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SPEAKERS

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

Jamie 00:10

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

Amy 00:47

Hello, everybody. Welcome to today's segment of Two Bees in a Podcast. Today, we have Dr. Micaela Buteler, who's a research scientist with the Institute for Research on Environment and Biodiversity INIBIOMA CONISET, and she's calling in from Argentina. We've actually had her on the episode before, and she was in episode 112, to discuss the microplastics and the effects of microplastics on honey bee foraging. Well, today we're bringing her back on because she just finished a publication and finished a research project called microplastics incorporated by honey bees from food are transferred to honey, wax and larva. So, thank you so much, Dr. Buteler, for joining us today.

Guest 01:32

Hi, and thanks for having me. I'm excited to tell you all about what we've been doing lately.

Amy 01:37

Yeah. So, in the other episodes that we worked with, with you, we were talking about the effects of microplastics on, just, foraging behavior of honey bees. And so, since then, you've published a paper called microplastics incorporated by honey bees from food are transferred to honey, wax and larva. So, now we're kind of taking a step into the colony to look at where these microplastics are being distributed throughout the colony. And so, can you just quickly remind us a little bit of background of the

work with that you've done with microplastics, and the connection between honey bees and microplastics in general?

Guest 02:12

Okay, yeah. So, let's go back a little bit and talk about microplastics. What, what were microplastics right? They're these, like, tiny fragments or fibers made from plastic that are created by the degradation and fragmentation of plastic products. And they are found in our water, in the air, and in the soil, but, pretty much everywhere. And I think since we last spoke, the latest news is that they have been found in human blood. So, it is a ubiquitous contaminant that we are living with. But research on microplastics is pretty recent, and not much is known about the health impact of this contaminant. We know that it does not kill us right away to eat microplastics. And we're actually eating and drinking quite a lot of them every day. But we need more chronic toxicity studies, and we need to understand more what is the health impact of these microplastics, and since we are entomologists and beekeepers, we studied, the goal of our project was to study the impact of these microplastics on honey bees, right? And first, I want to thank our funding agency, Eva Crane Trust from the UK, they made this project possible. And what we wanted to do was, like I said, determine the impact of these microplastic fibers, what happens to bee hives when they're exposed to these fibers, which are, I mean, it's not such an artificial study, right, because we know that honey bees are being exposed and are taking up microfibers from the air when they fly, and they're drinking them in their water, nectar can also be contaminated. So, we wanted to do a control study with whole hives and see what happens, right, after some chronic exposure. So, we fed our beehives, like, for a month, and after that, we looked at brood production, honey production, mortality to understand what is going on with microplastics and bees. And there have been -- why do we want to do this with whole hives, right? Because there is some previous research that has been done in the lab where they found that mortality from exposure to microplastics is pretty low. So, it does not cause significant mortality, but it has some sublethal effects on bees because there's changes in the microbiome diversity, turns on, turns on some immunity genes, oxidative stress genes. And there are also some subtle effects that have been seen in the lab on the behavior. So we wanted to see how this translated into performance of hives, right? And that's why we did this study.

Jamie 05:21

So, it's interesting to me that you talk about microplastics being everywhere, you know, humans being exposed to them a lot through what we eat, and what we drink and breathing and things like that. And you just mentioned that honey bees can be exposed to them while out foraging, while drinking water. Could you, could you elaborate a little bit on this? I mean, what would be the source of microplastics that honey bees would be exposed to? I guess, if this stuff's just everywhere, that would have a lot of sources, but in my mind, I'm thinking, you know, bees are collecting nectar and pollen from flowers, would we expect it to be there? Bees are flying through the air, would we expect that exposure to be high? And what would their exposure levels be in water, things like that? So could you elaborate on this idea a little?

