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SPEAKERS

Amy, Stump The Chump, Jamie, Guest

Jamie 00:10
Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere. In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast. Hello, and welcome to another episode of Two Bees in a Podcast. In this episode, we'll be talking with Elina Niño who's from UC Davis, and she'll be discussing with US drone contributions that impact queen success. In our Five Minute Management, we'll be talking about stimuli that leads to swarming in honey bee colonies. And of course, we'll finish today's episode with our question and answer segment. Hello, and welcome to another episode of Two Bees in a Podcast. We've got a really exciting episode for you today, and that's because we're joined by Dr. Elina Niño, who's the Apiculture Extension Specialist for the University of California Ag and Natural Resources Cooperative Extension in the Department of Entomology and Nematology at UC Davis. She's going to be talking with us about drone contributions to the success of queens. Elina, thank you so much for joining us. I'm really excited to have you on our podcast.

Guest 01:52
Absolutely. Jamie and Amy, thank you for inviting me. I think this is going to be a great, great little podcast. I'm excited to talk to you. And thank you for that great introduction. It I know it's a mouthful, so it's appreciated.

Jamie 02:02
it's it's okay, you know, you're well-deserving of it. So we're looking forward to chatting with you and Elina, you might know this, but one of the things that we get questioned about all the time is queen quality, queen quality, queen quality. So we almost always talk about it. From the queen management perspective, how can we address it, with queens, how can we recognize it, but you're going to come at it from a different angle, but it's equally important: drone contributions, right, to queen success. Before we get there. Since this is your first time on the podcast, we always like to have our first time guests,

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you know, introduce themselves talk a little bit about how they got into bee research, how they ended up where they are, etc. So could you do that for us?

Guest 02:40
Absolutely. I can absolutely introduce myself. I've done it many, many times now over the years when I first started it in disposition at UC Davis, I definitely introduced myself to beekeepers, and the first thing I would tell 'em always is that I'm actually from Bosnia. So if you hear a little bit of an accent, that's where it's coming from. I've lived in the United States since 1999. And I've worked with bees for about the past 13-14 years. I am a mother of two boys. So they're very, very active, and I've realized, you know that during this pandemic time, that's sort of the first thing that I am, we tend to forget that right? We get bogged down with work and thinking about what we're doing. But I realize that first and foremost, I'm a mother of two little boys, and they're finally back in school. I also have a dog, Coco and you hopefully she's not going to bark when we're while we're doing this,

Jamie 03:37
It'd be okay if she does.

Amy 03:39
She's welcome to join she can say hi!

Guest 03:41
That's right. So I started my career, if you will, as a scientist in an entomology... actually it was an animal science program at Cornell University and then I ended up in an entomology lab, working with veterinary entomology topics such as poultry pest management theory and beef pest management. And in fact, I got my master's degree at NC State University. Back oh, I don't even want to say when, I got the degree in working on dung beetles, so I worked with dung beetles and their contributions and benefit and beneficial contributions to the dairy and beef industry. So that's always been sort of my first love. But then I got married and my husband said, oh, you know what, you you kind of smell bad. So you tend to find something um to do.... (chatter) Yeah. But I got my master's again and Christina Grossinger happened to move to NC state at that time, starting her own bee lab and I thought, "Hey, that's pretty cool, my dad used to keep bees." At that time. I probably wasn't as into bees as I should have been, but I was very young, right, when you're young and you don't pay attention to the important things. But I thought, I'm going to go and ask Christina, if I can join a couple of her lab meetings, and I was hooked. As you know, bees are super cool. So they were doing all these crazy things and I didn't realize they were communicating primarily via pheromones. And obviously, they have the dance language. So I think it was really the communication of the honeybees that got me interested in it and then that was the time when all of the new molecular techniques started coming out. So it was really the great time to answer some of the questions that are still lingering with honey bees, and one of them being what are these seminal contributions of drones that are contributing to honey bee queen health, and really thinking about not just as you said, queen quality, but thinking about the fact that we need to support the drones as well, if we want good quality queens,

Amy 05:53
I always feel like when people are talking about drones, you know, the only thing we normally say is, well, the drones get kicked out, right? And so like what we always tell everyone, and everyone's like,

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oh, oh, cuz the drones don't do anything. They don't, you know, they don't clean, they don't help around the colony and so that's usually our first that's what we introduce the drones to our audience as.

