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SPEAKERS

Cameron, Honey Bee, Jamie, Guest, Stump The Chump, Amy

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. In this episode of Two Bees in a Podcast, Amy and I will interview Professor Steve Martin from the University of Salford. He is a world expert on Varroa and he'll be with us talking about natural resistance to Varroa. In the second segment, I'm going to be the one interviewed. Dr. Cameron Jack from the University of Florida will interview me talking about small hive beetles. And of course, we will finish today's episode with Stump The Chump. So one of the topics that beekeepers always want to talk about, no matter where I am and no matter who I'm talking to, they want to talk about Varroa. There's just a great emphasis on Varroa because we all know Varroa is one of the chief biological threats to honey bees around the globe. There are a lot of chemical strategies to try to control Varroa, there's breeding to try to control Varroa, there's cultural mechanical methods to try to control Varroa, and we're actually very privileged today because we are joined by one of the world's experts on Varroa, Dr. Steven Martin, who's a professor in the School of Science, Engineering and Environment. He's also the chair in social entomology from the University of Salford Manchester, from the UK joining us today from the UK. Thank you, Dr. Martin, for joining us on Two Bees in a Podcast.

Guest 02:02

Oh, thanks very much, Jamie, for inviting me. It's gonna be great.

Jamie 02:06

I've been very fortunate because I've spoken in the UK quite a few times and other places that you've been at the same meeting. I just absolutely love watching your lectures. You're a fantastic lecturer, you have good information to convey, beekeepers really benefit when they hear you talk, so I'm really excited to have you on the podcast today.

Guest 02:25
Thanks very much for inviting me.

Jamie 02:26
Sure, Steve. So one of the ways we always start off is we want to get the listeners to know a little bit about our interviewees. So if you could just tell us a little bit about yourself, how you got into bees, beekeeping, and how you found yourself where you are today.

Guest 02:41
Well, my name is Steve Martin. I started out in Japan. I was working on beetles in Japan. And then I went and found a large hornet's nest. Insects being cold-blooded, I thought, "Wow, it's so cold outside." And I went and prodded the nest and got stung quite badly, actually, by the hornets. And I thought, "Wow, this is not what I was told. Bee stings can attack even in cold weather." So I ran home, got a thermometer, came back out, threw the thermometer into the colony, literally, and ran, came back with a pair of binoculars and saw the temperature go up to like 30 degrees. And I thought, "Wow, I'm gonna get a Nobel Prize. I've discovered something." Yeah, of course, yeah, that wasn't the case. But that got me into hornet research, and I spent three years in Japan studying hornets. And then I went back for a postdoc in Japan, also studying hornets. And then when I came back to England, my expertise in social insects got me into the National Bee Unit. And this was in the early 1990s. And once that started, my job was to basically come up with a Varroa model and some sort of monitoring tool for the beekeepers because it had just arrived in the UK, it was a huge problem. And so I had to learn all about honey bees. And I mean basically, from that day onwards, I've been studying Varroa for the rest of my life. I'm sort of now just just nearly reaching 60 so I've been in the game for a long time, 30+ years, as many as a lot of beekeepers I talk to.

Amy 04:36
That's so cool. So this is not about the Asian giant hornet but did you ever work with that when you were in Japan?

Guest 04:42
Yeah, that's that's the velutina. We used to work down a little bit in Taiwan with that, and then, occasionally, when I've been over in China, I've still got my toe dipped in that. We did work on the giant hornet mandarinia a lot, actually.

Amy 05:00
Is it as big as everyone says it is?

Guest 05:03
Yeah. I mean, you're talking about, "Oh, should we have a monitoring system?" And it's like, you don't need a monitoring system when that thing's flies around, you know. It's probably the largest flying active

insect, as opposed to, I mean, there's some huge beetles that fly around but you never see them. But once you see one of them, you won't forget it.

Jamie 05:33
That's neat. I want to see it, just not in Florida.

Amy 05:35
Me too. So, Dr. Martin, when I had emailed you, I asked you, what are some topics that we could talk about? You said that you wanted to talk about natural resistance to Varroa. And so my question to you is, what does that mean, what is natural resistance to Varroa? I mean, I'm sure, as soon as we say natural resistance to Varroa, our audience, their ears and eyes are going to perk up because they want to know everything that you have to tell them.

Guest 06:01
Right. So I'm making the clear distinction between natural resistance to Varroa. And so this is where beekeepers have had zero influence on the evolution of this trait. So we know for a long time now that we've had VHS lines, Russian bees. People in Europe and in America have been very hard to try and select traits that will give these natural resistance. But for a long time now, for decades, the Africanized bees have been completely naturally resistant to Varroa. You don't need to treat them at all. The bees in Africa, they became resistant very quickly in a few years. And again, in most of Africa, nobody treats, and it's quite interesting because a lot of these countries can't afford to treat. I mean, it's all subsistence beekeeping. We studied them, oh, 20-30 years ago, we were out in Mexico, and recently had been back in Brazil looking at these cases. A good example everybody will be aware of is Tom Seeley's bee population, that this is actually quite a small population. And then what's been really exciting is that we've had cases now popping up in Europe, particularly in England, where the beekeepers are very different, where people haven't actually been treating for years and years. They've no need for it. They're not selected, these just sort of appeared through various reasons I can go in and explain.

Amy 07:52
So is this related to Darwinian, wow, I can't even say it, Darwinianism beekeeping?

Guest 08:01
Well, I've got to be quite careful here because the situation in somewhere like America, where there's a huge commercial and high densities of colonies, I think if you just let the bees go and we all become Darwinian beekeepers, you're gonna have one massive problem on your hand. But probably no more beekeeping, by and large. But in countries where we have low densities of beekeepers and bees, I mean, in Britain, most beekeepers just have a few colonies and they don't move them around very much. But most of them still treat, but it is sort of related. So the thing that's starting to come out with these colonies is that they were just left. If you go somewhere like Africa, they don't treat for anything. Now, I know I won't be popular among beekeeping, but beekeepers are keepers of bees, and they have to do things to keep bees in a condition that they want them. So they treat them against foulbroods and Nosema and all that and Varroa, all the disease that we have. But in a lot of wild places, so like down in Africa when the Africanized bees were moving, they never got treated for anything. So they're very

resistant against, actually, most diseases and appear to be able to adapt very quickly to new situations just through selection.

Jamie 09:37
So, Steve, let me ask some questions about this because, if I've got any future PhD students listening, one of the questions that I always ask PhD students in their examinations is I would say, let's say that you have two islands that are otherwise identical. Let's just say they've got the same, flora, fauna, they're 100 kilometers away from each other, but climatically, they're identical, and you put 10,000 colonies on one island and 10,000 colonies on another island and you put Varroa and you never treat, and let's say Varroa resistance, this natural Varroa resistance developed on both islands. Would you have reason to believe that both populations would have developed the same tools necessary to make them resistant? Or do you get a whole suite of behaviors of characteristics? I mean, you mentioned African bees. I did my PhD in South Africa. You're right, they've got Varroa. But do bees in Southern Africa have the same, quote, natural behaviors or characteristics that make them resistant to Varroa that the bees in eastern Africa do? Or the bees in South America do? I mean, could you talk a little bit about what these traits are? And do we have reason to believe that it's the same traits that confer resistance or a lot of different things can happen to make these bees naturally resistant?