Guest 06:01

Okay. Yeah, that's a great question. What we've done study, our group as well as many other groups, monitoring the presence of microplastics in water and air. And like, like we've been saying, they're

everywhere. So, we find -- what we find, when you're asking about the source, what we find are mostly microfibers that are carried with wind currents and ocean currents. And we -- based on what we're finding and the types of plastics that we're finding in air and water, it seems as though the source of these microfibers are our clothes, textiles, like, like everything from the stains because when we look at what we find in the water and in the air, we find stains and materials that indicate a textile source. And we know that when you wash your clothes, which are mostly synthetic fibers, every time you wash a fleece or sweater, or whatever, it is releasing these microfibers into the water, and then from the water, and they're just carried everywhere, like with the wind and atmospheric currents. So, so the source of these microfibers are our clothes and plastic products that we use here on land. But then from there, they're carried to the water and into the soil. And so, like you were saying, when these are flying, these microfibers floating in the air, like get stuck into their hairs. And so, they carry them with them in their cuticle. But then also, since the microplastics are in the soil, the plants are taking them up, and you can find them in fruits. There, there are some reports of flowers and nectar being contaminated with microfibers. And so, to me, it is kind of obvious that honey bees are going to be incorporating them because they're going to be taking them, taking them up from the air, from the nectar, and then when they're drinking water, they're going to be ingesting them too. So, but, the interesting to me is the fibers that we're finding all indicate that it's so -- it's a lot of it is coming from our clothes. And these fibers are just flying everywhere.

Amy 08:46

And these are like tiny, tiny little fibers that you can't really see with the naked eye, right? Or can you see them? I don't know.

Guest 08:54

Well, they vary in size, right? Some of them are -- microplastic means that they're like less than five millimeters in size. That would be the definition of a microplastic. But what we see inside of the bees, you can, you can see, you have to see it with a microscope. But they come in all kinds of sizes.

Amy 09:13

Yeah. So, the last time we had you on, again, we were talking about microplastics and foraging behavior. And this time, we're talking about the microplastics within the colonies. So, I'm wondering, you know, I, we had breakfast this morning, Jamie and I and the the entire lab, and we were talking about methodology of different research projects. And so, I'm kind of in the mindset of just wondering, you know, how do you conduct a research project looking at microplastics within a colony? I mean, it just seems like so much work. So, you know, what methods do you use to be able to fulfill this, this research project?

Guest 09:49

Well, we set up an apiary with with several beehives. We wanted to do, yeah, we wanted to see the effect on whole hives and what happened if there was any toxic effects on the bees ingesting these microfibers. And at the same time, we wanted to see what was, like, the route of the plastic inside the hive. What would the bees do with it, right, once they -- would it pass to the honey, or would they feed it to the larvae and stuff like that. So, so what we did was, during, for one month, we fed our beehives

with syrup. We placed the syrup inside the hive, and we treated that syrup with these microfibers. We used 50 milligrams of microfibers per liter of syrup every two days. And we chose this concentration because it is very similar to what the World Health Organization reports as that high-end range of the contamination that is found in drinking water in the world. So, depending on where you sample water in the world, you can find this type of concentration. And there's two types of microplastics. You could have, like, fragments, small fragments of plastics, or you can have small fibers. We used fibers because that's mainly what you find in the, in the water and in the air. So that's what the bees are most exposed to, right? The fibers. So, we fed them with this syrup treated with these microfibers for one month. And then we looked at brood production and size of the colony, honey production, and we compared control versus treated hives. It sounds simple, right? And what we found interesting, interestingly, was that we didn't see any difference in all these variables among, between treated and controlled hives.

Jamie 12:03

Great. So you have a really good design where you've got colonies that are being fed sugar syrup that contain microfibers, and colonies that are fed sugar syrup that doesn't contain this. And you're able to compare this number of parameters that you measured between the two colonies. You mentioned, for example, brood production, and things like that. So, so I'm dying to know, what did you find? What were the results from this study?