Guest 06:15
Yes, we do. And in fact, I think we were chatting about a little bit earlier, I'm talking to a group of undergraduates, I have a class that I'm teaching this semester. And that's literally one of the slides on my last presentation by last lectures, like, they really just are there to mate. And I don't know what the age of your audiences are. But and you can cut this out if you need to. But I've heard drones being referred to as the flying bags of sperm. So, they have--

Jamie 06:42
I have heard the same thing as well.

Guest 06:44
Yeah? They've heard the, they definitely get sort of the brunt of the jokes, right, "don't be lazy like a drone." So I think they we have now started to pay more attention and be more aware of their importance and the importance of having a healthy population of drones, which are going to contribute to that genetic pool of your mating queens. In fact, when we were when we would get our packages in the spring, often they would have queens that are just not well-mated, and they would fail, I would collect the queen open up the sperm, or open up the queen to look at the spermatheca. And it would be sort of marbled a little bit, not very... very, very clear, right. So we started preaching, if you will, about the importance of drones and importance, if you are producing queens, the importance of making sure that you have a really good healthy population of drones in the area where you're mating your queens, right, so providing good nutrition, providing space for the queens to lay those drones earlier than you would be producing your queens of course, in our master beekeeper Queen Production course, we talk about the importance of timing. So you don't want to start rearing your drones and supporting your drones after you begin producing your queens right, you want to ensure that those drones are starting to be produced well in advance of when you're planning on producing your queens. So there they are, they really are important. Again, they are we joke about it, but they're very important to keep the queens well-mated, because some of the research that I've done when I was working on my PhD and my doctorate has found that the queen's that are mated with or that have been artificially inseminated with eight microliters versus one microliter of semen are much better quality. And in fact, what always amazed me and I guess that's what how I got into the bees is that the workers themselves can perceive that the queen's that were instrumental inseminated with eight microliters of semen versus one microliter of semen smell better to them, and they're going to support those queens longer. And in fact, when we took these studies out of the cages and put in into the hives, the queens that were one microliter-inseminated queens, were attempted to be replaced by workers much more often than those that were inseminated with a higher volume of semen. So it's clearly that research has showed that the good mating and mating with enough good drones is crucial. In fact, those one microliter-inseminated queens didn't overwinter as well. Those colonies didn't overwinter as well. And this was in Pennsylvania so they didn't overwinter as well as those that were headed by queens that were inseminated with a higher volume of queen. So, higher volume of semen, semen. So clearly there are long lasting effects of the mating that happens early in the spring.

Amy 10:11

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Yeah. So, you know, when, when Jamie and I were talking to our podcast coordinator about what we wanted to talk to you about, I remember, Jamie said, you know, really, we could talk to her about so many things. I mean, there's so many things that you've been working with and of course, being in California, where the majority of the the migratory beekeepers end up at some point of the year, you know, I'm sure that you have seen and heard and worked with it all. And, you know, you've talked a little bit about the significance of drones, can you elaborate a little bit more on that, and you know, what you're talking about the quality of semen and the quality of a mated queen? And so I guess, can you talk to us about what that actually means.

