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SPEAKERS

Guest, Amy, Stump The Chump, Jamie

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 episode of Two Bees in a Podcast. Today, we are joined by Dr. Leigh Boardman who's an Assistant Professor in the Department of Biological Sciences at the University of Memphis, in Tennessee. Leigh is here to talk to us today about environmental eDNA and how that works in the honey bee world and how it might be beneficial to beekeepers in the future. So Leigh, thank you so much for joining us on this episode.

Guest 01:14
Thank you for having me.

Jamie 01:15
So Leigh, you've spent a little bit of time in the lab here, and you and I have known each other for a few years now. Our listeners, though, don't know you yet. We'd love for you to introduce yourself to our listeners and talk a little bit about how you got started working with honey bees in the first place.

Guest 01:30
So I stumbled upon honey bee research as an accident. My background is largely studying insect physiology and how insects respond to environmental stress. And as a postdoc at the University of Florida, I was looking for a position and the time lined up such that the Ellis lab was also looking for somebody who had a similar skill set. So I sort of stumbled into working on honey bees through an opportunity with the UF Honey Bee Lab.

Amy 01:56
Yeah, we loved having you at the lab. I miss you so much, Leigh.

Guest 01:59
I miss you all, too. It was a great place to be there, and to be there when the building was being built and the lab was sort of starting this fresh start was an amazing experience.

Amy 02:07
So you work with eDNA. I don't know what that is. Can you tell us what environmental DNA is?

Guest 02:14
Sure. So a lot of people haven't heard this term. It is a new sort of emerging technology in research in which we sample DNA from the environment, and not from a biological organism itself. So traditionally, if we wanted to use honey bee DNA for research, we would squash up some bees and extract the DNA that way. This approach uses DNA from an environmental sample or from the surface of part of a colony, perhaps from plant material that the honey bees have interacted with.

Jamie 02:49
So Leigh, I really enjoy working with you on this topic, and I've learned a lot about it over the years. You and I have published a paper together that we'll talk about momentarily, as well as have a grant together on this topic. But ultimately, this idea had to come from somewhere. So could you talk a little bit about how you initiated this line of research, how you got that idea and how it got started?

Guest 03:10
Yeah, well, I am not a beekeeper, so working on honey bees was a big learning experience for me. And it always seemed like a huge amount of work to monitor honey bee colonies for pests and pathogens and just to keep tabs on the bees, make sure that they're sort of happy and healthy. I was at an NSF invasion biology workshop when I ran into one of our collaborators, Dr. Rafael Valentin, who had used eDNA for detecting invasive species as part of his PhD work. And so in talking to him about this approach, it got me thinking, can we use this for honey bees? Like is this kind of a bit of a shortcut that may be beneficial, and may allow beekeepers to monitor their colonies on a wider scale with less time or labor involved?

Amy 03:55
So, Leigh, I'm wondering, are you the first person to kind of use eDNA with honey bees? And you're talking about monitoring methods, so I'm interested to know, how does it differ? What are the current monitoring methods?

Guest 04:07
Yeah, so we're not the first people to think of this. There are some groups in Italy that have used environmental DNA from honey samples in order to detect pathogens in honey, as well as to look at the

floral source, so what clients the honey came from. Our approach is a little different. We're trying to see whether there is a way of using this technology to potentially find pests or pathogens that are new invasives or new problems before they're prevalent enough to cause disease symptoms or to cause sort of big issues with honey bees. So we're taking what's called a non-targeted approach. So in our methods, we're not looking specifically for Varroa, for small hive beetle, for the problems we know about. We're looking to see whether those DNA signatures or other things that may be problematic, especially things that might be cryptic, some things that hide away, or diseases that may only cause problems down the line when the viral load is really high in a couple of years. So it's sort of a newer approach to monitoring. It will be different in that most of the current monitoring methods are what we would call targeted. So if you want to know what's going on with Varroa, you might do mite washes. If you're looking for a specific disease, you may use a targeted PCR method. But in that, you're only looking for what you're looking for. You won't find anything else that you don't know. I mean, you don't know what's not there, I guess. We're trying to see whether we can figure out what's there.

Amy 05:35
Yeah. Can you talk me through the method of collecting information to be able to look at eDNA? What does this process look like?