Guest 12:25

Well, so, after one month, like I said, we looked at the colonies. And we took samples from, we took wax samples, we took honey samples, and larvae samples and bee samples, and we looked at, we looked at them under the scope. And to detect these fibers that we fed them with, right, these fibers, they had a very particular blue color. So, we could distinguish them very clearly. And we didn't find any of these fibers in the control hives. So, that was good. And we found a lot of these fibers in the treated, in all the treated samples. So, what we found was that there wasn't any difference between the treated and control hives with respect to production, honey production, or colony size. So, we didn't see any major effect from ingestion of these fibers for a whole month. But, we found those fibers everywhere in the hive. So, we showed that honey bees were ingesting these fibers, they were feeding them to their larvae, they were putting them in the honey and in the wax as well. So, I guess, what it is telling us is that honey bees can incorporate these microfibers from the environment, and they will accumulate them in their hives. Especially, I think that this is an interesting result because there had been papers published where they had found contamination of honey with microfibers, but the authors couldn't really know whether that contamination in honey was from the honey extraction process or from textiles from the beekeeper. I think what this research study tells us is that, I mean, kind of like demonstrates that bees can ingest them and be a disperser of this contaminant that is in the environment. They can take them, incorporate it and accumulate it in their larvae and in their hive matrices.

Amy 14:35

That's so interesting. I almost feel like, I mean, I don't know if you looked at the honey bee feces, but I wonder if it just came, you know, went in, was distributed, came out and then was done. You know, it's

really interesting to, to think about that. I mean, are they just like spreading it around? And so, if there are no effects, that would be great, right? Ideally.

Guest 14:55

That's a great point that you bring out because we didn't look at faeces in this particular study, but when we did some other preliminary laboratory work, we did find the, these ingested microfibers in the faeces. And, and, and so they are dispersing to the environment, right? So, they're, they're ingesting it, they can, they're going to be ingesting the one that these fibers that we're feeding them with, and then they're going to be excreting them somewhere out there. But, I guess the good news is that, because a lot of it just goes through their intestine, then honey remained kind of like a safe food because it's not accumulating that much in honey. Some of it, they are putting it in the wax, some of it, they're feeding to the larvae, and it is going into the honey, but a lot of it is being excreted somewhere else, because we're not seeing huge amounts in the honey. Actually, the quantity of microfibers that we found in the honey are comparable to what is out there in food we're eating in general, right? Like we were -- we go back to microplastics are everywhere. Honey is not particularly a food that contains a lot of it. Even in this experiment where we were feeding them with, kind of like, a high amount of them, we didn't see a lot of it go into the honey.

Jamie 16:34

So that gives me a comment and a question. So the first comment is, I find it really interesting that you didn't find a difference in the number of microfibers in the treated colonies' honey and in the control colonies' honey that even them taking in microfibers directly, somehow it ended up somewhere else rather than the honey. And that leads to my question, which is of all the matrices you tested in the hive, where did it show up most?

Guest 17:01

Great question. We did find it in the honey and in the larvae. So, that was, I mean, it's showing that when they ingest it, they will they will put it in the honey somehow. But most of it was in the wax. And I think that has to do with the fact that wax is less polar. And so plastics have greater affinity to the wax, but accumulated more in the wax than in the honey.

Amy 17:30

So I get the honor of asking you the million dollar question. And so this is really what does this mean for beekeepers? Why should beekeepers care? What does this have to do with beekeepers? And how can beekeepers apply this information?

Guest 17:44

Great question. So I think what the research tells us is that microplastics are not killing our bees right away. Right? We don't have -- it's not that worrisome, we see that, at least when we when we did this experiment with healthy bees, we did not see a huge impact on their health. However, the research conducted in the laboratory, you know, like individual research conducted on individual bees in a more controlled environment showed that it has some sublethal effects and that it may be stressing our bees and making them more susceptible to other diseases. So I think we can say that microplastics are

another stressor to our bees that add up to everything else that goes on in the world, such as, you know, viruses, Varroa and other stuff that we have to deal with. And it makes it really important for us to keep healthy and strong bees to help them, you know, deal with this contaminant. So I guess that's, that's what it means for us beekeepers for now.

Amy 19:06

So just as a follow up, so what does that mean as far as recommendations for beekeepers?