Guest 10:51
So semen, it or I guess I should start by saying that drones do produce obviously spermatozoa, right sperm that is eventually going to fertilize the egg of the queen. But what we forget is that the sperm actually has the supporting seminal fluid proteins, their seminal fluid components. And what's really neat about that is there's quite a bit of work that was done by my colleague now period, University of California, Boris there, I'm collaborating with, there has been a lot of work done by him on evaluating what these seminal fluid proteins are actually doing for sperm, alright, and for the queens themselves. So sperm needs these seminal fluid proteins that sort of ushered into the spermatheca, right? And then it produces and provides protection from oxidative stress. It also provides energy for the sperm to be able to survive within this queen spermatheca for years, of course, they're contributing seminal fluid, or spermathecal fluid proteins and other molecules that are contributing to preserving that sperm so it can actually again survive in spermatheca for the length of time that we normally think that the queen's lives so sometimes upwards of two years even. Of course, it's a little less common now because beekeepers tend to requeen the queen or requeen the hives quite often, but sperm indeed does contribute quite a bit to the health of... or semen, I should say, semen contributes quite a bit to the health of the sperm and spermatozoa by providing the energy and sort of protection from the potential other stressors when they're in the spermatheca. So they can survive longer. And in order to have good healthy sperm and semen right, you need to provide work or need to provide drones that have been fed with good nutrition. They have been protected from potentially pesticide exposure. One of the questions that we are interested in asking and it's kind of been a little bit of a slow going because it's so difficult to work with Varroa mites as you know, Jamie, we're trying to see what the impact is Varroa mite feeding specifically on seminal fluid proteins because they can have such negative impacts on honey bees otherwise. So all of this to say that we still don't know everything that is going on. And the roles that the drone semen plays in terms of supporting bee queen health. And that's what's so exciting about it, right, we're sort of learning about it as we, well, as we as I've been going through my degrees I've been learning more and more about it. So we are still I still talk about this field as of it being maybe now in its toddlerhood, when I first started, I would say it was in its infancy, but now it's probably more in its toddlerhood. And we still don't know as much as we know about, for example, Drosophila seminal fluid proteins, seminal fluid proteins in Drosophila have been pretty well characterized. There are some work somewhere over 300 different proteins that we know of and we almost know what all of those individual proteins are specifically doing and contributing to the female health. And that's in fact, where we're headed in my lab and I did have a postdoc who recently left for a job, a real job. She was trying to dissect the contributions of specific and individual seminal fluid proteins to all of these different changes that are happening in queen physiology and queen, even pheromone composition for example and molecular changes after she mates.

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Jamie 15:00
So that's where I wanted to go kind of with some of the line of questioning it's it's pretty interesting that you had mentioned that this is kind of in its toddler years. One of the things that we commonly hear from this, the guests that we have on our podcast is that, you know, there's so so much we know about honeybees, but so much more we don't, right? And so, it's interesting to hear that you say that that's kind of where this science is. So let's think about it from the queen's perspective. Right? So we're really talking about drone contributions to queen success. So what are the some of the changes that queens undergo during and after copulating with drones?

Guest 15:36
So one of the things that first starts happening when the queen copulates with the drones, of course, there are changes in her molecular mechanisms, right? So this is, this is the often the time when I talk about this in my presentations, when people start taking a snooze, right, so I tend not to talk about this a lot, but there are definitely,

Amy 16:04
We won't fall asleep.

Guest 16:05
Thank you, your your listeners might, but they can just pause it and join later, the queen's first start undergoing these molecular changes that are then driving changes that are more visible to us, right. So these molecular changes are changes in, for example, in immune gene responses of queens. So from some of my work, when I was instrumentally inseminating queens. And granted, that's not absolutely the same as the naturally mated queen. But it's the best way of course, in which we can control matings, when we were doing instrumental inseminations we did see that the queens and we know that, in fact, from naturally mated queens as well, they upregulate a lot of their immune response genes, right. So it seems like they're almost priming to be more responsive to any potential challenges, immune challenges that these queens might encounter in the hive. So that's one of the examples in which the queens benefit from copulation long term, right. And then, we also saw that there are changes in again, molecular gene expression analysis, when we look at it, there are changes that are driving changes in pheromone composition of the queens so you all if your beekeepers know that queens produce tons of pheromones, we often think of them as egg producing factories, I always mentioned that they're also pheromone producing factories. And these pheromone play, pheromones play a role in social organization of the hive. They cause physiological and behavioral changes in workers, of course, but these pheromones change drastically after the queen completes the mating. So the queen is more attractive to the workers, right, after she mates. The workers tend to her more readily, they create this really nice retinue. And in fact, I show videos in my classes that I teach for the Beekeepers and of course, the undergraduates the difference between the responsiveness of the workers to the queen, before she mates, so the virgin queen. And then after she mates, before she mates, there are no really workers around her, they kind of are, they touch her and then she was sliding on the frame and then she moves off and the workers don't really follow her. They know they'll take care of her sufficiently so she can, obviously, survive and they push her out to mate after she comes back, mated and she starts egg-laying, oh, my gosh, that retinue is beautiful, right, you can see all of the workers that are touching her and they are antennating her and licking her. And they're so excited about her being there. They take good care of her, right. So all of these changes, as I said that are

