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SPEAKERS

Amy, Stump The Chump, Jamie, 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. Hello, everyone, and welcome to another episode of Two Bees in a Podcast. Today, we are joined by Dr. Kit Prendergast who received her PhD from Curtin University in Australia. She'll be joining us talking about the impacts of introduced honey bees on the Australian bee-flower network, and in our Five Minute Management we'll be talking about processing honey, and we'll end today's episode with our question and answer segment.

Amy 01:25
Hi, everyone, welcome to this segment of Two Bees in a Podcast. Today, we have Dr. Kit Prendergast, who is a native bee scientist, conservation biologist and zoologist and a recent graduate from Curtin University. She actually just published a paper a couple of months ago. We're recording this in mid-August of 2021. And she recently published a paper on the impacts of introduced European honey bees on Australian bee-flower network properties. So, Kit, before we get into that, before we get into your research, can you go ahead and tell our audience a little bit about yourself, your history and how you got interested in working with honey bees?

Guest 02:08
So I'm a zoologist and conservation biologist. I did degrees in those two biological fields. I love science, and I love biology. And so I definitely wanted to keep on doing science. And I did my honors project on horse behavior because ever since I was a little girl, I loved horses. And then after I finished that, I realized that working with horses offers very limited opportunities. They're big animals, you can't get a

large sample size, and I love horses, but it doesn't offer much scope. And I also wanted to really do something that made a difference to the ecosystems and nature and biodiversity. I was thinking of all these PhD projects, and one day, I went to this talk as part of a WA Naturals Club. WA stands for Australia, where I'm from. And there was this older gentleman, he was showing some amazing macro photos of native bees. And I was like, "Wow, these are so cool. I did not realize that we had so many native bees." And I sort of became fascinated with them. And I started reading up more about them. And I was then like, there's a lot of research into bee conservation in agricultural areas, but how about cities? They're a rapidly expanding urban footprint, and there's a massive potential, though, to help native bees in cities because you're less constrained by having to produce a particular amount of crop yield. And there's lots of opportunities to create bee friendly habitat, but also with many cities, we still have remnant vegetation, how important is this remnant vegetation with gardens? And then I started looking at, potentially, the interactions between introduced species and the native bees, including introduced plants, but also introduced honey bees. And here in Australia, the introduced European honey bee Apis mellifera is a super abundant species. It's been here about 200 years, and it's doing very, very well in Australia because we don't have Varroa mite and deformed wing virus. We also have amazing honey producing trees. So then I started thinking about, well how about these interactions between honey bees and native bees? And then it just turned into this enormous PhD project. And since then I've become absolutely hooked on native bees, and I absolutely adore them, and they're a massive part of my identity now. So, yeah, that's my history.

Jamie 05:16
That's a really neat way to get into working with bees. I've been to Australia a couple times myself, and you're right, you guys really do have some fantastic native bee species there. And so that leads to the type of research that you are doing where you're looking at the impacts of introduced European honey bees on Australian bee-flower networks. Okay. So we've got a broad audience of beekeepers and others from around the world. Before you talk about your research, tell us a little bit about what bee-flower networks are in the first place, because you looked at European honey bee impact on them, so what are they?

Guest 05:51
So they're basically the interactions between bees and flowers. I looked at two aspects, really, both the impacts of honey bees on native bee species and abundance and bees of particular ecological guilds, and then I also looked at the network. So these interactions between bees and plants, and they interact within networks. You can depict this graphically, and it shows which species of plants were visited by which species of bees, which bees share the same flower preferences and which flowers share the same bee pollinators. And you can also calculate all these metrics from these networks, looking at how connected they are or how robust they are to, say, an extinction of a plant or a pollinator. Also, the roles of the particular bee tax in these networks, are they important connectors? Do they have particular roles? Are they more dependent on the plants or are the plants more dependent on the bees? So yeah, some really interesting ecological analyses of these networks that you can look at. But yeah, I actually published two complementary papers. The other one was in the biological journal of the Linnean Society, and it was called interactions between the introduced European honey bee and native bees in

urban areas varies by year, habitat type and native bee guilds. So there are two sort of sides of looking at the question of honey bee competition, looking at the honey bee competition on native bees, and then their role in the pollinator networks. And we call it bee-flower networks because people often assume that everything that visits a flower is a pollinator, but it's actually very hard to demonstrate an insect must visit a flower, get pollen deposit on its body, fly to another flower of the same species, and then deposit the pollen and the pollen has to then result in fertilization. So not everything that visits flowers are pollinators. So to be super accurate, I use bee-flower rather than plant pollinator networks.