Guest 19:11

Well, what I would, what I would tell beekeepers, and pretty much just people in general, is to be aware of using things, products that release microplastic fibers into the environment. For example, I know some beekeepers are using microfiber towels or microfiber cloths inside the hives as a management tool for the small hive beetle. Well, I would be very cautious about putting any materials such as this because our results suggest that then those microfiber plastics would be incorporated into the hive and into the honey, and, you know, it might affect bee health and honey production, so, or honey quality. So, that's the kind of thing that, that I would start to be aware, like, whenever we go and buy something, think about what it is made off and if it's going to be releasing plastic fragments or microplastics into the environment.

Jamie 20:25

So, that leads me to a perfect follow up question with based on what you just said, what does all this mean for the consumer? So you had some recommendations for beekeepers there, but what does all this mean to the consumer?

Guest 20:36

Well, for us consumers, we could try and reduce the things that we buy made of plastic, especially, like single-use plastics, right? If we can reduce our single plastic use, then we are going to be reducing plastic pollution and microplastic pollution. And things to look out also would be, like, microplastics present in cosmetics or hygiene products, for example. Anything you buy, you could look at the ingredients, and if you see polyethylene, polyamid, polypropylene, that name, 'poly' indicates plastic composition. So, you could check the ingredients of things you buy, and make sure they don't contain microplastics, those would be just -- those would be microplastics put in there for a reason. And then you have microplastics that are created from the degradation of other plastic products. And we can we can reduce that just by reducing the amount of plastics that we buy and use, try to avoid single-use plastics, that would be, at least that's what, what I'm trying to do. And the power that we have as consumers, right, choose certain products wisely.

Amy 22:02

Absolutely. So, I guess just being aware of the products that we choose, right? So, just to clarify, so, when I look at the ingredient list of whatever I'm purchasing, anything that has 'poly' blank, right? Poly something. That is, that's what the microplastics mean, right?

Guest 22:19

Yes, exactly. And generally would be polyethylene, or polyamid, or polypropylene, those are the most common.

Amy 22:26

Cool, I learned something new today. Thanks for that.

Guest 22:29

Some of this is just that we don't know yet. I don't know. Like, this is, like, kind of like new information that is coming out. Very few years ago, we realized that there are microplastics in our drinking water. So, some of us don't know about it.

Amy 22:49

Right. So, it feels like it's a new field, and there's a lot of potential just moving forward with some of the research projects that you have related to microplastics. Was there anything else that you wanted to share, just in regard of your research this study, in particular, the lab or, or just future research?

Guest 23:09

Well, future research, I think that with regards to bees, we could look into, maybe, effects on behavior, like I said. So far, like, research has been done in the lab and it doesn't indicate a huge effect. But like, again, there are study effects, sublethal effects that could translate into, maybe, an impaired behavior of the bees, right? That coupled with, I don't know, other stressors might lead to -- so the interaction between other stressors and microplastics would be interesting to know what happens when these stressors interact, and if they are, what are the effects on foraging behavior or flight capacities and stuff like that? I think that's what we're gonna be looking into next.

Amy 24:05

Well, I'm excited to see what you come out with in the future. And, you know, hopefully, we can have you back on to share the results of your research. So, I thought that was pretty interesting, Jamie. I feel like the microplastic thing is still, you know, as she mentioned, still pretty new, right? Just this world of microplastics and what that means and the impacts on us and also the bees.

Jamie 24:49

Yeah, Amy. So, it's funny because I'm, I'm kind of a prolific reader of news. I don't know why, it's like, I don't read books, but I read news. And about a year ago, year and a half ago, I read an article on microplastics, maybe it's two years now. But I remember being -- having this topic newly introduced to me through a news article, and I was reading it, thinking, "Oh, this is pretty interesting. It's no surprise, I guess that this stuff's everywhere." And then, again, whether or not it was true, this was in the story that they made the point that the average human consumes over a credit card's worth of plastic every year. So, if you think about, like, what she was saying is you've got these microplastic fibers or these contaminants in everything, drinking water, our food, you know, floating through the air, all that stuff. It's, you know, we get exposed to this, and bees get exposed to this. So, it's, it's an obvious next step to try to determine the impacts of this exposure on, essentially, anything that's alive, right? How do these things impact anything, including us?