Guest 11:02
Oh, that's a really, really good question. So the answer is, it appears to be the same traits, which is absolutely, maybe, staggering in itself. And the reason that's come about, and I've got to mention at this point that I wasn't the person that made the breakthrough on this. The big person that made the breakthrough was Odie. So a girl called Odie, she's from Sweden. And she was looking at the population in Norway, so one that hadn't been treated for more than 10 years, and then comparing it with another population that had to be treated. And she was looking at various traits to see if you could find any difference between these tools. And she looked at hygienic behavior, damaged bees, all the things we've always done, and she couldn't find any difference. And then she looked at a behavior, which we've all known about, but never really sort of looked in detail. And that was this trait called recapping, and it becomes an interesting story because what she found was that the bees that were resistant had really high levels of recapped cells, so they were opening cells, and then closing cells. And they were doing this preferentially of ones that were infested. So there was really good evidence that that trait was actually they learn to target cells. Now, the problem was how is this recapping? Because it don't seem to be doing anything? There are some various ideas.

Jamie 12:54
Yeah. How does that help? Yeah, exactly.

Guest 12:56
Yeah, I've got this paper to review from Odie, and I'm like, "Wow." And, to me, a light bulb went on straightaway. I knew the whole system because it never worked out that way. But I was very fortunate. At that time, I was actually traveling, so I went straight to Brazil as part of some work I was already doing. And I said, "Well, if she's right, if Odie really is right, then there should be loads of it in Brazil." And, oh, my God, there was. So I thought, "Well, the bees from Brazil, they came from South Africa

because, basically, the Africanized bees and scutellata bees are the same. So I went to South Africa. And would you believe it? It was the same trait there. So suddenly, I thought, "Whoa, this is getting really interesting." So then we looked in the UK, and it was the same thing we found in the UK. So suddenly, we have this same trait of this increased recapping, which we found on many continents, and then she increased a study to look at the four big naturally resistant populations of bees in Europe, that's the original colonies up in Norway. It is the actual colonies in Sweden where they did your experiment, Jamie, well, they put many, many years ago Ingomar freeze on a huge number of colonies from all the different races they could find in Europe onto an island at Gotland, just left them and basically, they survived a few years then they almost died out. It was called the 007, the Bond, the live or let die experiment. And they got down to sort of half a dozen colonies and they thought about it. Then they became real swarmers and they're still going slowly, but then only found that they have high recap in the ones down to two populations in France habit. So this is the first trait that I know of where it brings all these colonies together. And this is, for me, brilliant in beekeeping terms, because we all know beekeepers, I don't call them racial. They love their bees, they love their black bees, or their yellow bees or the brown bees. And so it doesn't matter. It doesn't matter what bees they are, they're all a placeholder for honey bees. And any bee can do this, evolve this trait. They're already in some ways pre-adapted. That's really interesting. And Jamie, it's kind of funny, because I think Dr. Martin just gave all of your future PhD students the answer to your question.

Jamie 15:56
Well, I think they're still going to have the greatest question. How in the world could this help against Varroa? Because I've seen this. They uncap it, but how does this help? How does this help them survive Varroa?

Guest 16:07
Okay, so this is what we've been tackling with just recently. What we believe, and this is still up for debate, that it's not actually the recapping. It has very little to do with Varroa. We've done some work, and I think it's just, it's still under review in the UK, and we found that the ability to reproduce are exactly the same in recapped cells as non-recapped cells. So we believe that the recapping trait is a proxy. So it's a good trait to look at. And the reason why they're resistant is because these bees are really good at detecting them and actually removing them. So this is classic hygenic behavior that Marla Spivac has championed for so many years. And it's exactly the same mechanism, except the bees need to learn how to detect the Varroa mites or an infested cell, because unlike most diseases, they're living, and there are people looking at that side of things. So we've worked out that there is a strong relationship between recapping and removal. It's removal that actually is the key to all this. The bees detect them and then other bees then will remove them. They don't actually remove them, they cannibalize them. They don't kill a mite. The mites actually escapes, but it can't reproduce. It's really reproductively dead. And then this lowers the mite population, it lowers the virus population, and it leads to a sort of persistently low amount of infestation within a population. And this is at a population-level effect. So that's really interesting. I'm thinking about the behaviors and the observations that the researchers have. And my next question is what does the research look like to determine this? It seems like there are a lot of moving factors, which there always are in research. But how does the research look? And also, besides observation, I guess, have you all looked at other things like the genetics of these bees

as well? So, the observations, like any observations, are repetitive and pretty boring. We've focused on recapping to start with because it's by far the easiest one to determine. Even that is still very time-consuming because, unfortunately, at the moment, we've got no way of determining when the cell is recapped from looking from the top or from the outside, just looking at a brood frame. You can sometimes see it with wax moths where you get a line of recapped cells because the color is slightly different but it's unreliable for this level. So you need to open up the cells from the inside and that is time consuming. I am sure somebody, and it's a plea to people out there, please design a mechanism, possibly some sort of torch, a UV light we can shine on to the frames, and we can actually see which ones are recapped and which are not. People have used waxing strips, gaffer tape. Now, I have all sorts of methods, but the only one that seems to be good for researchers is recapping. But the really good data, the crucial data is coming from mite inserts. And this is where you very laboriously take live Varroa mites, insert them into cells at the right age, mark them on a sheet, go back sort of 10 days later, lift up the sheet and then see how many have been removed and how many have been recapped. This is what they were doing originally with the SMR lines. And you notice that soon as you scale this up, they sort of give up and then they start using proxies in differences in infestation rates because it gets quite difficult to do in a large scale. So this is why you'd benefit from a big team of people. The other work that we haven't done -- so there are the two main things to do, the genetics, we are currently working on, not the genetics, per se, but we're determining whether this is a learned behavior because we know things like bumble bees and social insects can learn things from fellow workers. A colony never really dies, it can always just be passed on in a learned behavior. Or is it a genetic behavior, which is carried by the queens because if it is, then that would be really beneficial for beekeepers because you could just be able to sell queens with the traits, which has always been a golden bullet for a lot of people. But that's what we're doing. And yeah, I'll leave it up to bigger experts to work out the genetics. But because it's a behavior, it's very rare that they pin this down genetically. It's very difficult. So we're going for the low-hanging fruit at the moment.

Jamie 22:03
So Steven, this is all very fascinating. You may not know this, but we interviewed Jeff Harris last week. We haven't even released the episode yet. He talked a lot about the VSH trait and the bees ability to determine this, and now you're talking about these uncapping traits. I'm familiar with a lot of these populations of bees that you've mentioned about having resistance. I remember Ingomar's study, the Gotland bees, all of this is fascinating. And beekeepers, I think, would find it fascinating. So at the end of the day, this research is great, this is all encouraging, it's exciting, but at the end of the day, how do you see beekeepers specifically benefiting from these findings? I mean, I know it's going to take years more of research. But where do you see this heading on behalf of beekeepers?