Jamie 08:19
So let me ask just a quick follow-up to that before we move on. So one of the things that I have absolutely --and I'm so appreciative of the type of work that you're doing. This is the kind of stuff that I'd really never heard of 15 years ago. I know that there were some folks kind of doing a little bit of work here and there but there's kind of been an explosion of this type of work just like what you're talking about where there's folks looking at how bee and plant networks interact, which plants are visited by what bees, all of this is fantastic and great. One of the words that you used throughout though was bee guild. What is a guild, so that our listeners kind of know what you are specifically looking at in that regard?

Guest 09:01
So a guild is a group of species that share particular behaviors or life history strategies. So when I looked at guilds, for example, I looked at nesting gills. We've got below ground nesting bees and above ground nesting bees. And then I also looked at these particular body sizes, so large body bees, medium body bees and small body bees, and then other guilds that we can look at is how specialized a bee is in its floral preferences. So we call this lecti, and we've got oligolecty bees, which means they're specialists, they're very fussy, and like me, and they'll only visit flowers in a particular family or even in a particular genus, whereas the other bees are polylectic, and so they will visit flowers across a diverse range of plants in different families. An example of a super polylectic bee is the introduced European honey bee, which visits all types of plants from all different families. Whereas, for example, one of the species that is in my part of Australia, called Euhesma tubulifera, it's so specialized, it will only visit on flowers in the plant genus Calothamnus. And it's evolved specialized mouth parts to be able to feed on them, so the oligolectic bees often have these special adaptations as well for the flowers, and these guilds of bees, if you removed these flowers, then they can't exist.

Amy 09:13
So I feel like every time I'm talking to someone who has done research on native bees versus European honey bees, I get a little jealous because I'm like, they get to hang out with plants and bees all day, like they get to sit there in the field and look at different types of insects. You can tell me if that's what you do or not. But I'm interested in knowing the methods of your research and what that looked like. I know that when I go outside, I look at a bee and I try to follow one. And it's hard after a couple of seconds, right? They just fly away, then they come back. And so can you tell us a little bit more specifics about your research project and the methodology and then some of the findings that you had?

Guest 11:27
Yeah, so it sort of is like that. I just get to go outside. My field seasons are, obviously, when it's sunny and warm, because that's when the bees are out. So it's pretty sweet. And I stalk flowers. I stare at them very intently. And it's actually quite exhausting, because you have to be switched on all the time. Honey bees are quite slow and bumbly. Our native bees are so fast. I'm actually really, really jealous of people that get to study bumble bees, because they just bumble around. Native bees in Australia are just super quick. And so I, for the plant pollinating networks, I stared at flowering plants, and I had a notebook and a pencil and I was jotting down little tabulations of the native bees and what genus visited them. And then when I was looking at the impact of honey bees on the native bees themselves, I collected the bees with a sweet net. And then, I had to look at which species they were and to identify the species. The differences are things like shape of wing veins. So you can't do that by observation alone. And our native bees in Australia, lots of them are really tiny, like some are just three to four millimeters long. So yeah, it's impossible to ID them just by looking at them. So you have to collect them and look at them under a microscope. And then, I was interested in how body size influenced competition, so I had to measure, it's called the intertegular distance, so it's the distance between the wing bases to get the body size of the bees, and so, yeah, it's very involved. But I think it's the best job in the world, like, just going out in nature at 14 sites. Seven of them were bushland remnants, and for anyone that's not in Australia bushland, we call natural habitat "the bush" in Australia. I don't know why. It's just called the bush. And then seven residential gardens or like home gardens, and then more recently, outside of my PhD research, I've been serving forest habitats and other bush habitats, and some urban bushland remnants as well. So yeah, it's a really, really neat occupation.

Amy 14:09
That's awesome. So with the residential gardens, did you work with homeowners that had pollinator gardens? Or, how did you kind of recruit the plots that you had for the residential gardens?

Guest 14:21
Yeah, so I wanted to make them as representative of general gardens, so I basically went in blind. I didn't want to specifically choose any gardens that might be unrepresentative of general gardens. So I just put out a thing on social media, Facebook garden groups, and I was like, "I'm doing a study on bees in urban areas. Is anyone interested in having me survey their garden?" Then, from that pool of people that said that they were keen for me to serve in their garden, I had to select sites. So before I even went to the sites again, so I didn't bias it, I just looked at where my bushland sites were, and where these other sites were, and made sure that they weren't interspersed. So there wasn't any sort of like, clustering of sites, which might confound any patterns. Yeah, so that's how I did it.

Amy 15:23
That's so cool. I love having the citizens help with research, whether that's volunteering, or volunteering their space. I think it's really important to know that we -- social media is such a blessing and a curse, right? And so I love that you were able to just blast that out on social media to help find sites.