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more visible to us, are regulated by these large molecular changes that are not visible to the naked eye, but are really dramatic when you look at it on, you know, RNA sequencing or when you're looking at it when I was doing it, I was working with micro arrays. So there are large changes that happen, obviously, and of course, one of the things that I'm talking about in the classes right now is swarming. So, the queen after mating, she doesn't leave the nest anymore, right unless she's going to swarm. So she doesn't leave the colony. She's not quite as receptive to the light, she starts egg-laying again, all of these visible changes are driven by these large gene expression changes or transcriptional changes within the queen herself. And all of this is sort of in response to the presence of the seminal fluid components, a lot of it is, one of the things that we did see is that the changes can also be driven not just by the seminal fluid components, but also the volume of the semen that the queen at least during instrumental insemination has been exposed.

Amy 20:24
Yeah, that was what I was gonna ask what's the role of the drone semen in the queen's?

Guest 20:29
Yes. So the volume itself was really interesting. So the volume of the semen that the queen has been inseminated with almost signals to the workers, right, signals that the queen was mated. So volume: 1 versus 8 microliters semen, the workers can actually tell, hey, this queen has been mated and is better mated. But when we talk about seminal fluid proteins, right, it seems like they are driving these more subtle differences in pheromone production to the workers at least. And the workers can sort of sense how well the queen was made it not just that she was mated but also how well she was mated. So it's very, again, it's very, it's always been really interesting to me. And I'm really excited to figure out the next steps in the process of how we can separate these seminal fluid components, and then manipulate those to see which specific proteins, and which specific components, of the semen are driving the specific changes. And I always tell beekeepers, because of course they're always like, "Oh, who cares," right? "What do we care about that we know what happens after the queen mates, that's enough." But one of the things that I will tell them is think about the longevity of the queen, right? So if we can identify specific proteins, and I'm just going to for the purposes of clarity, keep saying seminal fluid proteins, although there are other components that could be playing a role. But if we can find and identify a protein that would increase the longevity of the queen, and you had a really good breeder, queen that still has a lot of sperm, right and has has enough sperm to keep on going. Right? Wouldn't it be nice if you were doing instrumental insemination in your, in your operation, if you can provide extra dose of this longevity protein, and you now have a breeder queen that you can utilize for even longer, then you might have been able to do that before, right. So again, this is I'm aware that this is not something that's going to happen, you know, tomorrow, but those these are the goals and again, we still are learning so much about bees that to me to stay exciting.

Amy 23:01
So I had a question, would you say that it uh, queen is better made it if they had more drones that they made it with or more quality drone semen.

Guest 23:12
So when I was doing my research and working on this what we were doing for this particular project, we actually mixed the semen from many drones to reduce any potential differences due to genetic

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differences in those drones. So when I was doing the project, we were inseminating queens with the same pool of semen, we just varied the amount that the queen received, right? So presumably, to us that was sort of saying if there are enough drones versus if there are not enough drones in the drone congregation areas, for example. Now again, I the next steps would be to think about, let's say drones that potentially were exposed to Varroa mites, then we're talking about the quality of the semen potentially that would be impacted by the mites. We haven't made it there yet. But clearly, feeding and nutrition impacts the protein composition of any living things, as we've seen with nutrition, for example, can impact or influence the immune gene expression of a variety of workers, right. So it would only stand that the nutrition would translate into potentially improving the seminal fluid or seminal fluid proteins in the drones. But again, we're getting there.

