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SPEAKERS

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

Jamie 00:10
Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research and 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 today's episode, Two Bees in a Podcast will be joined by Dr. Madeleine Beekman from the University of Sydney in Australia. She's a world expert on worker honey bee policing behavior, specifically in Cape honey bees. So she'll be talking with us about this fascinating topic. In our Five Minute Management, we're going to talk about the benefits of starting colonies using a nuc. And of course, we'll finish today's podcast with a question and answer segment where Amy and I answer questions that are provided by you, our listeners. Hello, everyone, and welcome to this segment of Two Bees in a Podcast. I'm really, really, really excited about this segment because we're talking about two topics that are very interesting to me, one of those being worker policing behavior, but the the second of those Cape honey bees that are engaged in this behavior. We have a world expert on this topic with us. Some of the members of my lab were fortunate to watch the 2021 American Bee Research Conference where this scientist was the keynote speaker on this particular behavior, and that scientist is Dr. Madeleine Beekman who's from the School of Life and Environmental Sciences, the University of Sydney from Sydney, Australia. Right now, she is a fellow in Germany at the Wissenschaftskolleg Zu Berlin at the Institute for Advanced Study, where she'll be through a few more months here in 2021. Madeleine, thank you so much for joining us on Two Bees in a Podcast.

Guest 02:21
It is my pleasure. I love talking about bees.

Jamie 02:25
That's good because the topic that you're here to talk to us about today, I'm super excited about. I shared with you behind the scenes, I was fortunate to do my PhD in South Africa with Randall Hepburn,

where he got a graduate student working on worker policing. Cape honey bees are near and dear to me. So I'm really excited to get ready and involved in this interview. So before we get there, let me just ask you a little bit about yourself. Could you introduce yourself to the listeners? How did you get into research with honey bees? How did you end up working with Cape honey bees? Specifically, anything else you want the listener to know about you before we kind of get into the main topic here?

Guest 03:03
Well, actually, I used honey bees as a tool because I did my PhD on bumble bees when I lived in the Netherlands, where I'm from originally. So when I did my PhD, people were interested in trying to see if they could breed bumble bees year round. So bumble bees, unlike honey bees, are annual social insects. So the queens, when they've mated, they go into a diapause or they overwinter. And that's, of course, what you don't want if you're a breeder, because you want to have queens without them going into diapause. And then somehow, someone figured out that if you put baby bees, bees that have just emerged in a cage with a bumble bee queen, they sort of keep her awake so she doesn't go into diapause. So when I was doing my PhD, I needed access to all the queens and all the colonies. And I had a colony of honey bees to get the baby bees from. And so I have to admit that my love of bees didn't start with honey bees, but it started with bumble bees, but I can assure you having spent five years breeding bumble bees, they stink and honey bees are much nicer.

Jamie 04:14
We like all bees here. We're not going to discriminate against any bee, obviously,

Amy 04:18
Honey bee might be offended.

Jamie 04:21
Maybe so.

Guest 04:23
So that's how I started keeping bees. Then after I did my PhD, I moved to Sheffield in the UK to work with Francis Rennicks. Initially, I worked on ants. He had a project for me that he really wanted to have done on ants. And at some stage, he said, "Well, what if we go to South Africa?" It was myself and another postdoc, Steve Martin, at the time. We were contemporaries for a little while because Francis had just hosted a researcher who was then in Pretoria, Theresa Wossler. So Theresa did her PhD with Robin Crewe and Francis had invited her to come to Sheffield. And obviously, she had completely convinced him that Cape bees were the best bees on the planet. So Francis organized a field trip for himself, a PhD student who had them, myself, and Steven Martin to spend three months in South Africa. And that must have been in 2000, I think. So this was when I first was introduced to the Cape honey bee. But this is not the normal Cape honey bee. This was what we call the clone. So this lineage of Cape honey bee workers that have been going around ever since 1990 destroying honey bee colonies. So we weren't actually there to really understand normal Cape honey bee, but more this aberrant clonal lineage, which, they're interesting, but it's definitely not a normal bee. So that was my first introduction to Cape honey bee, and haven't left them alone since then.