Jamie 15:44

So, Kit, I've had to do a lot of that type of work before. It's very difficult, right? You're out all day, you're working, you're trying to ID these bees, you're sweet netting, and you're having to take some back to the field. I mean, it can be difficult, but also rewarding work. So I'm just curious, what are some of the key findings that you've made from your research? You said you had two refereed manuscripts that came out relatively recently describing the work. Could you tell me a little bit about some of the main things that you found through all that stuff, through all of that effort?

Guest 16:11
Sure. So, just on the research on honey bee impacts, I found that looking at how they impact native bees, they can have an impact on native bees, so they're not benign, but it's also not all species at all times in all places. And that makes sense. If it was, we probably wouldn't have any native bees left. So I found, firstly, if you just take a really broad brush approach and go, are the number of honey bees related to the number of native bees, I found there was no association. But then I looked at it, looking at the the ecological traits of the bees, of those guilds, and I firstly found that species that were were bigger bodied, they did tend to have negative associations with higher abundances of honey bees. And this makes sense, because larger body bees, they need more food, they need more energy. So they're the ones that are going to suffer when the honey bees take more of the nectar and pollen resources, and there's not enough left to support bigger populations of these larger body bees. Then I also found that using these plant pollinator networks that I constructed, the bees that had a high overlap with the honey bees in the flowers that they preferred, they also were at lower abundances. And again, that makes sense. If those species forage on different things, then there's going to be no competition. But if they both want to forage on the same thing, that's when competition will occur. I also found that when I looked at how many species of native bees there were in relation to honey bee abundance, it varied between years a lot. So I did the study over two years. And in one of the years, there was a positive association, which means that the factors that influenced honey bees also influenced native bees, they responded to the same things. But then in the other year, there was a significant negative association, meaning that when there are more honey bees, there are fewer native bees species. And this could be due to that variation in the total amount of flowering resources in the environment. So, ecology is such a messy science, which is both brilliant, because I love the messiness of nature, but also can be quite challenging when people want black and white answers. And my results really found that yeah, it's actually a lot more nuanced. And another key finding I found was that you hear people say, "To save the bees just plant a very high diversity of flowers." I actually found that in gardens that had more flower species, competition was greater and there were fewer native bees. And I think that's because, especially in gardens, many of the plants that people plant are exotic plants. And honey bees are fine with exotic plants, and they need a diversity of plants, so you're giving honey bees a leg up over the native bees, of which some are quite specialized. And if you've got lots of different plant species, you're going to have few flowers of, maybe, the ones that these specialized native bees need. So that was a really interesting and surprising finding as well. And then looking at the pollination networks, I found that honey bees actually were very, very distinct compared with the native bees. They visited a lot more exotic plants. They had different like ecological roles. And importantly, they had -- actually, I was able to find impacts on the pollinator network properties, which were indicative of competition. For example, more honey bees meant that there was more overlap, that there was also what is called functional

complementarity, which means that the bees had to sort of divvy up resources more when they were more honey bees, which is, again, a sign that they were suffering from competition, and honey bees also increase the generalization of the networks, which makes sense because they visited a lot more flower species. And I even found that when there were more honey bees, the networks were actually less connected, which is not a good thing. It means that they're sort of more vulnerable to disruptions and less healthy. So yeah, all really interesting findings in showing that honeybees do have an important role in making honey. Most bees can't make honey in pollinating introduced crop species, but we have to be very upfront and honest that they are an introduced species, and they can negatively harm our native bees. So we really need to make sure that we focus on helping our native bees and regulating honey bee hives and making sure that they don't dominate our habitats.

Amy 21:35
You just said so many things that, in my mind, I have so many questions for you. I feel like we could sit down and talk for hours. That's exactly what you said about planting more diverse plants. That's what we always say. And so it's interesting that you're actually saying that if we're planting more plants, then that gives honey bees a leg up because they're more generalists. So, given what you found, you just gave us a whole list of things to talk about, but how can we support both honey bees and native bees? What does that look like? I mean, in a perfect world, what would that look like?

