we did a screening, a former PhD student of mine, Jason Graham, screened wasps and bees from North Central Florida, and we look specifically for 13 honey bee pathogens, which includes some fungi, bacteria, and viruses. And we found a lot of honey bee bacteria, viruses, and fungi on these native bees and wasps. So it would be really tempting to say things like, "Oh honey bees are so bad at spreading these pathogens towards the native bees. These honey bee pathogens, these honey bee pathogens." Well, the fact that we're finding them on native bees could mean that they're coming from interactions with honey bees at the flowers. Or it could mean that some of these things are far more broader in host than we give them credit for being. So I would say the jury is still out. You could equally argue at this point that honey bees got those pathogens from native bees. So I'm not trying to make that argument. I'm just saying that we just don't know with absolute certainty who was first. We know because we found them first, often with honey bees. It's really tempting to say, honey bee bacterium, honey bee fungi or fungus or honey bee virus. But in reality, these things could have come to honey bees from other bees just as easily as they could have gone to other bees from honey bees. And there's lots of very intelligent folks around the world working on these very questions. So the question you asked was, these honey bee viruses, where did they come from, the native bees or Apis? I would argue at the moment the jury's out. People are trying to figure it out. I mean, there are some things that seem to be very honey bee specific. So for example, they are only known to make honey bees sick, and even though we find them on native bees, they're not known to make native bees sick. But we just don't know that for everything. And I would argue moving forward, there's just as much an opportunity for pathogens to move from native bees to honey bees as it is the other way around. So this is a growing area of science that will enlighten our view of this increasingly more in the near future.

Amy 41:44
That kind of leads me into our third question, our last question for today. I went to a talk recently, I think it was Samuel Ramsey's talk, and he had a distribution map of different pests and diseases across the world. I started thinking like, how do these maps work? Who is in charge of these things? And what is the decision process of identifying whether or not a pest or disease is in a certain location?

Jamie 42:13
So, I mean, that's an interesting question. I've never been asked this one before, either. I love these questions today. They're so great. So anybody can make a map. That's the short answer. Anybody can stand up in front of anybody with a world map with some countries colored one color and other countries colored another color. And in my time educating beekeepers and bee scientists about bees, I even created some of these maps. So I'm going to give you a little bit about a history of some of the ways that we've done it and how it's been incorporated. So the journal Bee World, which is a publication from the International Bee Research Association, published in the 90s, principally in the 90s, I think the late 80s and the 90s, distribution maps for honey bee pests and pathogens. And these were done by multiple authors. In 2005, I, with a colleague of mine, Pamela Munn, published an update in Bee World for the distribution of honey bee pests and pathogens. And the way that all of us did it, my 2005 update as well as the updates of those published in the 90s in the late 80s, the way we all did it is

we scoured the refereed literature, and any time a scientist would report a new something in that country, we could add that country to the list as positive for that something. So for example, if small hive beetles were found in the United States in 1996 and that came from a refereed manuscript where the scientists collected the beetle, had it professionally identified by a taxonomist, then we can believe that record, and we can say, small hive beetle found in the United States in 1996 and we can cite the manuscript that made the authoritative identification. If, on the other hand, someone posted on the website, I think I just saw Tropilaelaps in my colony in the backyard, that doesn't cut it. That's not an authoritative discovery. So in 2005, my colleague Pamela Munn and I scoured all of the literature, all of the papers, research papers that had been published since the prior update, which I think happened in '96 or '98ish. And we looked at all of those papers, and we looked to determine if certain criteria were met when reporting a new pest or pathogen in a region. And that mandate had to be reported in a peer reviewed article by an authoritative individual. That person had to be very reliable. In other words, like a State Bee Inspector or National Bee Inspector or scientist, not that other folks aren't reliable, but these folks do this for a living. And those things had to produce recognizable signs of infestation or infection, and had to be identified using the most up-to-date taxonomic or molecular approaches. So that would get it there. And furthermore, if people had done national screenings, thorough national screenings and could not find it on those 2005 maps, we would say, "Well, there's no information or it's absent." Or if we would have anecdotal reports, we would say, "suspected present" or "suspected absent." Okay, so 2005 was the latest time that we had updated the maps from our lab, and then our lab decided to try to do that again. And then around 2015 or 16, our team updated those maps and finally published an updated version of that, I think, in 2020, in Bee World, and we created a website, WorldHoneyBeeHealth.com that we believe now kind of serves as the authoritative distribution maps of honey bee pests and pathogens around the world. So when you see maps used in presentations, often those folks are downloading maps from our website that we try to update yearly with any new distribution information that we have. So WorldHoneyBeeHealth.com. Now again, Amy, anybody can produce a map based on their reading of the literature or their knowledge about unique finds in certain areas, but stuff can only make our maps if the citation is published in refereed manuscript, and it was done in an authoritative manner by the most appropriate identification techniques. It can't just be anecdotal. So I know that was a very long answer. But the short answer is, anybody can make a map. So you have to be careful about the sources. We try our best through WorldHoneyBeeHealth.com to update the maps yearly with the newest sightings we have. And a lot of scientists around the world just download and use our maps and they'll cite them as such. And other groups also create distribution maps for their pest or pathogen of interest. So anytime you see these maps, if you have questions about them, you can always ask the presenter, where did he or she get that as a source, and you can double check it yourself. But we try to keep ours up to date on WorldHoneyBeeHealth.com just to make sure that we all have kind of a single source that can serve as a reference for everyone.

Amy 47:31
Yeah, absolutely. And we'll be sure to link the WorldHoneyBeeHealth.com website to our additional notes and resources on our main website. So Jamie, thank you so much for answering those three. I just wanted to thank the audience for your questions. These questions are great. Don't forget to send

us an email or send us a message on Facebook, Instagram, or Twitter. We are @UFHoneyBeeLab. We look forward to hearing from you.

Serra Sowers 47:57
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.