Amy 06:02
When I heard you speak at the American Bee Research Conference, you were one of the keynote speakers. And first of all, I really just liked your presentation style, I thought it was very practical. I thought the information you had was very applicable, and it was just fun to learn about. I think, at that moment, when you gave the presentation, I had messaged our podcast coordinator, and I said, "Hey, you need to email Dr. Beekman because we need to have her on our podcast." During your presentation, you were talking about worker policing, and that was part of your introduction. So you were talking about that behavior, and so we wanted to bring you in to talk about worker policing behavior. I know that worker policing behavior is something that Cape honey bees exhibit. So can you tell us about worker policing and what that is?

Guest 06:48
Well, policing behavior is just what it is. It's policing behavior, where the workers basically make sure that the other workers don't do what they're not supposed to be doing. Now, then you may ask, "Well, what are they not supposed to be doing?" And in this case, they're not supposed to be laying eggs because the rule is it's the queen who does all the egg laying, and the workers do all the working. But they're almost human, the workers, so they like to cheat. Cheating, in this particular context, is then trying to lay an egg in a cell without anyone noticing, and then hoping that all the nurse workers will raise your egg to become a son, because of course, the worker bees cannot mate so they can only produce sons. The trouble is, so that's a great idea, if you can sneak your egg in, then you can produce your own sons instead of just doing all the hard work. But the problem is that all your sisters and all your half sisters, because your mother isn't that faithful, she mates with a large number of males, so you have sisters and half sisters, they don't like it when you do that, because they want to produce their own eggs too. So you have this interesting scenario where everyone basically wants to cheat, but they don't want the other ones to cheat. So what do you do, then? Then you invent a police force. I mean, you probably would like to rob a bank. But if everyone else would be robbing a bank, we have a bit of a banking problem. So, therefore, we have the police force that makes sure that we don't start robbing banks. And it's quite similar with the work of bees. Now, the Cape bees are actually not so good in policing. So I did a study. I think it was actually the first year that I was in South Africa, where I went from Pretoria, which is where the Cape bee doesn't originate, because it's not in the Cape, but where they have become parasites. I went down to the south to the actual Cape to see if you had a bee colony, if their workers would also police. The reason why I was interested in asking that question is these bees, these workers can clone themselves. So when they lay an egg, it's basically genetically identical to themselves. And then you can imagine that if all the workers would be laying eggs, provided they also do work, then it's not costly to the colony, because they just produce other workers. And indeed, someone, years ago, did a theoretical paper in which he predicted that the selection worker policing, which would be much less strict in capensis, or the Cape honey bee, than in normal honey bees where the workers can't clone themselves. And I wanted to simple test it. Lo and behold, the Cape bees are not that good at policing. They do do it to some extent, but they let a large number of eggs through, and that's basically because many of them are just too busy being cheaters themselves. And I guess you can't be a cheater and police person, woman, in this case, at the same time.

Jamie 10:09

So being a scientist and hearing scientists talk about their research just only serves to produce about a thousand questions. It's always hard for me to stick to a script anytime we interview someone speaking about a subject that fascinates me, like worker policing behavior. So let me ask two questions that are a little off script, if I may. Number one, you mentioned that Cape bees aren't great at policing. So per that statement, we can expect this behavior, I guess, to exist in the other subspecies of Apis mellifera. Alright. And number two, when you say worker policing, quote, stopping other workers from laying, do they do that behaviorally by nudging workers or attacking workers? Or do they do it by aborting their offspring when the workers lay eggs? So, again, question number one, is this behavior present in the other subspecies of Apis Mellifera for those that are not capensis? And number two, what exactly is this behavior, the aborting of eggs, the agitation of workers trying to lay eggs, etc.?