Guest 22:17
So we definitely need to focus on native bee friendly flowers, because honey bees visit lots of things. As I mentioned, some of our native bees are really specialized. So we need to focus on planting big patches of those native plants. There's still a diversity because we've got different native bees that specialize on different plants, but you're really focusing on big patches of the plants that the native bees need, because honey bees, they're going to do alright. In Australia, for example, the eucalyptus, that's like a major honey plant for the honey bees. It's also a major keystone species for our native bees, and many of them are specialized on it. So focusing on those and their mass blossoming, so there's mass blossoming resources and making sure that there's enough flowers because negative impacts from competition only occur, there's there's two conditions. One, the species have to overlap, so, if they forage on different things, so we need to make sure that we have plants as well, that maybe just the native based forage on, for example, buzz pollinated plants or honey bees can't perform buzz pollination, many other bees can. Outside of Australia, it's the Bombus, the bumble bees, but in Australia, we've got amegilla and some lipotriches, some lasioglossum, even some leioproctus. So they buzz pollinate. So, those flowers. Competition occurs when there is a limitation in resources. So if there's plenty of flowering resources, competition won't occur. But when there's a reduction in resources, such as through habitat loss for urbanization, or especially livestock agriculture, or when there's fewer resources due to drought or fires, then that's when competition is going to be quite intense.

Jamie 24:18
So, Kit, thanks. I mean, it's really cool research that you're doing, and I'm envious that you get to spend all that time in the field looking at native bees in these networks. Let me ask, and this is kind of the

grand conclusion because I've got this feeling that this research is going to continue to grow and grow and grow as others around the world do similar studies, where do you think all of this is headed? Right? What do you see folks doing with what you and others like you have produced in this ecological realm of studying impacts of honey bees and on native bees and plant pollinator networks and things like that?

Guest 24:55
Yeah. So it's really interesting to see the divide between public perception and in the science field. I created and I am in a Facebook group called Bees and the Burbs. It's now not just burbs, but when I started it was burbs because I was studying the suburbs. And I basically created it because there were so many people, and I was guilty of it too, that didn't realize that we had all these native bees and didn't realize that honey bees are not declining or threatened or anything, they're actually like one of the most abundant species on the planet, carrying on all continents except Antarctica. And this idea that honey bees are going to go extinct, which is -- if they're going to go extinct, almost everything else would be extinct already. They're actually doing relatively well and the mangonel, they're essentially livestock. So this divide between public perception, whereas many bee scientists, they're always bemoaning, there's like quite a few memes of, like there's this meme of a parent holding up their child, and then there's another child that's drowning, and the child drowning is the native pollinators and the parent holding up the child, the child is the honey bee. And so it's like neglect of the bees that are really in need of help. So I am seeing like a shift. And it's probably because I'm very active in promoting the native bees, I think there's plenty of other bee scientists out there, all across the world that are saying, "Hey, there's there's actually thousands and thousands of other native bees and these ones doing not so great." And part of the reason why some of them might not be doing so great is because of the European honey bee. So I think there is a shift towards appreciating native bees and I've seen a big movement in recent years, but there's still a lot of people that that think the honey bees are the ones that are threatened when they might be causing other native bees to be threatened. So it's good, there's just so many opinions about this. And it actually can get quite nasty, I found, but now there's like some data to say, yeah, honey bees, they can have negative impacts. No, they're not the biggest threat to native bees, it's habitat loss. But when you clear habitat loss is it actually going to exacerbate and invade competition? So yeah, we just need to keep that in mind.

Amy 27:58
Yeah, I think those are all really great. I think those are all really great points. And I I definitely see future research headed between honey bees and native bees. And as you mentioned, habitat loss. That's something that I think all bees and a lot of other pollinators are dealing with right now. So, thank you so much Kit. Do you have any other comments or things that you want to share with our audience?

Guest 28:26
I think that, at the moment, there's very little regulations on honey bee densities, and there's this big push for for urban beekeeping. And I actually don't think that's a great idea, because where honey bees are needed is in agricultural areas. And in Australia, for example, many of our crops are introduced. And some of our native bees will visit them, but they're never be able to service the pollination needs.

So really, I think the focus should be on supporting beekeepers, who keep bees for their living, rather than like getting your own backyard honey bee hive. The density of honey bees in urban areas is much higher than in natural areas, I found, and as I mentioned, habitat loss interacts with competition, and you've lost a lot of natural vegetation in urban areas. So this is where competition might be higher. So probably rethink about getting a honey bee hive in your backyard, and maybe supporting people that rely on their honey bees to make their living. The other thing is that these people that are professional beekeepers, they know about swarm management, whereas lots of people getting into backyard beekeeping, their hives swarm, and in Australia, this is a big problem, not just the competition with the native bees' food, but competition for hollows. So we've got lots of possums, they're related to your opossums in America. We've got possums, and we've got lots of gorgeous parrots, and many of them rely on hollows in trees to nest in, and then when the bees go feral, they take over these hollows. And so that's another issue. So, yeah, definitely rethink keeping honey bees. And maybe instead, if you want bees, you should want native bees. And even honey bees are fascinating species in their own right, their colony structure, their behaviors are incredible. But focus on creating a good habitat for your bees in your garden by planting lots of native flowers, big patches of native flowers, and well-designed bee hotels. I've been researching this as well and have a book called Creating a Haven for Native Bees that helps people learn what flowers are good for the native bees in Australia, but also good bee hotel design, which is applicable worldwide, so that we can create habitat for the native bees and create plenty of flowering resources so that competition actually won't be severe, and then the bees can coexist.