Guest 22:49
Right. So this is the big question. And I've changed the focus of my research from science more to beekeeping type thing. I was lucky to spend a summer with Marla Spivac last year, and we discussed this a lot. And the situation is in the UK. There's a strong possibility we have an increasing number of people now that just don't treat, and these are some big areas. We've got one area with about 100 beekeepers. Now, okay, they're only keeping 500+ colonies, but it's an area, well, it's almost an entire county in Britain and nobody treats in that area. I think there's only one person that treats. The problem

in the UK is its government policy that you have to treat. So there are a lot of people who just don't mention it. And every time I go around to give a talk, I get people coming up afterwards saying, "Oh, I didn't like to say but I haven't treated for 10 years." And there's quite a large number in the UK. And in fact, there's even a group called the Naturalist Beekeepers who refuse to treat. And I always thought, "Well, they'll just die out, Varroa will kill them." But they're thriving. So it actually hasn't. And we believe that this is what's actually going on. And we're starting to get data from these beekeepers to support it. So what I've done for the UK beekeepers, I'll separate the UK and America because they're two very different systems. So for the UK beekeepers during COVID lockdown, we've done an instructional leaflet, it's in the British Beekeepers special issue. You can buy it for four pounds. And basically, what that does, it lays out all the science. Some of it has not actually been published yet, and then a sort of methodology, so how to test your own bees to see where we are on the spectrum just using the recapping because it's the simplest thing. And I know in Germany, they're doing a very similar thing where they're having workshops and what have you. And they've got a similar system. Now, America, that's a very different kettle of fish. I was amazed that when I was working with Marla, we were doing these experiments, we were actually doing mites introduction experiments as part of a much bigger experiment that Marla was involved in. And I introduced the recapping part, just because I was interested. And Marla's hygenic bees were actually really good. They were amazing. They were just like bees I'd seen in Brazil or South Africa or in England. And I said, "Why are you treating these?" She says, "Well, they're research bees, and we need to keep them going." But then at the same time, this is crucial, she had somebody, I think it's a guy called William Shepherd. He's a beekeeper who hasn't treated for a long, long time in America. You have many beekeepers that don't treat in America as well. And Marla got some colonies and I had a look at them. And sure, they were heaving with mites, and they were recapping like crazy. And we've been able to work out and solve, potentially, one of the big issues. Because they're actually removing infested brood, if you get a big influx of mites, and the infestation level goes above sort of 40%, and this can just happen over a short period of time, say colony collapses nearby, then basically, they remove so much brood from your colony that the colony actually just collapses. I mean, it just spirals down because it killed too many bees. It's a bit like having a massive chalkbrood invasion. And this explains why, often, you can't take these colonies out of their population. So this is the big problem faced by America. You have such huge densities of bees, and you'd have to have whole areas on the same sheet, basically, for this to work. Me and her spent a long time and we didn't really come up with a solution to this at all because the scale is just too massive. And I think that ties in slightly to the VSH lines, which I'd love to see whether they've got the same traits as this. There are records of what we need to see now, and sometimes they work, sometimes they don't. And it may be that this is one of the problems, that they're just getting overwhelmed by the environment. And that takes us right back to the very first point to say, well, if we just let Darwinian beekeeping go, you just have too many mites, and basically, even if you had highly adapted bees, they would still probably die because you just have too many mites in the environment. So it's gonna take some time. If we can show that this is genetic, and you can use queens to transfer the traits, and we do have a project in Hawaii because it has already appeared in Hawaii, and we've got one of the commercial beekeepers online there, then that is a possible solution by flooding the market with these bees with this trait. But that's a long way down the pipeline because we need to know the influence of the drones and queens. But in the UK, I think in 10 years time, the vast majority of people will not treat for Varroa. We know of the halo effect, we've seen it so when people are not treating people nearby, they forget or there's colonies that don't do it. And all the selection happened in feral colonies, the wild colonies, that's where all the selection is. And most of these beekeepers are just originally collecting them from the wild. And then when they didn't die, they then split built up their stock from that.

Jamie 29:23
I think that this is all very promising. It's amazing to me. I think in the States here, we've had Varroa now for 35, almost 40 years, and so it's been a constant battle. I know Europe's had it longer. And then you mentioned researching in Hawaii, they've only had it less than a decade, I believe, in Hawaii. So the research that you and others are doing is so important for beekeepers. I think one of the struggles with stocks traditionally in the US is just adoption and people just don't use them. We've talked about this on previous podcasts. Furthermore, they can lose traits so quickly because beekeepers allow their queens to open mate. If they lose that stock that they paid for, they'll allow open mating. And it's easy to lose the traits. So it's so tricky. So it's great that there's research like yours, Steven, that you guys are doing that continues to show some benefits to this. I think it's interesting that you note that in the UK, you guys may not be treating much at all in 10 years. Having seen this firsthand myself in Brazil and in South Africa, it's an amazing horizon that's coming our way. And I hope that there's a day that we don't have to talk about Varroa because it's controlled. So thank you so much for joining us on this podcast and sharing with us about the research that you've been up to. This is just utterly fascinating.

Guest 30:37
Yeah, well, thanks, Jamie. I've been in this game a long time, and beekeepers and I've been generally pretty pessimistic and realistic about it. But to me, this is the first time we've ever had a light at the end of the tunnel. And it's amazing how much support I'm getting from the beekeepers wherever we work who are fascinated, and more and more keep coming out of the woodwork. And we know in the States, there are a lot of people who haven't been treating for many years, but the majority of them just keep their heads down because they don't want to be vilified at talks and things and they just get on with their beekeeping.

Jamie 31:17
Yeah, that's an amazing what a good summary. So everybody that's been Dr. Steven Martin, who's a professor in the School of Science, Engineering, and Environment, the chair in social entomology at the University of Salford, Manchester, UK. Steven, thank you so much for joining us on Two Bees in a Podcast.

Guest 31:32
Thanks very much, Jamie.

Honey Bee 31:38
Have questions or comments? Don't forget to like and follow us on Facebook, Instagram, and Twitter @UFHoneyBeeLab.

Jamie 31:49

Alright, everyone, thanks for joining us on this segment of Two Bees in a Podcast. We are going to do something very different this segment. I'm actually going to be the one who is getting interviewed, and Dr. Cameron Jack here in the Entomology and Nematology Department at the University of Florida will be the one doing the interview. And the reason we're doing it this way is because this segment is all about small hive beetles, and I happen to have done quite a bit of work on small hive beetles in my past. So I'm going to be the one answering questions on it. And Cameron, thank you for joining us to be the one who's going to ask me those questions. How you been, Cameron?

Cameron 32:27
I'm doing alright. Glad to be back. It's kind of funny. I mean, just for all those listeners out there, just so you know, every time that Dr. Ellis gets an email about something that somebody else has studied before, he considers us to be the resident experts. So, for instance, I'm the Nosema resident expert, I'm the resident Varroa expert, and then he'll throw that kind of to other people to get everybody's opinion. I mean, in this lab, he is still the resident small hive beetle expert. So if I get a question about small hive beetles, I'm sending it to him now.