Jamie 24:49
So Elina, you talk about the volume and quality of the semen or seminal fluid triggers these y'know, this cascade of impacts of the queen in the queen I wonder, is there any evidence the physical act of copulating triggers any of this? I mean, did you ever have groups of queens that you, you did all the instrumental prep, but you put the needles in, but didn't insert any semen, I'm wondering if there's any physical act contribution to queen development,

Guest 25:19
There is. There absolutely is. So there was, there was a study exactly where we did exactly that we actually treated queens as if they were about to be mated, but they really we didn't inject, so to speak, or introduce anything into their genitalia, right. So there was just that act of placing the instrumental insemination needle within the genital tract of the queen. And we did see some of the changes that were very similar to the changes of the naturally mated queen. So it's not what we did, we looked at the contribution sort of, of the carbon dioxide, right? CO2, which is commonly used for knocking out the queen, if you will, during during instrumental insemination. And in addition to changes on the molecular level, right, that we saw, that were driven by the exposure to carbon dioxide, we also saw additional changes in the queens that were just manipulated, right, but didn't have anything introduced into the genitalia of the queens. And we did see that there was a stronger impact of the genital tract manipulation than just CO2 alone. And most of those changes were mostly visible in the excuse me, in the brain gene expression of the queens and they looked more similar to the queen's that were mated. Right? So there are definitely additional impacts on the copulation of the copulation itself without even presence of the semen. The complicated process.

Jamie 27:04
Yeah, it really is. One of the things that, you know, is impressed upon me by beekeepers is that they will routinely say, you know, queen related issues, we've got queen related issues, and sometimes they mean shortened longevity of the queen, sometimes they mean, maybe they're, you know, not laying as many eggs or they run out of semen or whatever. And then I think about it, you know, your research suggests that yeah, you know, a lot of it could be specifically with the queen herself. But it could just be the simple act of copulating with, you know, how many males the volume she's receiving and the quality and then you think about all the potential impacts of stuff on drones. You've been mentioning Varroa. We had earlier people in interviews, talk about temperature, we've had people talk about pesticides. And so when I think about the applicability of your research to Beekeepers, you know, what can they do part of it makes me just want to run scared, you're right, there's nothing we can do. You

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know, it's so hard to improve drone quality when there's all of this working against us. So, you know, what is what does your research say that we can do to address, you know, the drone half of queen quality?

Guest 28:12
So can I run away now, Jamie, just

Amy 28:16
No, because I'll be stuck here.

Guest 28:23
So that's a good question. And that's exactly what beekeepers asked right, until we saw the satisfying when I have to tell them well, you know, hold on, I have a few more years of research to do to be able to, with certainty answer that question, right. But I think it's so disappointing for them to hear and I think this is where some of the other areas of research in my lab come in. There is no silver bullet so it's pointing to them to hear is like well manage your Varroa make sure your bees are healthy and fed and make sure that you provide if you have access to plentiful forage and diverse forage, and that's really one of the areas that we're working on again in the lab, in terms of controlling Varroa. We are also in the lab working on evaluating a variety of different potentially novel Varroacides, which then would lead to the contribution of keeping the colony healthy and also the drone population healthy. Right. So I think it is it's very dissatisfying and I can't you know, a lot of eye rolls and shaking heads and research, you know, is taking forever, but we're getting there. I mean, we I think we're getting there to understanding better what are some of these things that the beekeepers themselves can do? And one of them really and I'm not the only one who says this right. The research community now agrees that provide nutrition for your bees, and that's especially important for us here in California. Yeah, where we have a lot of dearth periods. So I've been talking to beekeepers, especially if they're not necessarily experienced beekeepers, I talked to beekeepers all the time about providing that good protein, and providing the you know, nectar or sugar that the workers need that the drones need to go out and fly and mate. Right. So providing that new good nutrition I see as being one of the big pluses and big positives when it comes to managing the colonies and drone health. And then of course, dealing with Varroa management. It's been, it's tough. I mean, last year alone, I've been talking to beekeepers, from beekeepers, who had, you know, a few colonies and back to those who have thousands of colonies. And they had for some reason, particularly bad year when it comes to Varroa mites. But anything you can do to support healthy colony population, which can then produce these healthy drones, and start your management earlier in the season, and and I keep thinking in terms of California, because we almost don't have the time where the queen's don't lay, so support those colonies throughout the season throughout the year. Right, not just oh, the colonies about to start getting bigger and start increasing in size. It's, you know, March, let's feed it now. If you're here in California, right, or even other places that you have a long turn season, think about these things all year round, not just during the times that you think bees are active. So, again, it makes me sort of leaves me sad that I'm not able to provide you know, that silver bullet answer, but it is that's the reality of things. Right. But for a lot of the beekeepers for us as well check your colonies and do anything you can to keep them healthy.