Amy 25:49

Yeah, I mean, so one question I had, I guess, you know, when she was talking about finding the microplastics in wax, I'm wondering, you know, the same thing has kind of happened as far as pesticide work goes, right? And so, the pesticides have been found in wax, and is that just -- can, I guess, can you just describe like wax and why it's maybe all of these things are kind of just attracted to it?

Jamie 26:11

Yeah, it's a really interesting thing, actually, to think about. So, beeswax, of course, is a lipid, right? It's a waxy, fatty substance. And so things that are lipophilic, which simply means wax loving, are attracted to that. So, a number of compounds that are used to treat pests in the world out there that bees are getting exposed to are lipophilic compounds. So, when they get into the hive, they'll be absorbed into the wax. So the big question that I've always had, so, you get this buildup of wax, so it's not, it's not a surprise, I don't think, to me, that these microplastics, these microfibers were showing up in higher amounts in wax than they were in honey and larvae and bees, is that suggests right, the plastics are attracted to this wax, which is not a huge, I guess, chemistry surprise, after all. But, the question is, do compounds that show up in wax impact bees in any way downstream? Or does wax essentially sequester these compounds away from the bees? So, a lot of people panic when they see high residue levels of compounds in wax go look at all this exposure that bees have. But the question is, if something's lipophilic, why would it leave wax, which is where it wants to be, to go to a bee, which is where it maybe doesn't want to be. And so, the fact that she's finding a lot of these microfibers in wax just kind of reinforces this idea that wax may be an important toxic handling device in the hive. Maybe wax has a function beyond just storing honey or a place to store pollen, or rear your young. Maybe it's important in the sequestration of compounds to keep them unavailable for bees. And so, maybe when you see this stuff building up in wax, it's part of mother nature's ways of trying to keep these things from bees having exposure to it.

Amy 28:17

Yeah, the other thing I thought that was kind of interesting that came up was just the, and maybe I didn't understand it correctly, but just the idea that the microplastics really didn't make a difference. Right? Did it, did it not do harm? Did it do harm? What are, what are the effects?

Jamie 28:32

I think that is a very key thing that she kept talking about and that I want to emphasize at this point. It's really easy when we talk about things for people, right, to get freaked out about what we're talking about and think that we need to radically change what we do. But, I will say that this microplastic thing is relatively new. In the bee world, it's very new, right? There's not a whole, whole lot of labs that are looking at this and Micaela was talking very specifically, like, well, we measured this and didn't see an effect, we measured this and we didn't see an effect, and we measure that and we didn't see an effect, but we did find it a lot of places in the hive. Right? And that was kind of the take home message, and she had mentioned some lab-based essays from other labs where they were finding potential impacts on behavior and stuff. So, I would caution everyone listening to us from being worried that this is something that you need to address, like, today or even tomorrow. What I would say is there's a lot

more research that needs to happen to look at the impacts of these things. And she kept mentioning, right, the potential synergistic impacts. Maybe, maybe the microplastics don't hurt the bees directly, but since they have a lot of it in their system, now they're affected by X, Y, and Z downstream. But I would say, you know, at this point, a lot of that's supposition and that's the kind of stuff that we need to figure out through research. So I was listening to this whole thing thinking that it's that it's a lot less clear than, say, some of the pesticide researches where we know if they get exposed to this compound, there will be downstream impacts if they also get exposed to X, Y, and Z. So I think that's one of the take home messages. It's this, we wanted to have her on to talk about the science of this topic, not necessarily concern beekeepers that their bees are dying as a result of exposure to microplastics. We really want them to be on the forefront of understanding that you might be hearing more about this in the future, and we wanted to give you a basis for understanding it at this point and know a bit more, so that as this topic comes up, you'll be ready to, kind of, think about it in a manner. Think about it from a standpoint that you've, this is not the first time you've heard it, that you're coming at it from a, from a familiarity standpoint.

Amy 30:35

Yeah, absolutely. I mean, that's kind of just the beauty of research, right? There's always something to focus on and the next question, so it'll be interesting to see what happens in the field of honey bees of microplastics moving forward.