Jamie 33:03
Well, Cameron, it's nice that I can be an expert on something, because all you guys know so much more than I know about everything else. I always have to come to you guys to ask questions.

Cameron 33:14
Well, good. Well, this would be a really useful, I hope, segment for beekeepers, because, of course, especially, I mean, here in the southeast, me, personally, I had never seen a small hive beetle until I moved to Florida to do my research here at the university. And so it's something that I wasn't particularly familiar with and something that I'm still learning about. So I've got some questions to ask you. And hopefully, they'll be useful for everybody. But I'd think it probably just make the most sense to start from the beginning. And just, if you wouldn't mind, Jamie, telling us a little bit about what are small hive beetles and where did they come from?

Jamie 33:57
Yeah, so I'll give a little bit of background on that and kind of my introduction to them as well. So I did my undergraduate at the University of Georgia from 1996 to 2000. I guess I'm aging myself here. And right in that window is when small hive beetles were first found in the southeastern US. That is when things exploded about them. And the funny thing is I also had only just sort of started seeing them once I was finishing up my time at the University of Georgia and I was fortunate. Well, it was a difficult time for beekeepers because of the new paths. But it was fortunate for me because right about that time, the USDA lab in Tucson, sorry, in Weslaco, Texas, had just developed a partnership with Rhodes University, which is in South Africa, to do some work on small hive beetles. And so Patty Ells and a scientist for the USDA at the time in Weslaco had worked with Randall Hepburn who became my supervisor, and they were looking for a student to do some work on small hive beetles. Fortunately, I was the student selected to do that at the time. And as a result, I was able to get in to work with small hive beetles on the ground floor. We knew so little about small hive beetles. All we knew is that they were found in the US and colonies were dying as a result of hosting these things. And we knew that

they were native to Sub-Saharan Africa. And that's pretty much where we started. And so when I went to South Africa to do my PhD research, I just started learning so much. And the first thing I learned is that we actually knew something about them. There were two scientists who preceded me. One, Lundie was his last name, A.E. Lundie, who had done some work in South Africa on small hive beetles in the 1940s. And he wrote this little pamphlet on small hive beetles. And if you go back and read that pamphlet, it is still chocked full of the relevant, most basic information on what small hive beetles are, how they reproduce, what they do to colonies, etc. And in the 1970s, literally 30 years after Lundie did his work, there was an individual who did some work, Schmolke was his last name, and he did work in, then, Rhodesia, now, Zimbabwe. He did some master's work on small hive beetles. And that master's thesis talks a lot about what small hive beetles are, how they reproduce in colonies, etc. And Lundie and Schmolke's respective papers really laid the foundation for everything we know about small hive beetles. In fact, almost everything I'm going to tell you in this series of questions that you'll end up asking me, no doubt, really have been answered by Lundie and Schmolke and the rest of us are just building our projects on that. So with that background, what are small hive beetles? Well, they are one member of a family of beetles, the family is called Nitidulidae. And Nitidulidae beetles have a lot of things in common. They have these life history traits that are common. For example, a lot of Nitidulidaes like to feed and reproduce on rotten fruits, or they might be pollen eaters. Well, we know small hive beetles as Nitidulidae are these beetles that inhabit honey bee colonies, and we know that the small high beetles feed on nectar, they feed on brood, they feed on pollen. We know that small hive beetles specifically are native to Sub-Saharan Africa. So this is a beetle that has been present in the lower half of Africa for many, many, many years, probably thousands upon thousands of years where they've been colony pests. They literally live inside the colonies of honey bees that are native to Sub-Saharan Africa. And if you look back at records of their distribution, they probably have a natural distribution in most every country that exists below the Saharan desert. So they're literally distributed all over the place in Africa. But the reason we didn't hear so much about them outside of Africa is because bees in Africa tend to tolerate these beetles quite well. And they only became a known thing once they escaped their endemic range and started being a problem in colonies of European-derived honey bees, and that's kind of what got the ball rolling. So that's what they are. They're just a colony pest and they originated, again, in Sub-Saharan Africa. And now that they're outside of that, all of us are becoming aware of these beetles, what they do, and how they can damage colonies.

Cameron 38:35
Well, thanks for giving the overview. It's also actually really interesting to kind of hear in your own words how you got started in this. Maybe people don't know this, maybe you don't know this, Jamie, but I'm actually not just an occasional contributor to the podcast. I'm actually a fan and I've been listening all the episodes. I think I've got, maybe, just some of the early ones that I might have missed, but I've listened to almost all of them. And I heard you mention very frequently that you did your PhD in South Africa and you've done some work with small hive beetles. But this is the first time I think that I've really heard you go into detail, maybe, about how you actually got started in that. But knowing from what you said, that they seem to be native to this Sub-Saharan Africa, and we know that they've arrived in the United States kind of in the mid 1990s, what does their current distribution look like now, worldwide?

Jamie 39:34

Yeah, it's kind of interesting. So, again, that 1996 to 2000 range, when I was University of Georgia, I was an undergraduate research assistant in the laboratory of Dr. Keith Delaplane. And I just started hearing about small hive beetles and knew that they were an issue and a budding issue. We all were doing background work on looking at where these things were from, and as I mentioned earlier, the only two papers, while they were amazing, but the only two that we had access to were from the scientist in South Africa and the one in Zimbabwe. And that let us know instantly that they were a Sub-Saharan African pest. And we looked at these two papers, and they mentioned this, and what's interesting is, if I get my history correct, the first beetles were, indeed, actually beetles that were found in colonies in the southeastern US. And once they were IDed, there were other states are saying, "Hey, we've got some beetles like this in our collections as well." And they would go back and identify them and they turned out to be small hive beetles. And it kind of pushed back the date that they arrived in the US. And so we believe that they kind of came to the US, just like what you mentioned, in the mid 1990s. It's possible they were here earlier, but we're just not sure. And from there, in 2000, if I remember correctly, they were found in Australia. And then from that point, other bee scientists or beekeepers in other countries around the world were starting to notice that these beetles were present as well. They were found, for example, in Europe. We now know that Italy has an established population. But before they were found in Italy, there had been spot finds in Portugal, for example, of some eggs or larvae, I forget, that were found on queen cages that had been brought in from elsewhere. So we know now that they have established populations in Europe, principally in Italy. We know they're in South America and Brazil and other countries. So now, we've got North America, South America, Australia, we've got Europe, and within the past five or eight years, they've been found in Asia as well. So they're native to Africa. They're in North America, South America, Europe, Australia, and Asia, essentially, they're in every continent now, except Antarctica. And what you'll notice, if you look at the literature associated with small hive beetles, they are often found first, in or around port cities. For example, here in Florida, some of the beekeepers who've been here for a very long time following the small hive beetle issues would say things like, "We were seeing them in the Tampa area, or the Miami area, or the Jacksonville area first." And of course, all of these are port cities. And we heard similar stories from Australia, they'd be in Sydney or Brisbane, important port cities. And we don't believe that that's a coincidence. We believe that it's possible that the beetles were traveling with swarms on the ships or with colonies that were moving around in these ways, or even, inadvertently, with people who were coming in and out of these port cities. So even though I've mentioned every continent, they still have spotty distributions on a lot of these continents. I kind of said Europe, when in reality, their distributions can find us some areas in southern Italy, as an example. Or I've said South America, whereas they've only been found in a few countries. But frankly, Cameron, at this point, given their presence of established populations on all six of those continents, it's just really a matter of time over the next decade, or two or three decades, where they spread to exist anywhere that honey bee colonies exist in these areas. There are a couple of caveats there. We know that these beetles really like to inhabit colonies that are in warmer climates. For example, they've been here for two decades in the US, but they're generally a larger problem for bee colonies in the southern half of the US, rather than the northern half. And that's largely because, likely, that they just don't overwinter well, so even though I believe that they're going to spread in a lot of these continents to a lot more countries that don't already have them, climate seems to be one of those things that limits the distribution of these beetles.