Amy 31:26
That sounds great. If you're okay with it, I'll probably find a link to your book. And then I'll also get the links to your papers and your publications, and we'll go ahead and add that to our show notes on our website, if you're okay with that.

Guest 31:41
Definitely. And yeah, I'm always happy to share my scientific publications. I really think that science is amazing, and everyone should be able to have access to it. And sometimes I can't pay. So it's really funny. Well, it's not funny. It's sad and funny. But I thought that you got paid when you publish an article. But you actually have to, like, lots of journals, if you want people to be able to read your paper without them paying ridiculous fees, you have to pay ridiculous fees. I'm just like, "No, just email me and I will send you a sneaky free copy."

Amy 32:23
All right. Well, now our listeners know. All right, everybody. That was Dr. Kit Prendergast, a native bee scientist, conservation biologist and zoologist. She recently finished her PhD from Curtin University and is in Western Australia. Thank you so much for listening to this episode of Two Bees in a Podcast.

Stump The Chump 33:09
Have questions or comments? Don't forget to like and follow us on Facebook, Instagram, and Twitter at UF honey bee lab.

Amy 33:27
Welcome to our Five Minute Management. We are on our third segment about honey. And today, we are going to be talking about processing honey. In past episodes, we had making honey, we had harvesting honey, and so I'm really excited to hear about how honey is processed. Jamie, let me know when you want me to start the timer.

Jamie 33:48
Oh, you can go ahead and start it Amy, because I feel like no matter what I do, I'm never going to make this particular one because there's so many different ways to process honey once you have it. I'll kind of be overly general about my discussion of this. But essentially, if you did what we said in the last episode, you've come back to your honey house with supers of honey. Hopefully, those supers are over 80% capped so that you've got ripe honey. And essentially, what you have to do at this point is you have to get that honey out of those combs, ultimately, into jars. We're going to talk in the next episode about bottling honey. So in this particular one, I'm going to focus on the general steps one will take to get it out of the combs. Now, of course, there's multiple different types of honey. Some beekeepers like to cut out entire sections of comb with the honey in it and sell it either like that or to put it in a jar and put liquid honey around it. But for purposes of just streamlining this discussion, I'm going to assume that you're wanting to extract honey, take it all out of that comb in liquid format. So, a couple things to remember. Number one, you really want that honey to be between 15.5 and 18.5%. moisture, so that it's not prone to granulation if it's on the low end or prone to fermentation if it's on the high end. So a lot of people, if it's a little bit wet, which is what we refer to honey that has over 18.5% moisture, a lot of people will put those supers in a room that has a heater and a dehumidifier to pull the moisture off of that honey until they get those supers down to the humidity level or the honey in the supers down to the humidity level that they want it to be. Next, after it's where it needs to be, you'll take those supers and remove the frames, and you have to uncap those frames. That simply means the process of removing the cappings from the cells of honey. There's very hands-on, labor intensive ways of using knives to do it. Oftentimes, there are hot knives that you can plug up to an electrical outlet, it heats this knife that you run down the face of the comb where you can remove the cappings. There's all the way up to the industrial method where commercial beekeepers will drop these frames in an industrial decapper, which either will use hot knives that are reciprocating on either side of a frame and uncap both sides of the frame at one time, or there's these chain driven and train laden ways of doing it where these chains will kind of rip off the cappings from the face of a frame. But however you uncap the honey, it needs to be uncapped because honey will not extract out of capped cells or, at least, extract easily out of capped cells. Once you've got those frames uncapped, they then move into an extractor. An extractor is simply a machine that spins frames around in a circle and through centripetal force, slings the honey out of the combs. Now, the best extractors are the ones that will extract both sides of the frames at one time. However, a lot of the hobbyist extractors and the smaller extractors will only extract one side of a comb at a time. So if that's the case, you'll have to extract half of the honey out of one side of the comb, flip the comb and extract all the honey out of the other side, and then flip it back to the original side and extract the other half. If you try to do it all on one side at the very beginning, you'll risk damaging the comb. So I just don't like to touch frames that much while they're being extracted, it's just too much