Guest 11:12
So let's start with the second question, and I probably should have explained this in first place. So I think, Fischer alone, I think it was Fischer, but I'm not 100% sure, suggested that workers recognize other workers who have active ovaries, so workers that are sort of about to lay eggs, and that they would harass them, and that harassment itself would be enough for the workers to not lay eggs. Now, people have been trying to repeat the experiments he has done in our lab. I think it was a student, Ben Oldroyd, I can't remember how long ago, so they basically had workers that they knew had activated ovaries because of a race on queen's conditions, which is when workers tend to activate their ovaries for reasons I can explain later, if you want. So they knew which workers had active ovaries and which ones didn't have active ovaries. And then they put them all together in an observation hive and basically watched which of the bees got harrassed by the other bees. And they found no difference between bees who had active ovaries and bees that didn't. And if I'm not mistaken, other people have also tried to repeat those experiments. So there's no evidence that workers can actually recognize workers who have active ovaries, which is interesting. I'm probably going off topic a little bit, it's interesting because in ants, workers can recognize it when other workers have active ovaries. And this is because they express more vitellogenin and the other workers can smell it, and then they are punished, which is beautiful work by a former colleague of mine, Thibaud Monnin, who was also a postdoc in Sheffield. The point is, with bees, because the workers provide brood food to the larva, they produce a lot of vitellogenin because they need to produce this brood food. So vitellogenin titres in honey bees are not an honest signal of reactivation. So that was a long answer to one question. So the policing basically consists of the workers being able to recognize an egg that is laid by a worker and not by a queen, and they remove all the eggs that have been laid by workers, and they can tell because the queen is somehow capable of marking her eggs. Now, again, my colleague, Steven Martin has spent way too many years trying to find out what that mark actually is, and as far as I know, he has never succeeded. There was also a group in Israel who worked very hard on trying to see what the chemical signal is, if there is a chemical signal. So we don't know what the signal is. But we do know that the queen leaves her royal mark on her eggs, so her eggs are not eaten. Eggs laid by workers are eaten. And as always, when people ask me multiple -- oh, yes, I remember your first question. Your first question was, do we find policing in other species? Am I correct?

Jamie 14:42
In other subspecies of Apis mellifera, specifically.

Guest 14:46
Yes, we do. So again, this was work done by Ben, in particular, and his students, and you can say it was just an excuse to go to Thailand. So he spent years doing fieldwork in Thailand, not trips, field trips, regular field trips to Thailand to study the Asian honey bee. So there's Apis mellifera, Apis cerana, Apis florea, Apis dorsata, and other species, and he wanted to know whether they also have worker policing. And in every single species they've ever looked, they find worker policing. So it seems to be quite conserved. And I think they even swapped eggs between species to see if the signal that the queen uses is also conserved. And I think they do recognize queen-laid eggs when they come even from a different species. And I think that's quite amazing. So it's nice, I think, that this is one evolutionary signal that's apparently so stable that all the different honey bee queen species use it.

Jamie 16:01
It is pretty mind boggling. I think back to just a generic Apis mellifera subspecies, maybe even using capensis, because it's by no means generic. But I agree that it's the most fascinating of all the Apis mellifera subspecies. I wonder what percentage of workers in a colony are cryptically trying to lay eggs? I know we're all aware of laying worker colonies, when the colony goes helplessly queenless, you can get workers whose ovaries develop, but in the presence of a queen, has any research been done to determine what percent of workers are actually in there trying to slide their eggs in without other workers noticing?

Guest 16:39
That all depends on when you look in the colony's lifecycle. So there's is classic paper from Greg Fischer, I think it was 1984, where he used some form of color morph, which makes the boys stand out because they have a different color. So he could use that color morph to look at the drones and see how many of those drones were offspring of workers. And he found that that was a very low percentage, and that's the percentage that everyone always mentions, which is less than 0.1%. But that was not what we found in our colonies. And admittedly, the Australian bees tend to, of course, originally, they just come from Europe, because they're not native to Australia, but they seem to behave a little differently, because we saw often evidence of worker reproduction, even when the queens were present. And then, also, it was our work in South Africa that showed these capensis workers or the Cape honey bee workers, they lay eggs so often. So we just wanted to see, well, okay, how many workers actually contribute to work reproduction in a normal Apis mellifera colony throughout the year? And then it turned out that the workers, there's basically two periods in which they tried to lay eggs. One is when the colonies are raising new queens. And that, of course, makes complete sense, because when that colony, your own colony is raising queens, it's very likely that colonies in the neighborhood are doing the same thing because it's the right time of the year. So that's when you should try and produce a drone if you're a worker, not when there's no queens around to mate with, to potentially mate with. So they are what we call the anarchists or Ben Oldroyd called them the anarchists when he first discovered them in the early 90s. But then there's this other group of honey bee workers and they have been called the rebel workers by a group in Poland. And unfortunately, I can't pronounce the names because my Polish is non-existing. They found that when honey bee workers are still larvae, when the old queen has left because the colony has formed, the new queen is either not yet merged or she is not mated, in any case, she hasn't started laying eggs yet. In that period in which the colony is semi-queenless in the sense that it doesn't have a laying queen, these workers