Cameron 43:43
Well, that's interesting to know about. Thinking about one of the things that you said was that if we're expecting that these beetles are showing up in port cities, assuming that we're not shipping bees around, like entire colonies, entire hives, then, how are these these beetles staying on these swarms? Or how are they getting here? It's really interesting to think about. Maybe to kind of help us understand a little bit better about how these beetles are actually spreading and moving and reproducing, maybe you could give us a little bit of an overview of the small hive beetle lifecycle.

Jamie 44:27
Sure. So let's think about this, then, kind of holistically. I'm gonna give a brief overview of the small hive beetle lifecycle and then maybe talk about how it could lend itself to the transportation of this pest elsewhere. So the adult beetles, the male and females, are really good fliers. We're not exactly sure how far they fly, it's one of the outstanding research needs, but we know that they're reasonably good fliers. They will fly into these honey bee colonies, usually, we believe, kind of dusk or during the evenings or night. So these beetles are going in, they're going into these colonies and the males and females will mate. We're not exactly sure on the number of times that they mate, how often they mate, etc. But we know that they mate. The females will lay eggs in cracks and crevices about the nest. Now, some of the research I did when I was a PhD student is we would see that these female beetles can lay eggs in brood combs. They can actually bite holes in the cappings or the sidewalls of the cells that contain brood, and then they'll stick in there ovipositor, which is this long appendage that can protrude from their rear end and stick into these cracks and crevices or holes and brood cells. They'll lay eggs, and then out of these eggs or come young larvae. These are very mobile larvae. Unlike a lot of other beetle larvae, small hive beetle larvae are very mobile. They'll eat brood, pollen, or nectar. We know that they have to have a protein source in order to develop appropriately. So while they will eat honey and nectar, we believe that they have to grow on a protein source like brood or pollen. So once these larvae finish growing, finished consuming all the food that they need to grow, they will exit the hives, usually, in the evenings, and they will exit the hive and burrow into the soil around the nest. And they literally pupate in the soil. Once they tunneled down into the soil, they will excavate these little cavities in which they pupate. After they finish pupating, they will crawl out of the soil as adult beetles and then fly off to find new colonies, either the colony under which they're pupating in the first place or other neighboring colonies. So, we get this lifecycle that when conditions temperature and food resources are optimum, it can be, three weeks to complete that lifecycle. We also have some evidence that if the conditions aren't optimum, for example, it's cold or the food resources aren't available, it can take four to six weeks before they'll complete this lifecycle. But nevertheless, all of these things can contribute to their spread. For example, the fact that they fly contributes to their spread, the fact that a lot of beekeepers have migratory operations where they will move the bees around can contribute to their spread because they're moving them around in colonies. And think about it. If you've had this huge flush of beetle larvae into the soil to pupate and you move your colonies away, they go pollinate a crop, well, now you've got all these beetles that are going to come out of the soil three to four weeks later, these adult beetles. Well, they're going to have to fly to find the nearest colonies to inhabit. When I was a student doing a research project on beetle distribution, when I was watching colonies swarm or abscond in response to having beetles in the nest, we were seeing beetles come out of the colonies

with swarms, we found beetles in swarms. And when we hive these swarms, we found beetles and the clusters going in colonies with them. We know that shipping traffic will oftentimes have swarms on them. We now know that beetles, adults, are able to trick bee adults into feeding them. So it's possible. It's not been demonstrated, but it's possible that while beetles are in these clusters of bees, they're able to trick bees into feeding them. There's been some speculation that adult beetles might be able to travel on fruit because of research projects that have shown that adult beetles can feed and even reproduce on fruit to low degrees. There's been some speculation that in containers that include soil, perhaps they include beetle pupae that are in the soil pupating. So all of these things contribute to their movement. We know that there's a lot of widespread shipment of bee products, bee packages, queen bees in cages, wax, honey, things like this. And so one of the suspects for transporting these beetles around have been bees or bee-associated products that have been moving and all of this is made possible because of the lifecycle that beetles have.

Cameron 49:00
Well, that's really interesting to hear about. I think you can appreciate this as well. But I mean, as both researcher and a beekeeper, when I learned about some of these honey bee pests and pathogens, my first thought is like, "Ah, like so frustrating when they're affecting my bees and harming my colonies." But then, the scientist part of me is like, "This is just so interesting, so cool to learn about how they can be so effective." But coming to the beekeeping side of thinking about, so we know a little bit now about their lifecycle but, what is the actual harm that they are causing these honey bee colonies?

Jamie 49:45
Yeah, absolutely. I'm gonna go from the least harmful to the most harmful. One of the interesting things that was discovered about small hive beetles is during the feeding process, they will defecate. That's pretty common for the larvae and the adult beetles, that's common. When you eat, you poop. That's just one of the things that happens in life, right? But what's interesting about beetle feces is we believe that these feces will promote the fermentation of honey or nectar in the nest. So what happens is when these beetles are feeding and they're reproducing, you will start to get this fermented bubbly honey, and you get this, what we call, slime outs. So these beetle larvae are tunneling through the combs. They're eating pollen and brood and honey, and then you start getting these slime trails associated with these larvae. And on top of that, when a colony is stressed, for whatever reason, queenlessness, Varroa, we believe a lot of stressors can promote these mass reproduction events for beetle larvae. So what does all this mean? So you've got a colony that's stressed for whatever reason, well, you get these adult beetles that will move in, they'll start reproducing, the females will lay eggs and you get this explosive reproduction. I happen to be one of the people who think that when beetles are present in an area that you always have beetle reproduction, right? Otherwise, where do the adult beetles come from? So you've got this kind of cryptic, low-level reproduction of beetles in the typical standard healthy colony. Healthy colonies are combating the beetles, they're keeping them confined to the nest perimeter, they're hygienically removing beetle eggs and young beetle larvae, etc. And all of this is keeping beetle populations relatively subdued and suppressed. You get this cryptic reproduction, but nothing explosive. But for some reason, every once in a while, either due to colony stress or some other factors that we haven't figured out yet, you can get this massive beetle explosion in reproduction. So you get a lot of larvae that come on at one time. And with all of these larvae, you get this massive