Guest 05:42
So in our initial research, we tried a lot of different ways to sample parts of the apiary. And the approach is a lot like what you would see in a forensic TV show like CSI, any crime scene investigation show where you will see crime scene investigators swabbing different surfaces. We pretty much did that. So we used some forensic swabs that we just moistened with water. And then we walk them over the surface until they look dirty. That dirt and debris that contains a lot of eDNA from the environment, which we can then use and extract in the lab. We also washed surfaces. So eDNA will stick to the surfaces of plants and parts of the hive. So we sort of rinse those down with water, and then we filter that water to extract the DNA from that solution. So there were a couple of different approaches we were trying. We're hoping that the swabs will work, mostly because it's easy. I also like it because it kind of makes you feel like you're a CSI investigator, and you're cool.

Jamie 06:44
So, Leigh, you have a lot of knowledge about environmental DNA through practice, right? You talked about how you got the idea for this research, you talked a little bit about what eDNA is, but you have practical application of this by conducting a rather large study related to honey bees and beekeeping that I was fortunate to be able to collaborate with you on, and it was recently published. Our listeners would probably really love to hear about that project so that they can understand how this technology might work in context with beekeeping. So could you talk about it? Feel free to take a while because it's a big study. But talk a little bit about the study questions, the methods and all that stuff, as well as the results that you found related to this work.

Guest 07:24

So let me start off by saying this was a huge team effort. This research started before 2020 and was sort of carried out through the pandemic, by a variety of people on multiple different continents. The folks who were doing the sampling were obviously based in Florida. I, at the time, was stuck in South Africa, thanks to the pandemic. And then we had various intellectual input from a lot of different people. So this isn't just a me project. This was definitely an us project. But the idea behind this initial work was to investigate whether eDNA is going to be informative for this practice. Whether it was just a good idea, that's great in theory, that just doesn't work practically. So the first thing we wanted to do is just to figure out which parts of an apiary have informative eDNA. So DNA is being shared all the time by organisms in the environment, but obviously where it ends up and when we can get access to it can be very different. So Jose, who collected this data for us, basically swabbed and washed pretty much every surface of a colony in the UF apiary that we could find. So this included things like hive bottom boards, hive tools, hive feeders, we even sampled soil underneath the hives, pond water that we know that the honey bees are interacting with, as well as the plants. So we did apply transect of all the plants that we know the honey bees visit. So I feel like we very much swabbed the entire apiary collecting eDNA to then see which of these surfaces possibly have some good information. So once we'd done that, we were able to extract enough DNA from pretty much every single one of these surfaces. Now, this perhaps isn't surprising, because obviously, we know there are a lot of biological organisms in apiary, honey bees, as well as everything else that lives in with them. So getting enough DNA wasn't a surprise, but it was good to know that we were at least able to pick it up and extract it. As part of the sampling, we also tested different ways to collect the DNA. So as I mentioned earlier, we used forensic swabs as well as spraying and washing surfaces wherever possible. We tried to do both of those on the same surface at different times. So there was time for the eDNA to kind of collect but we wanted to see whether these methods were comparable or whether one performed better than the other. And then once we had DNA from all the different sampling methods and all the different surfaces, we then used molecular techniques to see what the DNA was. In this study, we looked to see what we could find that was arthropod DNA. So obviously, predominantly insects, but there are some other eight-legged friends that hang out in the hives, some of which are big pests. We also look to see what bacteria and fungal DNA we could find. I will say, we weren't able to do virus work. A lot of the viruses that affect honey bees are RNA-based, not DNA-based, and those require some different methods. What was really awesome about this is that we were able to detect DNA from the pests and pathogens that we know are relevant for the UF apiary. Although, these are super obvious, and a lot of beekeepers would have them, having the DNA match what we could see was obviously really great. What we found was DNA from Varroa, from small hive beetles, and then from the bacteria and fungi, we found examples of species that are of apiculture interest. So we found what we would have expected based on what we know about our bees. The good thing is we didn't find anything that was horrendously bad. And so that was a good start. But it was really nice to see that the information that our beekeepers gave us matched the DNA that we could find in the method. So it was a great starting point. Obviously, like most research, it just led to more questions. And so we're looking forward to continuing to develop this technology.