have more ovarials, which means that they can, in principle, produce more eggs and are much more likely to activate the role for ones that adult and are much more likely to lay eggs. Now, the big difference between the anarchistic workers that lay eggs, their colonies swarm and the rebel workers that lay eggs after swarming is that the rebel workers cannot mimic this queen egg marking pheromone because their eggs are all removed. So they try to lay eggs, and they probably successfully lay eggs, but they're never raised. Anarchists, they somehow and again, we don't know how, we don't know what the signal is, but they somehow managed to get their eggs through, in a sense that the police workers don't recognize their eggs as being worker-laid. So those are two workers that have been found in Apis mellifera, the two kinds of workers that have been found on Apis mellifera to be engaged in worker reproduction. And that's just in Apis mellifera. Although, you have to be a bit careful with all the different subspecies. And then, also, I already said in capensis, which is also, don't forget, a subspecies of Apis mellifera, Apis mellifera capensis. They do police but they don't police as rigorously as non-Cape honey bee workers. We know that the African bee, which you in the US know as the Africanized bee, Apis mellifera scutellata, they also show the normal worker policing behavior as far as we can tell. They're not the nicest bees to work with, as you know. So getting data on them is quite tricky.

Jamie 21:21
I've not heard the distinguishing biology of the anarchist versus the rebel workers. It's interesting to me that there are rebel workers at all if their eggs are possibly never raised to adulthood. So that's an interesting kind of dead end in evolution, it seems like. Do worker bees police when a colony is headed exclusively by laying workers? This is a question that I've come up with, Madeleine, when I was listening to you. But I think when you talk about the anarchist versus the rebel workers, etc, I think I might know the answer. But I'd love to hear you discuss it. In other words, in this scenario, a colony goes queenless, and perhaps multiple workers began to lay eggs. Does this policing break down?

Guest 22:00
Well, it does, and it makes complete sense that it does because especially when a colony is hopelessly queenless, and of course, the colony doesn't know it's hopelessly queenless, it just knows whether it has a queen or not. So if it doesn't have a queen, then it makes complete sense for the workers to start laying eggs because it is going to die if there's no new queen. Then the best thing to do is try and produce your own sons, so at least these sons will hopefully have a chance of mating with a virgin queen from a different colony. Some of the genes, at least, from that colony will be transmitted to the next generation, even though the probability is probably very, very small. And that also explains, then, why those rebel workers are so sensitive to the absence of the pheromone that a normal mated queen spreads through the colony because this is how the workers know, inverted commas, that there's a queen, and that they're probably better off keeping a lot of ovarials because apparently those ovarials are trimmed or pruned during the larval development if they get the correct pheromonal input. And if the pheromonal input isn't there, because there's no queen then that pruning of the ovarials in a developing larva doesn't take place. So the resulting workers can have more ovarials, which means that they potentially can lay more eggs. You can see it as a sort of selfish behavior from the individual workers' point of view. But of course, it completely benefits the colony as a whole. In case, this new queen will never emerge, or she will never mate or whatever, all bad things can happen to virgin queens before they actually become laying queens. So it's sort of a safeguard. So that's really what the rebel workers are. So maybe being a rebel, the word rebel is not quite fair on the workers. Maybe they should be

potential rescuers of the colony. I think that would be nicer than calling them rebels. They're not really that rebellious. The real rebels, of course, are the anarchists because they lay eggs when they really shouldn't. But because the term anarchists was already taken, I guess the Polish group couldn't call their rebels anarchists too, and they came up with the term rebels.

Jamie 24:45
Yeah, it's really fascinating when you think about a honey bee colony. One of the first things you learn in social insect biology is this idea that so many female reproductives forfeited the right to reproduce and, of course, in honey bees and other hymenoptera, people often try to explain it through haplo diploid, how you're more related to your full sisters than you are to your own offspring. But it's still fascinating, nevertheless, that you've got one queen, tens of thousands of workers and that all these workers have, we're taught, have forfeited the right to reproduce, but as we've discussed with you today, there's this cryptic reproduction, there's these efforts to get their genes out, even in the presence of a queen through the anarchist bee, through the rebel bees, bees just trying to lay eggs, etc. It's amazing that there's checks and balances in a hive, this worker policing behavior. It's interesting to see a system for capensis where this tends to break down. All of the science and biology behind this is absolutely fascinating. We have lots and lots of beekeepers from all around the world who listen to this podcast. So I'm curious if you've thought about some potential practical applications that result from this research? What are some things that you think beekeepers can take home from all of the science that you and colleagues have performed on this particular topic?