slime produced, you get extreme amounts of brood being consumed, you get this extreme amount of pollen being consumed, you get this honey sliming out and being tracked everywhere in the colony, and you get these colonies that will collapse. So most of the time, bee colonies seem able to handle beetle pressures. But for whatever reason, be it the colony is stressed or some reason we haven't identified yet, you can get these massive explosive reproduction events that will just cause colonies to collapse very suddenly. And I remember when I was up in Georgia, and I was hearing about this down in Florida, I almost didn't believe that it was the case because the bees that I was working with in Georgia seemed to be able to handle beetles. But when I came to Florida and started running research projects, I'd get a colony that was completely overwhelmed by beetles for an unknown reason. It was queenright, the Varroa were controlled, I couldn't understand why the beetles were a problem, but they were and the colony died. And then, the beetles just seemed to march right on down the row of colonies taking out otherwise seemingly healthy colonies. So it's really amazing how all of this happens. And there's so much that we don't know about it. But I will say the principal reason these colonies ultimately collapse is just the feeding habits of the larvae. They just slime out everything. And it's almost like the morale of the adult bees that are left behind is just beat down. It's almost like they're no longer able to do anything about this. Once it reaches a critical number of beetle larvae that are in the nest causing this damage, it's almost like the bees just give up. So you get these colonies that collapse. And in some circumstances, it can be so bad the bees just completely abandon the nest. We call that absconding behavior. So when colonies are overwhelmed by beetles, they will often abscond. So collectively, you get colony collapse, you get colonies that are underperforming, you get colonies who are having to divert resources to addressing beetles, and all of these can affect the bottom line for beekeepers.

Cameron 53:59
Yeah, as I already mentioned, I mean, before I moved to Florida, I had never seen a small hive beetle. And so kind of getting here, at least within the probably the first year or so, when I first experienced a slimed colony and saw that, I felt that horror that you're describing. When you can see all these adults in there and you're just waiting for it, you're like, "Well, it looks like the bees are okay. It looks like they're handling it okay." And then all of a sudden, the next time I'm in that hive, there's just a big mess, and it's just really disheartening. So can you share with us, maybe, some ideas of what beekeepers can actually do? What are some control options for small hive beetles?

Jamie 54:41
Well, it's interesting. It's interesting to think about small hive beetle control management and the associated, what I call, paranoia with small hive beetles. What you tend to see when beetles first move into an area, you get all of these slime outs, you get collapsing colonies, and beekeepers, rightly so, began to absolutely freak out. And as a result, we got all this negative press associated with small hive beetles. And when they first move into an area, people think it's the end of the world. But, two decades into having small hive beetles here in Florida, if you ask Floridian beekeepers about small hive beetles, especially the commercial beekeepers, they largely feel that they have beetles under control. They're a secondary stressor. Now, you contrast that with areas around the world where you're hearing beetles are moving into, for example, Italy. I know Europe is really panicking right now about small hive beetles being present in Italy. Whereas, it's almost like a lot of American beekeepers just kind of moved on. There are other things that we're worried about. Well, you saw it with Australian beekeepers. When

beetles moved in there it was a big freakout, what are we going to do? But now a lot of Australian beekeepers have just kind of moved on. And you see that time and time again, once beetles move into these areas. So what in the world is happening? Well, let me paint a few pictures for you. Number one, beetles haven't ceased to be a problem. When they move into an area, they remain a problem. But what you'll notice is that beekeepers just learned how to live with them. And if you ask a beekeeper, "What happened, why are they not so worried about beetles?" They'll say, "Well, they just kind of lessened over time," when in reality, I think, it's we have done things as beekeepers to help lessen the problem, even if it's kind of subliminally. Let me give you some examples. One of the ways to minimize the impact of beetles is keep strong colonies, manage the diseases and pests that you can manage so that the bee colonies are strong enough to handle the beetle populations that are low initially. Another thing is a lot of beekeepers won't leave dead-outs in their colonies or in their apiaries. It was pretty routine if you left the colony, if you go to work your apiary of 30 colonies and there's 30 colonies there and two of them are dead when you move in. Well, there's no pressing issue to get those two hives taken out because we'll just deal with it when we're back. Well, we know if you leave dead-out hives in your apiary they're just wealth of resources for small hive beetles. The beetles will move in, they'll eat the pollen, they'll eat the nectar, and it'll just serve as a reservoir for beetle reproduction that's just going to inundate your apiary later. So beekeepers are very good about dead-outs. And for that matter, they're really good about weak colonies. Beekeepers who are in areas where beetles are present, they just don't leave weak colonies. If you have a weak colony, you have a nest where the adult bees aren't able to patrol the whole nest, which means there's a lot of unaccounted-for space in that nest that beetles can go in and reproduce in. So a lot of beekeepers have developed an incredibly low threshold for weak colonies. If a colony is even remotely weak, they will take it out themselves, combine it with a strong colony so that there's no resources available for small hive beetles. That kind of lends itself to hygiene in the honey house as well. A lot of our beekeepers would have collected supers and just collected supers to extract maybe for weeks before they actually get around to extracting them. Well, you can't do that anymore. If you start stockpiling supers in an area where you want to extract them later, a week or two later, and you come back a week or two later and beetles are present, you're going to have a bunch of slimed out supers. So a lot of beekeepers have kind of adopted the policy that they'll take off supers and extract it the same day to minimize the impact of explosive small hive beetle reproduction in the honey house. So collectively, a lot of these little subtle management practices, making sure your colonies are queenright, making sure that diseases and pests are controlled, making sure the dead-outs are taken out instantly, making sure the weak colonies are combined instantly, a lot of these cultural or mechanical or management-based control practices have really lessened the impact of beetles. And there are, of course, a few chemical options that American beekeepers have accessible to them, i.e., Gardstar that you can put on the ground around colonies to control the beetles that are pupating in the soil. There was CheckMite+ that you could use in colonies to control adult beetles. But what has really happened in colonies was this explosion of trapping for small hive beetles. You know, Beetle Blaster, AJ's Beetle Eater, the West Beetle Trap, and just so many more traps that beekeepers are starting to put in colonies to trap and capture adult beetles. They'll just use some very basic attractants like apple cider vinegar or vegetable oil or they might put in mineral oil as a killing agent, but this idea that they're constantly trapping and taxing adult beetle populations. I know some people have experimented with using nematodes. Nematodes are these nearly, but not quite, microscopic worm-like creatures that live in soil, many of which have an affinity for attacking beetle larvae of all kinds. So people have experimented with using nematodes to control small hive beetles. But you know, I've said a lot. But basically, it boils down to a few basic things, good hygiene, keeping your honey houses clean, taking out the dead-outs, making sure your weak colonies are combined, keeping the other diseases and pests that you can control controlled so your colonies can be strong and healthy, make sure your colonies are queenright, etc, and then using lots of traps in advance of beetle problems. I know here in Florida, when we do our research projects from, say, July to October, we often put beetle traps in colonies, because we anticipate having beetle problems. So all of those things collectively are things beekeepers do to help minimize the impact of beetles in their apiaries.