Amy 08:21

So, Leigh, that sounds like a really fun project. I'm just thinking about Jose because he was at our lab, I'm thinking about him going and just swabbing everything outside. And I'm sure he had a lot of fun with it too. I'm interested to know, you're talking about identifying some DNA from bacteria, some fungi, does it just kind of tell you an overall, there's this much fungus or there's this much bacteria? Does it go into specifics of what it is?

Guest 11:51
Yeah, so the molecular methods we were using are specific, in some cases. Briefly, sort of how this method works is we see what DNA sequences are in our samples. We then have big reference databases, where, for example, we know that the sequence for Varroa destructor is whatever the letters are. And so if we have those letters in our sample, we then get a match. So we know yes, there's some Varroa. However, if what we're looking for isn't in the reference database, then we might not be able to get too specific with what that DNA is. We may be able to tell the taxonomy at a genus or family level, but we can't tell exactly what species it is. This can obviously be an issue in some cases where some species are a problem but not other closely related species. But it all depends on the reference database and how informative that is. eDNA can be used to actually quantify and say how much of the DNA in the sample can be attributed to each of the different species. But we didn't take that approach. Ours is very much a broad brushstrokes initial view. It's somewhat specific, but it's not the be-all and end-all. What I should also add is, just because you find DNA in your sample, doesn't mean that it comes from a live viable organism. For example, if a small hive beetle is dead in a colony, or alive in a colony, obviously, that has very different impacts for the honey bees. But we would still just be able to tell you that the DNA from a small hive beetle is in the colony. We can't tell, with our methodology, whether it's dead or alive. And so obviously, for things like small hive beetle, if you have one dead one, you probably have a lot more live ones, but with some of the other things that we might be looking at in the future, it's an important consideration for interpreting what we find with this methodology.

Amy 13:53
Yeah. I can definitely see how it could be useful, especially for beekeepers, or just looking at invasive species in general. So I think that it would be super useful, definitely, for beekeepers. And I'm wondering, is this something that is testing that's available for beekeepers to utilize, or what is the practicality as far as the beekeepers' perspective?

Guest 14:11
So at the moment, no. This is still very much a research-based technique, there is a lot more fine-tuning that we would need to be able to do and to figure out before this is something that could be used for beekeepers. So we have a lot more work to do to figure out. For example, what sampling techniques work really well, which parts of the hive are giving us the best information in us determining what species are present, as well as just the cost of the analysis and things. At the moment, this is still probably a little too expensive to be able to be useful to beekeepers, but like many molecular techniques and technologies, things are becoming cheaper almost every day. Perhaps down the line, once we've done a little bit more research, this is something that beekeepers might be able to use, especially in areas where they're worried about new invasives or emerging diseases.

Jamie 15:05
Leigh, taking this technology into the beekeeping is relatively new. I guess it's a new technology in general. But I do know that I hear about other bee scientists who are exploring using this technology, particularly with invasive species. I think about the hornet issues that we have in the US and that they have elsewhere. And I know, Leigh, since you're a bit of a pioneer in this research, you and your respective colleagues, on this topic in the honey bee world, that you've got some future plans. So maybe without going into too much detail to spill all the beans, but just a little bit about what you plan to do moving forward with your colleagues on this topic.

Guest 15:39
Yeah, so thankfully, we recently received a USDA NIFA grant -- the "we" here being Jamie and I. And so we have four years of funding in order to continue to refine this technique. What's great about this is in the interim, since we started the work, that we are now more aware that a lot of other honey bee related researchers are interested in the technique, or pursuing their own lines of research. And this is fantastic. The more people we have using this technology and working on it, the more we're going to end up with a refined product. I'm excited that we will be continuing this research. We're going to be looking to see how well it works against some of these emerging invasives. Because obviously, if it's not working against them, then it might not be the best option for invasive species detection. We're also going to be testing it on samples outside of the US that have a lot of the pests or diseases that we're worried about coming in the future. By doing the testing outside of the US, obviously, we can do it safely without bringing anything in, but allows us to test the feasibility of the technique, as well as sort of nail down some of these methods and iron out the creases so that we're ending up with a product that is useful and can be used by research to kind of continue to keep tabs on honey bee health.

Jamie 16:56
So, Leigh, now that you've been doing some honey bee research for a few years, do you see yourself keeping this type of connection with honey bees throughout your career? Are you just loving it or you're keen to move on to other things that are of interest to you as well?