effort. So I really like those extractors that will extract honey from both sides of the frames at one time. This can take a couple of minutes. It can take even longer if the honey is cool. So a lot of folks will bring their combs and their supers in and extract these these frames in an air conditioned room. That's not always best, you really want it to be very hot in your honey house so that you can sling out as much of that honey as possible. You really want those combs to be nearly dry when they come out of the extractor. Now at this point, all you really have to do is filter that honey as it goes from the extractor into settling tanks. The process of extracting honey puts a lot of bubbles in the honey. So you really want to filter that through a screen, into a settling tank, which will allow those bubbles to settle out. Furthermore, when you're extracting honey, you can get pieces of wax, you can get pieces of bees that come out with the honey as well. So filtering it through a double screen, the first screen being one that collects the bigger chunks of wax or bee parts, the second screen that will remove the finer things, all of that honey will pour through those screens into some sort of settling tank where the bubbles and the bits of debris, etc. will settle to the top after which you can bottle from the bottom. But I'm going to talk all about bottling next week. And that's pretty much it, Amy. You've got to uncap it, you've got to make sure it's the right humidity, and you've got to extract it in a warm room in a way that gets as much of that honey out of the column as possible. One of the beauties of honey is that it's not pasteurized. It's not, quote, processed in some way. You really just need to run it through a filter. And a lot of commercial beekeepers might heat it a little bit, but that's not for the purpose of pasteurization. It's simply for the purpose of passing it through the system better. If you have to pump it or if you have to filter it or if you're trying to extract it, heating it a little bit can really improve its flow through the system. That's it, Amy.

Amy 39:57
That's it. And you did it all in a little bit over five minutes.

Jamie 40:01
Well, the thing is I could talk about all the ways to uncap it and all the different styles of extracting, but I just really wanted to keep it focused just to try to get as close to five minutes as possible.

Amy 40:10
That's fair. All right. And so that is our third segment of our honey series. And in our next honey series and our last final Five Minute Management, we will talk about bottling honey.

Stump The Chump 40:28
It's everybody's favorite game show, Stump the Chump.

Amy 40:45
Welcome back to the question and answer segment. Jamie, we'll start with the first one, which is, what are some best management guidelines or strategies for non-chemical control of Varroa?

Jamie 40:58

Well, first of all, it's good that this questioner recognizes that Varroa is a significant issue for bees. Right? I mean, that's important. And what I always tell folks when I talk about Varroa control, there seems to be some sort of natural continuum, where on one side, kind of one extreme side, beekeepers will do whatever it takes to kill Varroa and that will often involve off-label use of compounds. And then you've got on the far other extreme, which is beekeepers don't want to do anything at all related to chemical treatment of Varroa. They want to pursue it from a more natural, quote, natural perspective. And if you consider it kind of the standard bell curve shape, most folks are actually somewhere in the middle, and they just want to know how to control Varroa safely, effectively. Generally speaking, they may want to not use chemicals, they may want to stay away from them, if possible, but they will use them as a last resort. And incidentally, the folks who are in the middle of the bell curve are, in fact, the folks who are more prone to use integrated pest management strategies. IPM doesn't eliminate the use of chemical to control Varroa. It's simply preaches the use of chemicals when all else is failed, and it becomes the final last resort that's necessary. So this particular questioner is saying, what are some of the best management guidelines related to non-chemical control of Varroa? So I will start with some basic premises, but then tell you that you still may someday need to use a compound because nothing at this moment is perfect. So, I'll start at the beginning. I always tell folks, it's a good rule of thumb to use resistant queen stock in your colonies. Now, there are quite a few different stocks that have some sort of level of resistance or tolerance to Varroa. And these are Minnesota hygenic, VSH queens from the Baton Rouge lab of Louisiana, Russian queens from the USDA Baton Rouge in Louisiana, they're developing also a poll line that may become available soon. There's the New World Carniolans, there's stocks that have been bred specifically to have resistance to or tolerance of Varroa. So I always tell people step number one, make sure you're using a Varroa resistant stock. Step number two, there's plenty of research on the use of bottom screens and Varroa. Bottom screens by themselves don't do a lot to control Varroa, but collectively, the research suggests you get about a 14 or 15% reduction of Varroa populations if you use bottom screens, rather than conventional solid bottom boards. So those are two key things that you can do. Also, appropriate splitting of colonies, timely splitting of colonies helps because you can break brood cycles. It's very popular for folks these days to cage queens for a period of time to create a split in the brood cycle. But to me, non-chemical control of Varroa boils down specifically to your queen stock. There's also things like drone brood removal, where you can remove drone brood. We know that Varroa are attracted to drone brews preferentially. So the periodic removal of drone brood can be useful. Now, there's a lot of other, what I call Band-aid strategies that folks use that might give a little bit of benefit here or there but aren't really super impactful. So I'm going to stop by saying, essentially, there is a fantastic resource available produced by the Honey Bee Health Coalition. It's called, or at least I think it's called, Guide to Varroa Management. We're going to make sure to link that document in our show notes for the question and answer segment. But that document includes a lot of non-chemical methods for Varroa control, when to use them, how to use them and the efficacy you can expect from using them. And it goes over drone brood removal, using resistant stocks, etc. And if you follow the management's recommendations in that document, it'll tell you how to integrate that with the occasional use of chemical intervention if Varroa populations ever reached damaging levels. So there really is no one size fits all for non-chemical control of Varroa, but I really feel like the Honey Bee Health Coalition's management guide for Varroa puts all the information in one place so that you can make informed management decisions related to non-chemical control of Varroa.