Guest 26:07
I think understanding your bees is always a good start on understanding why they're doing what they do. But that is probably a very scientific answer. So one thing, that is tricky, so Tom Seeley, whom I'm sure everyone knows, over the last few years, he's been going around the United States and other places really advocating for more natural beekeeping practices. And this, of course, has a lot to do with Varroa, viruses like Varroa and factors in the use of pesticides and antibiotics, and you name it. And what he has pointed out is that in many instances, what commercial beekeepers, but not necessarily just commercial beekeepers, but also hobby beekeepers tend to do is quite unnatural, and it may put a lot of stress on the bees, which then means, of course, if your bees are not happy, you're not happy because either they sting you or you don't get honey, etc. So I think just understanding the biology much better allows you to be a much better beekeeper. So it's a very generic answer. What we in Australia are quite concerned about and the beekeepers in particular are very concerned about is that this wonderful Cape honey bee can make it to Australia. Of course, for our scientists, that would just be great because then we can study what happens when you have this weird bee invade in a new territory. But of course, it will be devastating for the local beekeeping industry. So we're trying to understand, part of our research is trying to pinpoint how you can tell a Cape honey bee apart or Cape honey bee colony apart from the neighboring subspecies, the Apis mellifera scutellata, or the Africanized bee. And that has huge implications also in South Africa, because in South Africa, as you know, you not only have the capensis bees, but also the scutellata bees. And there's now this hybrid zone, which is sort of arbitrary because no one can really say where that hybrid zone is because there used to be no genetic markers for capensis and scutellata. So I researched over the last few years and not everything of it has been published, now allows us to pinpoint which colonies are Cape honey bees. So where you expect all this worker reproduction, and basically a breakdown of the whole social structure and the

scutellata where the bees basically tend to behave quite normally. Apart from that, they're extremely aggressive, which of course is another problem. So in that respect, science or our work has allowed a more realistic delineation of that hybrid zone, which I think will become important for commercial beekeepers in South Africa, because they will be able to know more precisely where that zone is, and where they should or should not move their colonies to. Now, they're not allowed to move colonies across that hybrid zone because of the problems that those laying workers have caused in other colonies in Apis mellifera scutellata population. I'm not quite sure if I really answered your question.

Jamie 29:49
I think that's a fun answer. I struggle with this too. In the US, we're obviously interested in keeping out capensis as well. As a scientist, I find it fascinating. Of course, I worked there for three years and even still publish on Cape honey bees now, on markers, the very thing that you're talking about, no less. So clearly, it's an important topic globally because as fascinating as this bee is biologically, it can present a threat, potentially outside of its native range. So I think you hit the nail on the head when you were talking about practical applications. So I really think your research is fascinating. Cape bees have fascinated me since I was privileged to do my PhD in South Africa. I love to see publications come out of your group and think about this policing behavior, think about all that Cape bees are able to do and they really paint a clear picture of how something can be fascinating biologically and scientifically, but still be a threat potentially to an industry such as the beekeeping industry. So, Dr. Beekman, I thank you so much for joining us on this episode of Two Bees in a Podcast.

Guest 30:50
It has been my pleasure. Thank you very much for inviting me.

Jamie 30:54
Absolutely. Everyone, that was Dr. Madeleine Beekman from the School of Life and Environmental Sciences at the University of Sydney in Sydney, Australia. Currently, a fellow in Germany at the Wissenschaftskolleg Zu Berlin, at the Institute for Advanced Study. Everything we talked about with Dr. Beekman, we'll make sure and link in our show notes so that you have access to our website and some of the manuscripts that we discussed, as well as other topics related to what we discussed in this particular segment. So thank you for joining us on this segment of Two Bees in a Podcast.

Honey Bee 31:33
Have questions or comments? Don't forget to like and follow us on Facebook, Instagram, and Twitter @UFHoneyBeeLab.

Amy 31:47
It's that Five Minute Management time. If you're listening to this episode and haven't listened to the episode right before this, on the last episode, we talked about the benefits of starting with a package of bees. So Jamie, for the Five Minute Management, I'm going to start right now and ask you what are some of the benefits of starting with a nuc?