Guest 17:09
I sort of laugh because as I mentioned earlier, I stumbled upon honey bee research, and it's been a lot of fun. I have really enjoyed working with bees. I will love to continue doing some honey bee research. But I'm also very grateful to not be running a honey bee lab. It is a ton of work. And so I think continuing to dabble as a honey bee researcher is a great middle ground. Being South African and obviously coming from the country that has a bad reputation for our very defensive honey bees, it's also nice to do a little bit of work in the honey bee world and try and, I guess, correct the views of the honey bee and of South African beekeeping in general. So I sort of feel an obligation as a South African to represent well in the honey bee world and teach people about how cool and interesting and fun ourbees are, and not just all the bad things that they have a bad reputation for.

Jamie 18:03

Well, thank you so much, Leigh. I really appreciate you joining us on this episode.

Guest 18:06
Thank you for having me. It's been fun to share some of our research.

Amy 18:22
Jamie, this idea of eDNA is just so interesting to me because it feels like there's so much stuff out there. When you take a cotton swab of something, the fact that you can find all these things, it's just kind of mind-blowing to me. I think it's just so big to me in my mind that it's hard for me to comprehend. How do you look at a list and identify exactly what is on, I don't know, even swabbing like a flower or something like that? Could I swab anything, and use eDNA to figure out what has either touched it or been on it? Tell me more about eDNA?

Jamie 18:57
Yeah, it's really kind of a neat topic like Leigh was sharing. Basically, it's based on the premise that living organisms that move through a system end up depositing DNA in that system. That's one way. Or, living organisms that encounter other living organisms might pick up DNA elsewhere. And so, as you can imagine, a honey bee colony is a tremendous sink, which is what we would call it in the research world, where a lot of DNA would end up in and around honey bee colonies by virtue of things wanting to be in honey bee colonies. Varroa, the pathogens, the honey bees themselves, as well as the fact that honey bees are canvassing the countryside, touching flowers, collecting rosins for propolis, collecting water, and in the act of canvassing the countryside, they're encountering DNA and bringing it back to their nest. So the colony serves as a sink. Plus, all of these places bees touch serve kind of as the sources for DNA. And so the idea is simple. Wherever honey bees are or visit, maybe we can know something about the organisms they encounter by screening the DNA where those honey bees are or visit. And it's a pretty neat idea. Like Leigh mentioned, we've got some time before it ultimately becomes a tool, maybe, that can be used by beekeepers, but I can certainly see where it'd be advantageous. Like in the invasive species world, for example, this hornet that's now in the southeastern US, the yellow-legged hornet, it's possible, if it becomes established, maybe, to monitor its spread through the presence of its DNA without physically having to see a hornet. So that's an example. Or, looking for tropilaelaps, evidence of tropilaelaps in colonies searching for the DNA rather than searching for the mites. So yeah, in theory, you can swab any area that an organism has passed through and pick up evidence of that organism potentially having been there.

Amy 20:58
Jamie, of course, with research, there's always something else to look at. What do you see as far as like what would need to be next to make it more practical or to be able to use it? What methods need to happen to make the technology a little bit better?

Jamie 21:11
Yeah, Leigh mentioned a few really important things that I think are key to consider. For example, in the kind of broad sweep approach that we took with this project, we can only screen for organisms whose