I just want to say one thing here, quickly before I conclude this thought. It's difficult. It's difficult to control Varroa without chemicals, and I know that that might get a lot of people riled up here on the podcast, because it is possible, but it requires a lot of management and potentially, compromised colonies and high colony loss rates. So, what I would argue is you shouldn't be afraid to use chemical intervention, because Varroa causes way more damage to colonies than any of the research suggests the chemicals that we use against them do. So in this particular case, I'm more interested in killing Varroa than I am any minor impact that a particular compound might have on colonies. Varroa will kill your colonies. The compounds registered for use against Varroa, when used according to the label, won't have that same impact. So make sure you check out the Honey Bee Health Coalition's guide to Varroa, and you can see a lot more information beyond what I'm able to share here just in the short Q&A segment.

Amy 46:36
Yeah, I think that completely makes sense. And I think what I think about it is, well, even though honey bees are not necessarily exactly like our dogs or our cats, but I do put flea medication on my dogs. I provide them heartworm medication. And so I guess when it comes to controlling Varroa, I kind of see it as the same thing, especially, if you're a hobbyist beekeeper and your honey bees are your loving animals that you're caring for. So I guess I'll just leave it at that.

Jamie 47:06
Amy, those are good comments. And right now there's a lot of push, in fact, we've even had folks talk about it in earlier podcasts on this survivor bee movement, right, where you just just let your bees die. If they're going to die, they die, and whatever colonies survive, you breed from them and whoever dies, dies, and from the colonies that survived you breed from them, and maybe over the course of four or five years, a decade, you have bees that, maybe, are tolerant to Varroa. The jury's still out on that. There's a lot of research on this topic at the moment. But for people who are truly chemical-free, you're going to experience high loss rates over the first few years and maybe even severe bottlenecks periodically throughout your keeping of those bees .And just like what you said, and I, again, I never try to tell people what to do, I just tell them their options. And like I said, there's that continuum, some people who will not touch chemicals at all. But in my opinion, what Varroa do to bees is far worse than what the registered chemicals do to bees. And so we should do what it takes to kill Varroa. I think it's our obligation as beekeepers to be involved and cognizant of the welfare of our colonies.

Amy 48:10
Alright, so the second question I had, this one's really funny. I feel like this question stumped me. I even brought it up at lunch and asked a lab manager, asked some of our other co-workers and so I'm going to let you answer it. The question is, how do bees distinguished living things from nonliving ones? So for example, the bees are going to stick my finger, but they're not going to sting a piece of wood. If I put my hand in the hive, they're going to sting my hand, but if you put a piece of wood in the hive, would they sting it? I have no idea. Is there a difference between ourselves and non-living organisms?

Jamie 48:48

So I've never seen a research project on this. That doesn't mean it doesn't exist, but I've just never seen one. So I'm going to be purely answering out of my hypothesis driven speculation. But I think that there's a couple of things that cue them into what they're working with, for example, mammals or humans, in particular with this question. Number one, movement. Number two, carbon dioxide emission and number three, smell. My guess is that bees, we all know bees have a really good sense of smell, so just by smell, they're probably able to detect mammals. And also, when we're working hives, we move, right? The walls of the hive aren't moving, but we are, and so we give them that kind of moving target to notice. And also, we know with certainty that they're attracted to carbon dioxide emissions. That's one of the things that they target when they start their stinging frenzies, right? They hone in on the mouth and the nose area. We do know that they will sting inanimate objects. One of the chief ways of determining defensive behaviors in honey bee colonies is to take a small patch of cloth and wave it at the entrance of a hive for a set period of time, and then count the number of stings in it. In that case, they neither have the CO2 emission or the smell, quote, of a mammal or an attacker. Instead, it's just purely movement in that case. So my guess is it's a lot of stimuli that ultimately lead bees to make a decision that this is an intruder to sting. And I will say, as well, once they sting you successfully, they leave that pheromone there that says, "I've committed a successful sting in a place that seems to be impacting the intruder," and other bees will cue in on that as well. And my guess is if you were to put that same pheromone on inanimate objects, you could get them to try to sting those things as well. So there's probably a lot of factors at play here in the answer to this question.