Jamie 32:08

Well, Amy, as you've implied, there's multiple ways to start a colony. As you said in the previous episode, we talked very briefly about some of the benefits of using packages of honey bees as your brand new colony. Well, now, we're going to talk about some of the benefits associated with using nucs or nucleus colonies as your brand new colony. Number one, the chief benefit that I see in using a nucleus colony is that they are established colonies. Now, it's important to know that a nuc or a nucleus colony is simply a small colony. It's a mini colony. Instead of being a full size colony that might have 10 frames per box and multiple boxes, it's usually three to five frames and a much smaller box. The benefit, though, of buying colonies this way is that they're established. You get combs, you get five frames of bees, five frames of brood, honey pollen, you get a laying queen, usually you get a very strong colony, the nuc producers want you to continue to purchase from them. So they're usually selling you high quality colonies that are really ready to explode, right? The moment you purchase a nuc, usually, you'll move it over into 10 frame or more frame equipment to get it in that growing and expansion phase. So purchasing a colony that's ready to go is always a benefit. A second benefit to using nucs is that they tend to be cheaper than full size colonies. They are a little bit more expensive than using a package as your starting colony because you're getting more, you're getting combs and honey and pollen, etc. But they're much cheaper, usually half the price or less, than purchasing a full sized colony. So price is another benefit. A third benefit is one that maybe many people don't think about but I think it's one worth considering. When you purchase an established nuc, you are able to do an inspection to confirm that you're not inheriting or purchasing someone's diseases or pests. I mean, you could open that hive and inspect it and see what you're getting. With a package, you don't really get that, right? You just get adult bees and you're not really sure if they're harboring any diseases or pests that you don't want. But with a nuc, you can do a standard bee inspection first and say, "Hey, is there evidence that there's a widespread Varroa issue? Is this queen a good queen? What's your laying pattern like? Are they defensive when I work with them? Am I seeing evidence of American foulbrood or European foulbrood or some of these other diseases or pests that you don't want to have?" So starting with an established colony, even if it's a small nuc, gives you the opportunity to know really what you're buying. You're not just buying bees, you're buying some evidence of a colony. You can look and see if you're getting really what you're paying for. And so I think those are the three chief benefits of using nucs. Nucs are wildly popular here in the US these days, as well as around the world. There are lots of individuals who are growing their businesses to focus on the production and sale of nucs exclusively. And really, there's a lot of people making a lot of money selling nucs. And I think it's a very popular way. So for those of you who want to start colonies with nucs, there's lots of benefits. But just as an added bonus to this Five Minute Management, you might consider producing and selling nucs yourself, because there's certainly money to be had in that as well.

Amy 35:25
Great, you did it in less than five minutes. And so I guess since we have another minute, I'm just going to ask you, what do you recommend? Starting with a nuc or starting with a package?

Jamie 35:35
Well, Amy, if it's just my pure opinion and personal preference, I would always say you need to do a package at least one time. But I personally prefer to start with nucs. I will say there was a paper that came out or a talk that I watched recently, I can't remember which of the two it was, it was trying to provide some evidence that packaged colonies expand faster. The nucleus colonies, because nucleus

colonies are already established, they already kind of know what they're doing, and they're in a focused growth phase. But with a package, what you're buying is you're buying essentially a swarm. And a swarm is programmed to grow and grow fast, build comb fast, expand fast. So some beekeepers believe that you get that with packaged. That said, I still feel like there's added benefits to starting with nucs, and that's where I tend to point people. So once you've started with a few nucs, go back and try a package or two and see what what you think. I mean, a lot of beekeeping is about personal preference. So try both, see what you like, but I tend to start with nucs myself.

Amy 36:39
Great. There you go, folks. That's what we have. Five Minute Management. I hope you all are enjoying this segment, and we will continue to release more very straightforward topics for you all.

Stump The Chump 36:56
It's everybody's favorite game show, Stump the Chump.

Amy 37:12
All right, it's our question and answer time. We have questions about nematodes and nectar flow and hygenic genetics.

Jamie 37:21
Alright. What a combination. Looking forward to it.

Amy 37:24
Exactly. Okay, so the first question we have is do nematodes survive in the winter? And what do nematodes have to do with honey bees?

Jamie 37:31
Yeah, those are questions that probably need to be answered. So, nematodes are worm-like creatures. They are not worms, but they're worm-like creatures that are incredibly tiny. The largest nematodes can be seen with the naked eye, but they're still quite small. And a lot of them need to be viewed under a microscope to be able to be seen. I've once heard it said, and I have no way of knowing if this is true because I'm not a nematologist, but I've once heard it said that nematodes are the most abundant organism on the planet, that if we could snap our fingers and make all matter disappear, you'd still have the shape of trees and dirt and all that stuff because nematodes are everywhere. They're still in those things.