DNA or information about the organism's DNA has been deposited in a repository to which we all have access. Let me give you an example of what I mean. Let's say that none of us knew that Varroa existed. The Varroa genome will not have been sequenced or pieces of its gene would not have been sequenced. So, therefore, these things wouldn't have been deposited in this repository that we use, so that when we run our DNA sequences through this library, we'd never find evidence of Varroa because the book of Varroa has not been written. It's very important to recognize the limitations of eDNA at the moment because you can only screen for things for what you know sequences of various genes of that thing. So the more that's added to this library, the more that we're able to know. And in fact, that's one of the exciting things, to me, about eDNA because you get the swabs, you isolate the DNA from those swabs, we call that extraction, we extract the DNA from those swabs, then we can run the sequences from those DNA against the database/the library. Well, you could use that same DNA five years from now, and perhaps pick up more organisms that now have their sequences in the library. And you could screen that same swab 10 years from now and add to that list and 20 years from now and add to that list. So it's almost like a frozen in time snapshot of the organisms that moved through that system, even if we don't know those organisms exist at all. Now, we might be able to rescreen those same swabs, 10, 15, 20, 50 years from now, if they were preserved adequately. Another thing I'll mention, a current limitation is that we have to do a bit of ground truthing, and Leigh kind of alluded to this. In our study, we screened for and found DNA from organisms we knew to be already in those colonies. Varroa is a good example. We knew our colonies had Varroa, so if we failed to find Varroa DNA with the swabs, we would be suspicious of the ability of this technology to find it because we knew Varroa was there. So then we went back into the colonies and confirmed Varroa was there. We call that kind of ground truthing. So when the swabs tell you something, experimentally, it's good to confirm that that something is present or has been present in the colony. That's easy to do with things that we can recognize from the bee world, Varroa, small hive beetless, wax moths. But it's harder to do with things that maybe we don't encounter frequently, which kind of leads me to this third point. Honey bees visit everything and bring DNA back to their hives. So not only can we use this technology to screen for honey bee pests and pathogens, but also can be used to survey for all kinds of things. I could conceivably see human pathogen DNA showing up in honey bee colonies just by virtue of honey bees visiting stuff. So you could use, potentially, this technology to figure out what plant species honey bees are visiting. It's just really cool that we're all in the early edge of this technology. Leigh and I and others can't really wait to see where this goes.

Amy 21:11
It's really mind-boggling. Like, if a worker bee landed on my arm, and then went back to the colony, would my DNA be in that colony?

Jamie 24:26
So I mean, that's the thing. We have every reason to believe it would be. I'll tell you though, and most people don't think about this, there's the added complication of human DNA because anytime humans are involved in studies and just looking for your DNA within a honey bee colony would involve a human in the study. We have to have extra levels of regulation in our research projects. So at the moment, we've not really looked at human DNA. We tried to limit our screenings to plants, pathogens,

arthropods, pets, things like that. But yes, conceivably, if a bee landed on your arm and went back to the nest, there'd be Amy Vu DNA in their nest.

Amy 25:10
That's crazy. All right, well, we don't know what we don't know. Right? And so it'll be really cool. I think, just to see. I think Leigh had said that too, we just don't know what we don't know. But it'll be interesting to look back. And as we start getting and collecting samples, that database just continues to grow and grow and grow. Very cool.

Stump The Chump 25:36
Everybody's favorite game show, Stump the Chump.

Amy 25:45
Welcome back to the question and answer segment. Jamie, the first question that we have today, this person is wondering about using roach bait in a hive to kill small hive beetle. They also said that the label is the law, they know that we've told them this over and over again, but they were still wondering if it works. The answer is that it's probably not legal, the label is the law, and it doesn't say anything as far as using it to kill small hive beetle. But this person's state inspector said that you could be fined if this product was found in a hive. What are your thoughts on using roach bait for small hive beetle in a honey bee colony?

Jamie 26:26
Easiest question, I think, I'm going to answer today.

Amy 26:28
Is it? Because that was really hard for me to ask.

Jamie 26:30
The hardest question for you to ask but the easiest question for me to answer. It's illegal. You should not do it. Now, of course, I have to expand on this because nobody wants short answers. But this is how it works. We probably answer something regarding label products every second or third Q&A in our podcast. And I love the fact that so many of our questioners will put into their answer, "I know the label is the law." And Amy, the reason I love that, Amy, is because we talk about that nonstop. And that's how we know the impact of this podcast is far reaching. People are hearing and listening. We're so grateful for you listeners out there who listen to this and you make beekeeping decisions based on the things that we and our guests share. Okay.

Amy 27:15
Also, I need to set the facts straight, this is not Jamie's. You did not come up with "the label is the law."