Stump The Chump 30:52

It's everybody's favorite game show, Stump the Chump.

Amy 31:02

Welcome back to the question and answer time, Jamie. We just got back from the American Beekeeping Federation. We were there about a month ago, in January, and we did a live Two Bees in a Podcast Q&A segment. And so, some of the questions that we have today are from the American Beekeeping Federation. Some of the beekeepers there had a little question box that they could write their questions in, so, we're, we're still just out answering all the questions that we received. And so, we've got three questions.

Jamie 31:33

We had a lot, didn't we?

Amy 31:34

We had a lot. Yes, we did.

Jamie 31:36

Some we were able to answer live, and you guys, if you're listening to us now, you probably already heard those on previous podcasts, because we play the live versions on that, but here are some of those leftover questions we couldn't get to live, but we're happy to do now.

Amy 31:47

So, the first question is what has a lab done that we can be excited about in terms of help for the bees? What have you done?

Jamie 31:57

One of my favorite questions that I get from people is like, "Jamie, what research are you doing?" And they always expect it to kind of be a short answer, but I always tell them, "Hey, look, we've got over 30 active research projects at any given time." So, it's like a two hour answer. And in this particular case, the question could really include research we're doing or have done, extension we are doing or have done, and teaching we are doing, have done. So, I'm going to blow through this as quickly as possible and make the point that you can find all of this and a lot, lot more on our lab website Ufhoneybee.com. So, just very quickly, from the research perspective, some of the things that we've been working on most recently is we've been doing a lot of work on pollen sub research, as well as publishing a review on pollen subs and how they have been shown to impact honey bee colonies, both positively and negatively. We do a lot of work with Varroa Integrated Pest Management, including looking for new compounds to control Varroa. We've also done a lot, a lot of work, looking at the impacts of pesticides on bees, and other things, such as controlling Nosema, controlling small hive beetles, etc. So, all of that kind of falls under the honey bee husbandry category. And the best way to find out about our research is to go to our website and click on the research tab, and we will have our refereed manuscripts or publications listed by year. And so if you just click on the publications tab, you'll be able to see all the refereed manuscripts we produce every year. Usually, we're somewhere in that, kind of, 10 to 20 range. And you'll be able to see all the types of projects that we've done, kind of, most recently, and they would be a really good indicator on what we've been doing for beekeepers. From the Extension perspective, Amy, I'm kind of speaking on your behalf since you're the Extension professional here in the lab. But we've got an online master beekeeper program. Of course, we've got this podcast that we're doing now, we've got our bee learning short courses that are online, we have a lot of online materials. And, of course, you and I travel all over the US and world giving talks about bees, beekeeping, all kinds of demonstrations, workshops, documents, answer emails, videos, just all of these things that we try to do to be in the face and walk with and partner with beekeepers to help the health of their colonies. And then finally, from a teaching perspective, and I'm trying not to over brag here, but we probably have the largest teaching program for university students, maybe even on planet Earth. Dr. Cameron Jack teaches eight different courses on honey bees and beekeeping. Basically, beekeeping 101, beekeeping 102, honey bee biology, practical beekeeping, using honey bees as a research model to teach, research, commercial beekeeping, commercial beekeeping internship that Cameron's developing now. And then we have two additional study abroad courses, one on Apis diversity, as well as Asian beekeeping, and both of those take place in Thailand. And actually, I've been counting with my fingers as I've said all that and that's actually nine courses on beekeeping and not just eight, so from the research, extension and teaching perspective, we do as much as we can to help beekeepers improve their practices and ultimately, improve the sustainability of beekeeping, not just here in Florida, but around the US and around the world. So, we're very focused on that. And you can see all of that at our website and a lot more as well as by following us on our social media platforms, which you can find us @Ufhoneybeelab on Twitter, Instagram, and Facebook. And those are great ways to keep up with what we've, what we've been doing and what we will continue to do on behalf of beekeepers.

Amy 35:29

Jeez, I feel like, just that list, I feel like you just need to take a huge deep breath in.