Amy 38:11
Did you know that they're on our eyebrows too?

Jamie 38:13
Yeah, I know that nematodes are in lots of places. Yes, let's just put it that way. So the thing about nematodes is most people interact with nematodes because nematodes can be pests for gardens. "Nematodes are causing all these problems for my tomatoes," or whatever. Well, nematodes, all of them have very specific diets. Some eat plants, some eat insects, I mean, whatever. So the reason this

individual was asking this question is nematodes, in context of small hive beetles. I did a research project years ago looking at the impacts of nematodes, soil dwelling nematodes, on small hive beetles that pupate in the soil. And the idea is that there's this whole science built around what we call intimopathogenic nematodes. That would be nematodes that eat insects. So, how this works is there are soil dwelling nematodes that specialize on insects that live in the soil. Since small hive beetle larvae crawl into the soil and pupate there, perhaps there's some nematodes that could eat or kill the pupating small hive beetles. And what these things do is they go through the soil looking for insect prey. When they find it, in our case, the small hive beetle, they burrow into that developing beetle, they regurgitate bacteria, that bacteria produces a toxin that kills the developing insect, and then the nematodes slurp up the juice as it were. So some nematodes, a few nematodes go in, hundreds or maybe thousands of nematodes come out. It's biological control. So if you can find nematode species that are dangerous to or kill small high beetles, then maybe you can augment their population, put them on soil around the colonies, they'll burrow into the soil and basically be either ambush predators or heat seeking missiles looking for small hive beetles. And as you might guess, there's probably not a nematode that's specific to small hive beetle. In fact, there'd be just a nematode that likes beetle larvae in general. So, the beetle larvae that are likely to show up around our colonies in the soil would be small hive beetle larvae. So, a long time ago, maybe 10, or 15 years ago, my team and I looked at how nematodes can be used to kill beetles in the developing stages of small hive beetles in the soil around colonies. So we did a lot of lab-based studies. We also did some very controlled field studies. And in all of those studies, we had remarkable success, killing small hive beetle pupi in the soil around colonies. And right when we were going to do a large scale field trial, something called colony collapse disorder started being talked about and all of our resources and attention got diverted, and we've never followed up with that. So to make a long story short, it is very likely that small hive beetle pupi can be attacked with the application of nematodes around colonies and it has to be a very specific species, I can make sure that that particular paper is linked in the show notes. But I'm stopping short of making broad recommendations of their use, because we're just not quite sure if it's worth the money. Yes, they can kill pupi, but how long do they last in the soil? Do they go from year to year to year? Which brings back the question the questioner actually asked, do they survive winter? The short answer is they do. These things are biological organisms that live in the soil around your colonies anyway. In fact, the the species that we tested are native to the region where we were doing the tests. So they're there already. The bigger question is do their populations sustain well enough from year to year to year to where you can make one application and expect extended benefit? That's the question we can't answer. We don't know if these things need to be applied multiple times per year, from year to year to year, or if you just put them out once where you have a sustained population that lives in the soil forever, and you never have to do it again. But the specific answer to this specific question is yes, they will survive winter. But we still don't know application rate, how often, all of that stuff that we feel like we really need to know before we can make broad recommendations on their use.

Amy 42:27
Yeah, now I'm just wondering what that would even look like as far as application goes. Do you just get like a pill bottle worth of microscopic --

Jamie 42:35

Actually, what we did is, the individual supplier we were working with would rear them up in the lab and actually, in wax moth larvae, wax moths are used very commonly in insect research in general, but rear them up in wax moth larvae, isolate them, and ship them to us on gel. And we would put that gel in a watering can like you water your flowers with, you fill up with water, and you'd sprinkle the water around your colonies. And then you'd go back with a hose and kind of water them in. If you do this kind of late in the evening to avoid sunlight damage, it's a really good way to get those suckers into the soil. So yeah, that's how you do it.

Amy 43:11
Cool. All right, so the second question, is there a way to extend a nectar flow? And what are some heavy duty nectar producers that can be grown in pots?