Jamie 32:06

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So I think so this, this is off the cuff, but I think that really does a good job covering it. Do you think Elina, there's stuff we need to ask, is there more questions you want us to ask? Or do you want to suggest? I mean, I think you did a good job with that with that statement.

Guest 32:23
Yeah. No, as I said, I just always feel feel bad. When beekeepers asked me "What should I, what should I do? What do I do? Like?

Jamie 32:32
I think you've answered it appropriately. I think you're fine,

Guest 32:34
Yes, like, just go just go for it and go forth. And at least you know, appear in the area where I am, at least we don't have small hive beetles to deal with I always think about the colonies that I saw in Florida when I was visiting actually Jerry Hayes many years ago, and the beetles were just everywhere. So I am not envious of that. For you guys.

Jamie 32:56
I killed one this morning.

Guest 32:57
There you go. We barely have seen like yours.

Jamie 32:58
Helpin the world one beetle at a time,

Amy 33:00
Good job Jamie.

Guest 33:04
One beetle at a time, and beekeepers here on the coast definitely do have issues with small hive beetle, but us further inland in Davis, even you know an hour and a half away from the coastal region coastal area, we don't have that issue because it gets so hot and dirt is so dry so they can't survive, which is amazing. They can't really reproduce that well. But I do appreciate the fact that you brought up that in the lab we do quite a bit more and it's been really a fun ride. Working with beekeepers in California because they have such a variety of issues and you're trying to you know, touch up on all of those and nutrition especially in the almond orchards. Right. So we've been evaluating different flower mixes for health in honey bees and long term impact on health of honey bee colonies and we did see some so obviously providing a new food and nutrition additional nutrition to the bees is great, in terms of forage. Varroa sides, we've been testing those, there are some that we found that could potentially have some positive impact on Varroa management. And you know, just actually in terms of queen, more direct impact of our queen research. One of my students is currently evaluating different stocks of honey bees. So Italian, Caucasian, Saskatraz, some of the new VSH pole line bees for their performance really in Northern California so we can evaluate what might be beneficial to backyard beekeepers, for example, or what might be beneficial for commercial beekeepers, in terms of the stocks

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that they're working on. So again, that's better, more direct, I feel it will have a more direct and more immediate impact for the beekeepers.

Jamie 35:00
Well Elina, I really appreciate you sharing all that. I mean, you've got one of those positions that Davis is so important you impact the lives of so many beekeepers, and your research is so relevant and I really appreciate you for joining us on this podcast episode.

Guest 35:12
Well, thank you, Jamie, I really appreciate you having me on. And again, Amy, and I know Lauren was involved as well. So thank you for having me. And as you said, you know, I've started so positive thinking about all the cool things that we're doing. And of course, as you said, like sometimes it gets a little depressing thinking about what can we do more and better off to help the beekeepers always keep reminding them, you know, just be patient research takes time.

Jamie 35:37
Thank you so much, everybody. That was Dr. Elina Niño, the Apiary Culture Extension Specialist at University of California Ag and Natural Resources Cooperative Extension Service from the Department of Entomology and Nematology at UC Davis.

35:49
Have questions or comments? Don't forget to like and follow us on Facebook, Instagram and Twitter @UFhoneybeelab.

Amy 36:16
During our Five Minute Management today, we are actually we're not going to talk about management. But in our next Five Minute Management, we are going to talk about basic swarm management techniques. So we thought that we would take five minutes today to really talk about the stimuli that lead to swarming because we feel like that is just as important. Right, Jamie?

Jamie 36:38
Absolutely.

Amy 36:39
Let me know when you're ready. And I'll start the timer.

Jamie 36:41
I am ready.

Amy 36:42
All right, and... go.