Jamie 27:16

Yeah, for sure. This is something that we use in extension all the time. Yeah, this is not new to us. Yeah. But let's expand, then. The label on the product will tell you how it is to be used legally. There are no roach baits, roach gels, ant baits or ant gels, at least in the United States, that are labeled for use against small hive beetles. You can go look at the label, the label will say, here is what you're allowed to use this product to control. In fact, it'll say, for the control of, it'll list the number of pests and list a series of situations in which you can use it. For example, can control moths on peach trees, can control beetle bores on corn. It'll tell you, none of these products are labeled for use against small hive beetle and honey bee colonies. That makes them illegal to use. Yes, it's very popular to control small hive beetle with some of these roach baits or ant baits. But it's illegal to do and so your state inspector was right. If it's found in a hive, you can get fined. There are other things that can happen to you legally. That's not just true here in the US. It's true all around the world. That's the purpose of a pesticide label. Now, that's the truth of it. The bigger question is, so should it be legal? That's a philosophical discussion that we could have later. I know that there are other folks who are looking for new compounds to control small hive beetle. We, our lab, we've even published a paper looking at some compounds to control small hive beetle. So I would argue that there's lots of research in this area, and maybe someday, some iteration or future version of what we see currently to be illegal, could be legal in the future in a different context or a different formulation or a different application method. Until that time, it is illegal to use any of these things in honey bee colonies for the purpose of controlling small hive beetle. The label is the law, and if it's not on the label or if it's excluded on the label or doesn't specify on the label, then you shouldn't use it.

Amy 29:37
Think that's fair. Okay, so for the second question, this person has heard that you're not supposed to heat a honey above 130 degrees and that cooking honey actually lowers the quality and it loses those essential enzymes and nutrients. The actual question is, when I'm drinking my hot cup of tea and I add honey into it, what happens to the honey then? That's what, well, I mean, I guess not most people do that with honey, but a lot of people do that with honey. They put it in their tea.

Jamie 30:05
Amy, this is a really funny question for me.

Amy 30:07
I love this question.

Jamie 30:08
I feel like I'm going to be stirring up a pot of trouble. So let me just, again, I can always-- A whole pot of trouble, pot a tea trouble. Okay, let's let's go ahead and get myself in trouble. I've had so many questions recently about heating honey and destroying these living enzymes or killing enzymes. I've heard about using metal to destroy these living enzymes. I'm so grateful for the way the questioner asked this question. They didn't ask about living enzymes. Enzymes aren't alive. You can't kill them. Anytime you look up heat impacts on enzymes in honey and metal impacts on enzymes in honey, all these people are talking about, "You don't want to kill the enzymes, it's gonna be bad." You can't kill

something that's not alive. So what they're really saying is that heat will denature the enzyme and make them ineffective. So why am I stirring up trouble? Okay, there's this huge culture associated with honey and health, right? Honey is not just sugar water; it's got color and flavor that's unique. Therefore, there's other stuff in honey beyond just sugar water. So you can't exactly say, "Gosh, come on, guys, honey's just sweet. The real reason people eat honey is for sugar," because there are enzymes and some vitamins and some ash and some other things. But I don't think that honey is a good source of any of these other things. I think I just made a lot of people mad with that statement. A lot of people want to say they're eating honey for health reasons and because they're trying to get beneficial enzymes. What enzymes would be in sugar that would benefit us, right? There's this whole culture about denaturing enzymes and destroying the nutrients. Really, to me, the better question is, can you heat honey to destroy what we're actually going to it for, which is the flavor. And you can. You can overheat honey. The questioner here mentions 130 degrees Fahrenheit. That's roughly, calculating it now, that's roughly 54 degrees centigrade. The truth is, if you heat honey above about 140 Fahrenheit, that's roughly 60 degrees centigrade, that's the temperature at which wax melts, it melts around that temperature. So if you heat it above 140 Fahrenheit or 60 degrees centigrade, you're mixing the wax and the honey and you might have some filtration problems downstream and things like that. But even some honey sites, like our National Honey Board, or some other documents that I read prior to coming on and answering this question, a lot of those were recommending even flash heating to 175 or 185 Fahrenheit, just to quickly get out all the sugar crystals to make it pass through the filters a little bit easier. That's not really pasteurization, it's just heating it. Well, the National Honey Board had funded a research project where they were looking at it and where they were having this third party look at it. And I'm going to read a quote from their article. "The research shows a great deal of variability between samples from the same supplier as well as samples across suppliers." In other words, they had these multiple suppliers providing honey and they were heating it or not heating it. Anyway, because of this level of variation, it's difficult to draw more than general conclusions. However, here are their general conclusions. Processing with heat is not a fully destructive process, as some consumers have been led to believe. Heating and filtering honey does not completely eliminate all enzymes, nor does it have a negative effect on honeys, minerals, and antioxidant levels. In other words, you don't want to heat it to a crisp if those things are important to you. But my question is, what are those things doing for us? Right? So just eat the honey for the flavor and the other things. There might be some microbenefits from enzymes and nutrients. But most of the heating scenarios that honey encounters, according to this research, don't alter it so significantly that we're not getting some of those things. Anyway, I know I rambled a long time there, but I keep thinking, what nutritional benefit am I getting out of a big pile of sugar?