Jamie 43:20
Yeah, all very good questions. Now, if you're asking are there ways to extend the nectar flow there's really no way to do it for any one species of plant, right? The plants are tied biologically to what's going on that time a year. So the only good way to, quote, extend a nectar flow is to plant things that continue blooming after nectar flows are over. For example, if your nectar flow traditionally stops at the end of May, maybe you would look for some June or July or August blooming plants. So that's the research that a lot of folks are looking at right now. We can plant a lot of things that bloom during what we call offseason or after the main nectar flow. The problem is finding things that produce copious amounts of nectar. There's not a lot that you can plant that produces copious amounts of nectar. Some exceptions, of course, clover, some variety of sunflowers, buckwheat, maybe some cotton, I think of things like that. But there's just really not many great options with wildflowers. A lot of the wildflowers that are produced, produce some nectar and a lot of pollen, but really not copious amounts of nectar probably in the way this listener is asking the question. And the next question is what are some heavy duty nectar producers that can be grown in pots? Well, there are a lot of things, there are a lot of answers to that question and it all depends on where you live. I know, for example, where we live, honey bees absolutely love African basil. African basil is something that's easily grown in pots. Bees really like to use it. We see them there all the time. There's some trees and shrubs, vytex, the chaste tree, there's a lot of things like that. But I would say it's region specific. So the best way to get that question answered is to contact your local county extension agent or to network with other beekeepers in your area who are very aware of very nectariferous, nectar bearing plants that can be grown in pots around where you live. I want to back up just briefly and say the answer to that first question, is there a way to extend a nectar flow, really, I'm telling you, I want to emphasize, that is the subject of a lot of ongoing research for labs around the world. Everybody's trying to figure out how to extend nectar flows, how to cultivate plants that are good during the offseason, plants that aren't just showy, but that actually provide lots of nectar. So hopefully, we'll have better answers for that in the coming years.

Amy 45:44
And that are not invasive, right?

Jamie 45:46
Key, key, key. African basil, for example, is not native here in Florida, but it's sterile. So it can be grown from cuttings. We're not so worried about taking over the environment. So that's a very important

consideration. You don't necessarily want to use invasive plants in pots around that might take over your yard or your neighbor's yard. So that's a very important point. Amy, thanks for raising that.

Amy 46:09
Yep. All right, so the third question. So this kind of stems from all of our talk about hygenic genetics and hygenic queens and just tolerant bees in general. And so this person is asking, could a hobbyist beekeeper successfully integrate any of these taller and/or hygenic genetics into their apiaries?

Jamie 46:29
Yes.

Amy 46:30
I'll start with that. And then there's a couple of other questions after that.

Jamie 46:33
Yes, yes, yes. Absolutely. A lot of people think this is something that only the commercial beekeepers can do and that's not the case. Anyone can purchase and use hygenic stock. And I'll tell you, the concerns that a lot of people have, "Well, we've only got three colonies, and we put that queen in there, and she only lives six months. Now, her daughter, who may be pure hygienic stock is going to open mate with drones out there that may dilute. " That's true. And so what I tell people is if you are going to invest in hygienic stock, you're either all in or you're all out, you can't be halfway. So if you're all in using hygenic stock, I recommend requeening your colonies once a year with a queen that you purchased from a queen breeder who's producing that hygenic stock. I like to have spare nucs or nucleus colonies on hand that are carrying, for me, some queens of the same hygenic stock that I got from the same place. So if one of my production colonies, my queen doesn't last a year, she only last six months, instead of waiting to put a new hygenic queen in that colony next year, I'll use that nuc to requeen that colony and then I'll purchase a queen from a hygenic stock and requeen that nuc. So that's my point is you gotta be all in. A lot of people will buy them one year and expect to get a few years worth of protection, when you can lose that trait very fast if that original queen dies, and the colony tries to rear a new queen that open mates. So I like to at least requeen once a year with this hygenic stock and maybe even have a few spare ones on hand in nucs that I can use to requeen those colonies whose queens don't last a year. You're either all in or you're all out. But you can do it as a hobbyist.

Amy 48:11
Got it. Yep. So the second part and the third part of the question was how to deal with the dilutions by open mating. And so your recommendation is just to requeen and have backups.

Jamie 48:20
Exactly. You can allow your colony to open mate. That's fine, if you don't want to purchase that queen because you've already fed it a queen this year, but I would definitely requeen that colony next year, even if the queen is only six months old. If she's open mated, she instantly diluted what you paid for a year ago. So requeening once a year addresses that.

Amy 48:40

Awesome. All right. Well, these are great questions. So, everyone, keep them coming. We look forward to hearing everyone's questions. They're all so fun and creative. 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 49:10
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!