Jamie 36:43
I think Amy, like you said the key is, in order to know how to manage swarming, you've got to really know what ultimately leads to it. So, I want to just spend this five minutes talking about the stimuli that

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ultimately lead to swarming, and there's about nine things that I like to point out. And incidentally, swarm management is all about mitigating these stimuli. So let's talk about these in some order. First, there's some biological stimuli, some environmental stimuli, maybe it's a better way to think about it. And these are things like lengthening daylight, warming weather, and increasing nectar availability, right? If you think about this logically, when spring rolls around, the days are getting longer, there's more daylight, the weather is getting warmer and all this leads to a great bloom of flowers that are full of nectar. So these three are intimately tied together. And of course, swarm management, you can't lessen the daylight, you can't cool the weather, and you can't take out the nectar. So really, those three are beyond your control. But there are some things that lead to swarming that happen within the hive. And these are things that we can manage against. And they are things like colony congestion. There's just simply a lot of bees for the unit area that's actually in that hive. And not only there are a lot of adult bees crowding the hive, but there's also very few cells or a lack of cells in which queens can lay eggs, right. So not only there are a lot of bees, but there's just not a lot of place for the queen to lay. Because there's a lot of bees you can get another stimulus, the dilution of the queen's pheromones right over time as that colony gets more and more full of bees. And as you add more and more space and it gets bigger and bigger, you get the dilution of the queen' s pheromones, another stimulus that leads to swarm. As colonies prepare to swarm they will also invest heavily in the production of drones. So when there's a lot of drone comb, they will start preparations for swarming. Also coupled with this is an aging queen. Usually in most swarms, it is the old queen who leaves with the swarm. So the older the queen, the more likely they are to swarm. And then finally, the kind of straw that breaks the camel's back as it is, is the presence of queen cells. When bees are ready to swarm, they start making queen cells. I want to think about all these just very quickly again, I'm going to repeat them. You've got these environmental cues, right lengthening daylight warming weather, all of this leads to increasing resources. That's critical, because it benefits colonies to swarm. when resources are most available. Think about that cluster of bees that left that hive, they now have to go find a cavity in which to make a new nest. They have to build comb, they have to raise brood, and they have to store enough honey to survive the coming winter. So it benefits them to swarm in the weeks leading up to the major nectar flow and during the first part of the major nectar flow because that's when the resources are most available. And of course, all of this starts to happen in early spring. So when these environmental cues start triggering these biological changes in the hive, they start rearing drones. They start growing as a nest there's more bees and less places for the queens to lay eggs the queen is already old. She's usually about a year old at process, right? Colony congestion, dilution of pheromones, she's old, they start building queen cells. And the next thing you know, you have a swarm. So in the next five minute management, we'll talk about controlling some of these stimuli that we can actually manage against as beekeepers. And that really helps when you think about what's necessary to do in order to manage swarming in your colony.

Stump The Chump 40:25
I t's everybody's favorite game show Stump the Chump!

Amy 40:43
Welcome to the question answer segment. We've got three questions for you and Jamie, hopefully, you can answer them.

Jamie 40:49

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I will certainly try my best to promise.

Amy 40:52
So the first question we have so this person says that their friend and I both have bees, how fun is that? Okay, so recently, they started reading about heat treatments for Varroa. They're wondering, you know, what your thoughts are, what do you use? There are lots of different treatments. What are kind of the pros and cons of each?