Jamie 35:35

I went fast before, we started this, before we started recording this, I told you, well, there's a lot to report, but I'm going to breeze through it and point people to the website. So, hopefully, folks out there, you'll see that we've been active and you go to our website to see what we've been doing. We're not the only ones. You know, the question was, for our labs, specifically. There's lots of bee labs around the world, and they do great work as well. Since the question was about our lab, specifically, I just thought I'd highlight kind of what we do.

Amy 36:00

So, I wanted to highlight one other thing that you didn't mention, and it is that we started the adopt-a-hive program. And so we take donations from beekeepers from all over, and we have three different levels to the program. And we have adopt-a-bee, adopt-a-queen and adopt-a-hive. And I know, Jamie, that this past year was our first time doing it, but for those who adopt a queen and who adopt a hive, those individuals got to come to our lab to go through all the things that the lab has done to help the bees, and I know that we've had beekeepers around the state who donated came to that event. And they were like, "We had no idea." You know, and these are people that we've been working with every single year. And so it, you know, this is kind of a call and invitation to those who want to support our lab and see some of the research that we have going on here in Gainesville as well. Alright, so for the second question that we have. This is actually, this was from an email that we received recently, and the beekeeper was wondering about dipping beehives in hot wax or paraffin. And so, I, I personally know a lot of commercial beekeepers that do this. But the individual was asking, specifically, if there is a service for this, or whether beekeepers just do this on their own.

Jamie 37:19

Yeah, so a little bit about this. Beekeepers, broadly, now this is not universally true and exclusively true, but beekeepers broadly use wood as the basis of their hive pieces. They, yes, there's Styrofoam, yes, there's plastic. But most of the beehives I see are, are made of wood. And one of the things that wood does is it ultimately succumbs to environmental pressures. In other words, it rots, right? In some places, wooden beekeeping equipment last longer than in other places. Here in Florida, as an example, the hot, humid climate, especially all the rainfall we get in summer months, just absolutely gobbles up our woodenware. Our woodenware, if you don't protect it in some ways, doomed in five years, maybe 10 years, and that's if you're painting it well. So, a lot of beekeepers want to protect their investment. And so, they'll do things like treat their wood, but there's some questions about the toxicity of those treatments to bees, you know, some of these treatments, some of them were -- they're more like copper naphthenate-based, copper tops, and other products. Some of these things are used for beekeeping equipment, where it will either be painted onto the wood or the wood will be dipped in it. But some beekeepers are a little anxious about doing that, not knowing exactly the effect that these kinds of copper-based products might have on their bees, which has pushed a lot of them to just hot wax dip their hives. As far as I know, there is no single professional service that will offer this. But, the

idea is that you build your boxes, and then you dip them in wax, and that beeswax or that paraffin will then be the wood preservative to keep that wood from rotting so quickly and prolong the life of that woodenware. I'm not aware of any research on this topic. It's certainly an interesting thing. And I know a lot of beekeepers who do it, and they do it to avoid, again, the collapse of the woodenware after a short period of time. And I would say that it's, probably, my guess, and I don't want you necessarily to run out and do it based on this comment, but it is probably safe for bees, right? If you're dipping it in beeswax, it should be safe for bees. But, I would say since there's not much known about the topic, I don't know if it's actually, actually economically advantageous even though a lot of beekeepers do it. But the question that was asked is, is there a service for beekeepers to do this or do it on their own? All the beekeepers I know do this on their own. And I think that there needs to be more research into this topic, but it's not one of those practices that is otherwise alarming to me on the front end. And I just, I can't really envision a scenario at hurting bees, but I also would want to only do it if it actually had an economic benefit, and I think that's what we need to know more about in the future.

Amy 39:59

All right. So, for the last question that we have, this question was asked at the American Beekeeping Federation. And the question is where can I find more information about Dr. Martha Gilliam and her life, bio and work? The question specifically asked, you know, who is continuing her work and research?