Amy 50:48
That's fair. Okay. So for our third question, actually, we've gotten a couple of questions just about the swarming process. When bees are swarming, who's actually leaving and who is a part of that process? So I'm just going to leave that there and have you maybe talk us through the swarm process?

Jamie 51:07
Yeah, so swarming is an amazing phenomenon, right? Tom Seeley, Professor Tom Seeley wrote a really good book about this called Honey Bee Democracy. It's definitely one of those books that you should get or check out from your library to read. It goes into much greater detail than I'll be able to go into here. But essentially, when a swarm happens, 30 to 70%, which is a wide range, we used to say about half of the bees, but really, it can be 30 to 70%, so a third all the way up to two thirds of the colony, and mostly, it's worker bees, right? Because that's the biggest composition, the largest group of bees that compose the biggest group of bees in the colony, the worker bee. So I think the question though, is speaking towards who are the worker bees? When does the queen leave? And do drones accompany them as well? So let's work in reverse order. Drones do go with swarms. So the question is, why do they go with swarms? I don't know. Right? They have no purpose, or at least seeming purpose. They're not contributing to the scouting out of new nest sites. They're not contributing to the production of wax once they get to the new nest site. Why do they go? I don't know. I'm not even sure if it's known. It's certainly something we need to look into to see if we can answer in better detail. But they do occur with swarms. And what I've discovered in nature is that there's very few accidents when it seems to be purposeful. So drones seem to be making the decision to leave with swarms. Or they might just get caught up in the excitement of all the bees running out of the nest, they're like, "Yeah,

I've got to go there, too." It seems like the thing to do, and then they end up in the cluster. But for whatever reason, we know they do move with a swarm. Queens also move with swarms. In fact, the colony will not swarm, or typically will not swarm without its mother queen. It's the old queen who leaves with the swarm. She does not lead the swarm out of a nest. She gets caught up somewhere in the first third, somewhere in that middle third. So at the end of the first third to the beginning of the last third, she's somewhere leaving that nest, somewhere in that middle third. So as worker bees are rushing out, she will rush out, and I've seen this myself over the decades of working with bees. If I'm in an apiary when a colony begins to swarm, and I become aware of it swarming, it's funny, I've become very comfortable saying, "The queen has not left yet. Maybe I can stop this." And I'll run to the nest entrance and wait for the queen to run out, quickly grab her, put her in a cage, put her somewhere that I can capture that swarm, the bees will land on her, and then I've got that swarm. So she leaves somewhere roughly in that middle third with those worker bees that are exiting the nest. And so then speaking to the very first thing that we were going to discuss, who are those worker bees, well, number one, they have to be capable of flying. So that takes out the day old or up to two day old workers, right, because they can't fly. We know it's heavily composed of bees who have been flying at some point, two week, three week or older bees, bees who are forager bees who have some experience outside the nest. We also know that includes a number of scout bees who had begun scouting for potential nest sites while in the original parent hive, but also scouting for nest sites while they're on that swarm cluster, so older worker bees. But we also know that includes a high percentage of younger bees, bees that are nurse bees as well. So it seems to be a reasonable cross section of the worker bees in that nest. If it were weighted one way or the other, it's slightly weighted towards the older worker bees just because they have more experience, but there is a cross section of bees that goes with it, which, frankly, makes sense because honey bees subscribe to temporal polyethism, right, age related division of labor. So you really want all the cohorts represented in the new nest, because it's going to be 21 days before that first egg laid and that new nest is going to emerge as a worker. So by the time the first workers are being born in that nest, the youngest workers in that nest are 21, 22, 23 days old. So you really do want young bees to accompany that swarm because you need young bees present in the nest to do the young bee tasks. So it's really neat to think about, once they move into that nest site, build comb, and the first brood emerges, the youngest worker bees may be four weeks old. And so four week old workers are doing one week old worker tasks. So swarms are just a really interesting dynamic from the ground up.

Amy 55:46
I know. It seems like every time I think more about honey bee biology, my brain just starts to break a little bit more.

Jamie 55:51
Mind boggling indeed. Yep.

Amy 55:54
Alright, well thank you for answering those three questions, and for audience, thank you so much for sending in your questions. Don't forget that you can send us questions on our social media pages. We

are on Facebook, Twitter, and Instagram. You can also send us an email to our email address, which is honeybee@IFAS.ufl.edu. We look forward to seeing more of your questions. Hi, everyone, thanks for listening today. We'd like to give an extra special thank you to our podcast coordinator Chelsea Baca and to our audio engineer James Weaver. Without their hard work, Two Bees in a Podcast would not be possible.