Cameron 1:00:55
Well, it just kind of reinforces this idea that, as a beekeeper, nowadays, beekeeping now is probably very different than it was 30 years ago, in the amount of time that you just need to actually spend with your colonies iand in making sure that they are healthy and okay. And so beekeeping is no longer probably just a really easy hobby that you might do when you occasionally have spare time. I mean, you actually, sounds like you need to be active in your management. So one more question that I'd like to ask is, what do you think the future -- what research is needed for small hive beetle?

Jamie 1:01:41
So there's a lot that I could say here, but I'll try to keep it basic, Cameron. Obviously, I mean, obviously, we need a lot more and even better control options available to us. And so that's going to be research-based. It is obviously a very bad thing that small hive beetles are spreading around the world. On the other hand, there is some good that's going to come out of it, right? There's always a silver lining. And that good might not be immediately obvious to a lot of people, but I'm encouraged by it. When small hive beetles were in North America, there were North American bee scientists who studied them. In principle, he said small hive beetles were mainly a problem in the southeastern US. That's where they were studied. Well, now that they are spreading to South America and Europe and Asia and elsewhere, there are a lot of other labs. There has been an explosion in labs looking at small hive beetles and studying small hive beetles. There has been a huge explosion in beetle research. There are Australian scientists and South American scientists, European scientists, African scientists, North American scientists, etc. Asian scientists looking at this beetle. And as a result, I think there's going to be an explosion in beetle control research. I think that research is needed. And I think it's happening, I think it's going to happen even more and more. And I believe that we will have really good control options for small hive beetles, in what I hope will be the near future. I also believe we need a lot more research on beetle biology. These small hive beetles, I think you mentioned in one of your comments earlier, these small hive beetles aren't just an interesting pest problem. And let me give you an example. We talked a lot about beetle management, lifecycle, etc. There's a lot that I didn't tell you about just based on time. When small hive beetles show up in colonies, the bees actually put them in prison, and they will keep them in prison. They station guard bees at these prisons. I did a lot of work on this when I was a PhD student in South African. My colleagues and I even discovered that the small hive beetles that are in prison can coerce their guard bees into feeding them. So just biologically, small hive beetles are fascinating to learn about, this prison system, this feeding mechanism, how beetles are able to beat the bee defenses and incorporate themselves into the lifecycle of a honey bee colony. So just from a biological perspective, there are students who are interested in exploring really cool stories. There's a

lot of that research. So the biology of the beetle, the behavior of the beetle, the control of the beetle. And also we need to know more about how the beetle is spread, and what its flight and movement capacity is. I know that some colleagues of mine are looking at these very topics, but we just need to know a lot more. So, again, one of the bad things about beetle spreading is a lot more beekeepers are encountering this pest and they're having to address it in their apiaries. But if there is a silver lining, it's that it's opening the world to being able to study this particular pest. I'm encouraged that we're going to be able to get a better handle on it over time and I think we're going to learn a lot of cool things in the interim.

Cameron 1:04:49
Well, thank you for sharing with us. I mean these beetles are just interesting and tricky little buggers. I mean,it's good to learn about as beekeepers. It's good to know what your options are, and at least to just have this mindset that you have to do something. You have to at least be aware of what to do when you start encountering beetles. And so what you've shared with us today is going to be really helpful towards that end. So thank you for taking the time to do that, and I'm glad that I had an opportunity to sit down with you and interview for this.

Jamie 1:05:26
Yeah, thanks, Cameron. I think it's odd because as someone who's being interviewed, I think, "Gosh, with small hive beetles, there's so much more that we could cover. " I always tell the people I'm interviewing, "Hey, we need to have you back on in the future, because there's a lot about this topic that we can talk about." And I really feel that way with small hive beetles. So thank you for being willing to interview. I appreciate it.

Cameron 1:05:47
We'll have you back on the podcast.

Jamie 1:05:49
I think that would be a good idea, Cameron. Thank you so much. But if you've been listening to this topic about small hive beetles, we're gonna make sure and include a lot of links about small hive beetles, some of the information that we provided here at the University of Florida in our show notes. So make sure you look out there. Of course, I'll be happy to be a guest again on Two Bees in a Podcast to be able to talk a bit more about small hive beetle biology, behavior and control. So thank you guys, for listening to this segment of Two Bees in a Podcast, and Cameron, thank you for being willing to interview me about small hive beetles.

Cameron 1:06:18
Absolutely. Thanks again.

Jamie 1:06:19
Thanks, everyone.

Stump The Chump 1:06:21

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

Amy 1:06:33
Welcome back, it is question and answer time. And we have had a ton of questions coming in so I hope you all are patient. I think we have like 1200 listeners a week, Jamie. So we've got a lot of questions coming in. Anyway, you ready for your questions?

Jamie 1:06:49
I think I am. Yep.

Amy 1:06:51
Okay, so the first question is from someone named Todd. He emailed us and asked when queen bees sleep or rest or if nurse bees sleep or rest. I guess you would kind of assume that foragers are active all day, and then they sleep at night. But if you don't leave the hive, and it's dark all the time, I would probably sleep all day if it was dark all the time, so how do they know the difference?

Jamie 1:07:13
All right, these are all interesting questions. I've got a pretty short answer. The funny thing is that most bees sleep or rest. I hate to use the word sleep. So I'm going to use the word rest. Most bees sleep most of the time. I used it again, sleep.

Amy 1:07:28
Wait, I was about to say, are you going to use rest or sleep?

Jamie 1:07:31
I was asleep while you asked me the question. So anyway, so what I discovered -- I once wrote a column for the American Bee Journal where I talked a lot about honey bee biology, and one of the things that came up were the task of worker honey bees. And of course, we all go through all the different things that worker honey bees do. They are born and they clean cells, and they feed the babies and then they take care of the queen, and as they age, they graduate, ultimately, to foraging behavior. And so we've got this saying, "busy as a bee," we call them workers. But if you look at the research, worker bees spend the majority of their time doing nothing at all. In fact, if we called them what they did, we would stop calling them workers and start calling them resters. And this is true across all three bee types, queens, drones and workers. They need to rest. They don't sleep, as it were, but there are certainly periods of inactivity where they do very little. And in fact, if you mark a bee and watch them in observation hive, you'll see that they do that quite a lot of the time. There's no one time they all just stop moving. But bees stop moving when they need to stop moving, they rest when they need to rest, and that's actually a good chunk of the time. So if the specific question is, when do queen bees or worker bees rest, the answer is a lot of the time. So the next time you're watching an observation hive, see how many times a queen just stops and her retinue of workers will start licking her and taking care of her. She's essentially doing nothing, she's resting during that time. Mark a few random workers in your observation hive and see how a good chunk of the time any given marked worker is just standing there. Yeah, there's lots of time where they're working, but there's a lot of time

where they're doing nothing. And so they rest periodically throughout the day and throughout the night when they, quote, need it. And they do more of it in the evening. You do mention that the hive nest is dark, but in reality, there's a lot of light that comes into that entrance. There's this activity associated with the sun being up, the foragers are foraging, so there are lots of ways that bees can know that it's daytime without necessarily having to see light. But regardless of that, they rest a lot throughout the day as well.