Jamie 40:18

That's an interesting question. I, first of all, never been asked that question. And I've actually never had anyone verbally reference Martha's work. So, Martha was a USDA scientist at the Carl Hayden Bee Research Center in Tucson, Arizona. And she's listed on their website as a microbiologist, and she did a lot of great work a few decades ago, through the 80s and 90s and some other years, and I don't have before me her complete academic history. But the academic history that I'm aware of is her work at the USDA. In her work as a microbiologist, she did a lot of work with the organisms, right, that impact honey bees, the small organisms that impact honey bees, including chalk brood and other things. She also looked at beneficial microbes. And what I did in preparation to be able to answer this question well, is I simply Googled, Martha Gilliam honey bee. And when I did that, one of the very first things that came up was Martha Gilliam's research works USDA, which is what you can find on ResearchGate. And I clicked on that. And it shows, I don't know if it's a complete list, but it's a really thick list of a lot of her work from her years at the USDA. For example, the first papers on chalk brood, the second's on enzymes and the honey bee midgut, then chalk brood, then chalk brood that enzymes that impact chalk brood, that, just all kinds of things. You'll see, if you look at these research works listed at ResearchGate, that you'll find a lot of other things. And I even see an independent individual created a Gilliam research archive on a separate website, which you can again find by just Googling her name and, and looking at those research works. So, just looking at the types of things that Martha did, I would argue a lot of scientists have continued this work. When I think about the honey bee microbiome, Nancy Moran, for example, has done a tremendous amount of work and other labs around the world, for that matter, have done a lot of work. I don't see as much work on things like chalk brood, because a lot of bee scientists kind of consider it a secondary issue now, but if you just see the types of things that Martha has done, look at those two lists that you can easily find by Googling and getting to ResearchGate, you can go down and look at the topics and the titles of her papers, and then you can

go to Google Scholar and search, you know, in this case, chalk brood research, and it will list for you a ton of papers on that topic, and you'll be able to do a little bit of sleuthing to figure out, hey, this, these are the types of things that Martha published. Now let me find who's doing this type of work now. And it's pretty simple sleuthing to figure it out. And you'll notice that Martha had laid a lot of groundwork through her research that's been followed up upon by a lot of bee scientists around the world. So, a very impactful researcher, and a really great thoughtful question to come from one of our listeners.

Amy 43:09

Absolutely. I'm looking at the ResearchGate right now. And it, you know, one of her publications is from 1972. And that, that was before I was born.

Jamie 43:18

Me too, Amy. Me too.

Amy 43:20

Oh really? Ok.

Jamie 43:22

It was. It was five years before I was born, in fact.

Amy 43:25

That's so funny. Well, it looks like, yeah, again, it looks like she did a lot of very impactful research. And it's just, it's really amazing to see, like, all the different researchers, and I've said this before, but it's always fun to know that there are just so many different avenues and so many different people that come together, you know, for the common cause of just understanding honey bees, so that we can we can promote the health of honey bees around the world today. So, that, again, like you mentioned, that was a very thoughtful question. And, you know, I learned a couple of new things, can't wait to go into ResearchGate and read more of her publications.

Jamie 43:59

Well, Amy, let me give the listeners just one more quick cheat. If they find a Martha Gilliam publication, usually, you will be able to route yourself, very quickly, to the journal website for that publication. So, for example, if she published something in Journal of Apicultural Research, you can go to Journal Apicultural Research's website, find that publication, and the reason I'm pointing this out is most journals at the article website will list papers that have cited the paper you're looking at, which allows you to say, "Hey, Martha published this. Who are all the other authors that cited this?" And you can then see all the papers that were built on the back of that one paper, just by going to the journal website for that paper. It's a really neat source that they have that allows you to see who cited whom, and it allows you to track and say, "Hey, where has Martha's work been cited? How has it been used? And who were the individuals using it?"

Amy 45:02



You know what, Jamie? I think we're gonna have to do an episode to discuss academia and citations, and, you know, what all that is. I think we could talk about that for a segment.

Jamie 45:12

I could do that for sure. For sure, Amy, it's a good idea.

Serra Sowers 45:17

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.