Amy 30:13
A pot of tea? Yeah, definitely.

Jamie 31:36
I know that's gonna get some comments, Amy. I guess I should be ready for him. But there we go.

Amy 34:27

I'll forward them all to you. Okay. All right. Third question. There was this article that came out and it was titled "The beekeepers who don't want you to buy more bees." I feel like I've heard that from either backyard beekeepers or commercial Beekeepers. I've heard that before. And so I am interested. And I think the article kind of talks about the pollinators outcompeting each other or competing for resources and then the possible trouble that might happen when there are too many honey bee colonies in one area. What are your thoughts about this as far as the beekeepers who don't want you to buy more bees?"

Jamie 35:04
I have two very different thoughts about this. One, I'm going to come at it from a scientist, and one, I'm going to come at it from a pragmatist. Let me tell a little story to kind of help set the stage for this. As a scientist, I am often requested to answer questions from a science perspective, especially in a political realm. I've had to testify, for example, not testify, maybe it's not the right word, but give a presentation from an Ag Committee in the Florida Senate as an example. And they're just looking for facts. It's the scientist's responsibility to provide unbiased facts. It's other people's responsibility to act upon those facts. And so that's what politicians do. They don't just get facts from science. They get facts from economists and healthcare professionals and so forth. I mean, think back to COVID. The scientists were all screaming one thing, the economists were screaming another thing, and ultimately, the decision-makers had to take all of that information and try to make some sort of practical sense out of it. So why am I telling you this to answer this question? Well, there are science facts in my answer and there's also "someone needs to just figure this out" facts in my answer. From the science perspective, yes, you can overstock honey bee colonies. Yes, you can have limited resources. If you're a beekeeper in an urban area where there are not a lot of resources available, and someone comes in with 100 more colonies, it can be a problem. Not to mention, it can be a problem, potentially, for native bees in the area, if honey bees aren't native to the areas. Everything these beekeepers site in the article, yes, we don't want more beekeepers because of the limited resources, because of potential impact on all these other things, they're just using science to justify a stance. But the problem is it's hard to know if their stance is really on the side of science, or on the side of business because they also have a vested interest in not having more beekeepers in their area.

Amy 37:11
Unless they're selling bees.

Jamie 37:13
Exactly. So what right do they have to be the lone beekeepers in an area to the exclusion of other beekeepers just because they were there first. Right? So they're using science arguments to kind of justify, in some cases, capitalistic dependency. So the big question here is from the science answer, yes, they are making some legitimate comments. You can overstock bees, you can do all these things. But it's not up to scientists to figure out if it's the right thing to allow to happen. Scientists are just part of the answer in this context. So if I were asked directly, do I think there should be fewer beekeepers? That's not a science answer. All I can say as a scientist, well, more beekeepers in this particular area leads to fewer or more problems, etc. It's up to people who have all the information to make the

decisions on what happens next. So my sneaky suspicion, having read this article and looked at it, considered other things similar to this issue is part of this is motivated by science, but also part of it's motivated by just, we want to be the sole beekeepers in town. That may not be universally true, but I know here in Florida, for example, a lot of commercial beekeepers are starting to complain about the number of beekeepers we have in Florida, beekeeping densities, and all of those things. But probably some of it's based on density, probably some of it's based on economics. We just don't want more competition. The truth is complex. Let's just say it that way. The truth is complex.

Amy 38:40
I think that's a good way to put it. All right, everybody. If you've got other questions, feel free to send us an email or message us on our social media pages. Thanks for listening to today's episode. This episode was edited and produced by our podcast coordinator Mitra Hamzavi. Thanks, Mitra.

Jamie 39:06
Visit the UF/IFAS Honey Bee Research and Extension Laboratory's website, UFhoneybee.com, for additional information and resources for today's episode. Email any questions that you want answered on air to honeybee@ifas.ufl.edu. You can also submit questions to us on X, Instagram, or Facebook @UFhoneybeelab. Don't forget to follow us while you're visiting our social media sites. Thank you for listening to Two Bees in a Podcast.