Amy 1:09:48
Interesting. So all the workers are getting all the recognition, just like people.

Jamie 1:09:52
That's right. Well, the thing is the way that I teach this, Amy, the way that I teach this is if you watch an observation hive, your eyes gravitate towards the bees that are moving, not the bees that are standing still. And if you watch closely, most of the bees are just standing still. So try that the next time you pull a frame out of your hive or you watch an observation hive. You'll see it's happening.

Amy 1:10:13
Cool. All right, so the second question, it's a little bit long. We received an email, but I do want to read the whole thing, just so that you have a little bit of background of what this person is asking. So Tony was asking, when it comes to seasonal temperature differences impacting bee colonies progressing through the fall to the winter to the spring, we're a little confused about understanding the differences in brood rearing, especially the development of winter bees. So summer bees, they live approximately 42 days, winter bees are said to live for much longer to support the colony without new brood development. This person lives in South Georgia. So, we may have winter temperatures that support brood development, but are there winter bees, quote-unquote, winter bees in the south? And then what makes a winter be developed differently in both versus the South?

Jamie 1:11:03
Yeah, this is a series of comments and questions that's really difficult to give good answers to, but they're great questions because I get the benefit of traveling a lot and seeing what other bee scientists are saying at meetings, speaking to beekeeper clubs, myself, etc. And when I do all of that, I have noticed, in the past 10 years, an explosion of people talking about winter bees, something I had never heard of when I was brand new beekeeper. Heck, for the first 20 years of keeping bees I never heard of it. I knew that there were bees that could live six months during winter and I knew there were bees that pretty much, in spring and summer, work themselves to death in six weeks. But I never thought about the interface, the transition between those two bees. So Tony's asking really good questions. We live even further south than Tony does. The University of Florida is in Gainesville, we're further south than him. But we still get winter temperatures and we still have winter bees. So what does all this mean? Well, the research suggests that the bees that carry the colony through winter are physiologically different than those that carry colonies through spring and summer. It's a little bit more than the bees in spring and summer just work themselves to death. That certainly has something to do with it where the bees, literally, just activity themselves to death. They just move so much through foraging and other things that they just die. Whereas in winter, they have a lot fewer activities in which they have to

engage themselves and so they can live longer. But there's more to it than that. The winter bees are fatter, have more fat bodies, a lot more energy stores, in this case, there's just a lot of physiological differences. So there's a lot of research at the moment, and I would argue almost exploding research at the moment, where people are trying to understand what causes a colony to transition from the production of standard, ordinary workers who do their thing in spring and summer, to those worker bees that are longer lived, who have slightly different behaviors, and that carry the colony through winter. So we don't know the answer to a lot of these questions. People are beginning to outline some of the physiological differences. I pointed out one, fat bodies as an example. But how does that happen? Aren't they all fed the same food? What initiates this trigger? Tony mentioned that he lives in South Georgia. Well, that's a three hour drive straight north for us here where we live in Florida and we live a five hours drive straight north of people who live in Miami. So what triggers the differences in these bees? What triggers the production of these bees? And Tony, we just don't know. We know it has to do with cooler temperatures, shortening day length, we know it has to do with what you mentioned, specifically, about brood production shutting down. And we know it has to do with triggering of different resource availability. We have pollen nearly year-round. So we're able to produce brood nearly year-round, but in northern parts of the US and in the world, or extreme southern parts in the southern hemisphere, when resources are less available, bees won't produce brood during winter. And people are trying to model this out right now because they're trying to answer the very questions, Tony, that you're asking. So I hate to leave you hanging and say we just don't know a lot about it. But what I will tell you is just watch over the next five to 10 years about how all this research on this topic is going to lead to a lot of answers and help us understand this better. But the reason this is important is because there tend to be high winter losses for a lot of commercial beekeepers and they want to know what they can do to ensure the production of quality winter bees when they would ordinarily need to be produced, July, August September, so that their colonies have a high likelihood of surviving winter. So this is important and people are beginning to look at it. So I'm excited to see where this goes.

Amy 1:15:01
Yeah, that's awesome. All right. So the third question is from Dave and he listened to your podcast on Nosema. I want to say that was last week's episode.

Jamie 1:15:11
It was in fact, yeah.

Amy 1:15:11
Yeah. Wondering if there's a direct feed microbial biotic that's been studied to see if it may help control Nosema.

Jamie 1:15:17
Dave, there's a lot of people who are producing probiotics, or what I would call feed stimulants, at least that's what they call it. They're making claims that these are good for the gut microbiota of bees. But I would argue that the jury's still out. There's not a lot of data to support these claims at the moment. So why does this matter in the first place? Well, we all know that humans, we humans have things in our

guts that help us digest food. In fact, Amy, I don't know if you know this, but we actually have more foreign cells in our bodies than we do human cells in our bodies. A lot of the bacteria --

Amy 1:15:52
Ew, that's so gross.

Jamie 1:15:54
Basically, our human cells, our human bodies are just a big huge ecosystem for all the other things that everything lives in. And likewise, honey bees have important bacteria and fungi and other things that live in their gut that are important for honey bee survival. So just like I mentioned, this concept of winter bees is really starting to gain a lot of traction, and people are researching a lot. This concept of having good microbiota is beginning to change a lot of thought processes for commercial beekeepers who are now recognizing that it's important that our honey bees are not just healthy without, but they're also healthy within. So Dave, to your specific question, I'm not aware of any products that have actually been tested at the university or USDA or federal lab level, looking at how some of these things are beneficial to honey bees, even though I know that there's a lot of companies that are claiming that their products are. With that said, I do anticipate a huge surge in literature on this very topic in the coming months and years, just because it's something people are focusing on at the moment. So, there are some anecdotal reports on some of these products. But what I would just say is use some of these products, experiment with them, but don't necessarily put all of your eggs in one basket until we know more about these things.

Amy 1:16:02
We're just trash. It seems like there's a lot of research that could potentially be done. So I think that's pretty exciting.

Jamie 1:17:16
Oh, my goodness, Amy, two of the three questions that you asked about, you asked about sleep and rest, you asked about winter bees, and you asked about the microbial probiotics, the winter bee one and the probiotic one are things that students galore, postdocs galore are starting to look at. And I really expect a tidal wave of information coming out on these topics over the next five to 10 years because they have direct management implications. So I think supporting this research is important. Beekeepers, attend your state, national and international meetings, so you can hear the cutting-edge answers to these questions you're posing.

Amy 1:17:50
Awesome, thank you. Hey, everyone, thanks for listening today. We'd like to give an extra special thank you to our podcast coordinator Lauren Goldstein and to our audio engineer James Weaver. Without their hard work, Two Bees in a Podcast would not be possible.

Jamie 1:18:14
For more information and additional resources for today's episode, don't forget to visit the UF/IFAS Honey Bee Research Extension Laboratory's website ufhoneybee.com Do you have questions you

want answered on air? If so, email them to honeybee@ifas.ufl.edu or message us on Twitter, Instagram or Facebook @UFhoneybeelab. While there don't forget to follow us. Thank you for listening to Two Bees in a Podcast!