Jamie 41:10
Yeah, well, Amy, so I've started educating folks about bees, bout 20 years ago and when I first got into beekeeper education, the latest craze at the time, Varroa control was fogging colonies with mineral oil. And they developed these foggers you could dispense mineral oil throughout the hive. And the idea is that it would kill mites. All right from there. The next craze was powdered sugar, you just dust your colonies with powdered sugar and it kills all the Varroa and your your life will be fine. Then it moved into small cell foundation. If you use small cell comb, the bees will be able to control Varroa better and life will be just great. And now we're at heat treatment of Varroa and fogging, small cell and powdered sugar all were shown ultimately through lots of research projects not to do anything really overall beneficial for your colonies. Now I know that'll generate a lot of hate mail. But you know, the science is talking in this case. And so the data suggests that those three things don't really do much for Varroa. So where are we with heat treatment? Why did I give that introduction to answer your heat treatment question? Well, there's there's a compelling body of literature to suggest that Varroa die at temperatures slightly lower than those temperatures that kill bees. And so this has led to a lot of novel thought that if we just raised the nest temperature of the hive to that temperature that kills Varroa, we can kill those Varroa and avoid killing bees. And so all of that's true right Varroa seem to die at temperatures lower than the temperatures at which bees die. So that makes sense. And so a lot of folks are beginning to develop these devices that you can put hives to raise the temperature in those colonies. Okay, that's where the science is stopped. And I don't want you listeners out there to get mad at me, I am not suggesting this doesn't work. All I'm suggesting is the science hasn't caught up with the contraptions that have been built to try to address Varroa this way, it may well be shown that putting these devices on hives, raising the temperature is a fantastic way to control Varroa there just isn't a lot. There isn't not a lot of data out there available. To see regarding this, there's more a lot of anecdotal reports. So this is one of those examples where the use of a device is outpacing the science keeping up with it. And so as a scientist, I usually am quite skeptical about these things, I have to see the data before I'm going to make recommendations that people should use these things. And right now the data are are lacking in this particular field. Again, the data aren't necessarily lacking about Varroa dying at certain temperatures. It's just that the data are lacking regarding using these devices to control the roll. I would say the jury's still out. So maybe in 2, 3, 4 years, maybe even in six months, I'll be overwhelmed by data to suggest that all of these contraptions work that we should be using them. But I would say at the moment, there's lots of compelling data to suggest that lots of other ways of controlling Varroa do work. And so I would say until the data on heat treatment catches up, you know, it's not necessarily something that I'd be recommending people run out and expect it to solve all their problems. That doesn't mean you shouldn't test it. That doesn't mean the anecdotal reports are incorrect. It just means I'm kind of stopping short of recommending it until I see more data related to it. So if you've got some experience out there with a heat treatment of colony for Varroa control purposes, let us know we'll be happy to look at it and see if it's something that will change or do. And like I said, Amy and maybe one

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of those things that we all are using 10 years from now and looking back and going this was a silly time that we ever questioned it. But I will say a lot These devices are quite expensive. So even if they do work, you've got the expense issue, you've got the efficacy issue, you've got the "how do I plug these things up in the field" issue, there's a lot of questions that still need to be answered, I think, in this world before I'm able to make solid recommendations regarding it, but it's certainly fascinating. And I really look forward to seeing where the research takes us in the next few months and years.

Amy 45:24
Alright, sounds good. So the second question we have, this person has been taught that to prevent inbreeding the queen flies to a drone congregation area, a DCA, much further away than drones leaving the same colony by moving a drone source, this person's wondering, aren't we potentially undermining this protection?

Jamie 45:45
Yeah, so let me expand on this a little bit for our listeners for whom this may be a new concept. So basically, queens do not mate in the hub in which they're born. And the reason they don't do that is because the only males available to them would be their brothers. And so queens will fly away from their hives, to go to areas called drone congregation areas where they will mate with drones that are, you know, lucky enough to be the successful drones about the 1000s of drones available. So it has generally been discovered that queens will fly to DCAs further away from their hives than the DCA is to which drones from their hives fly. So drones from the hive will fly about half a mile, maybe to a mile or so away from their hive to these DCAs. And queens, on the other hand, tend to go a mile and a half, two miles or further. And so the biologist and all of us suggests that queens are doing this potentially to avoid inbreeding, I don't know that they're thinking to themselves, "I have to go further to avoid mating with my brothers." But this is something that nature has sorted out and by virtue of sorting this out, queens tend to fly to DCAs that are further away from those DCAs to which drones from the same colony fly. Now, what practical management implications does this have for us? Well as queen breeders, it's very common for queen breeders to flood their queen, apiaries with drone source colonies. And so the biology suggests that this may not be you know, 100% the best strategy because the queen's from these mating yards are going to, in general, and on average, be flying to DCs further away from their colonies and the drones from the drone source colonies in the same yard will be flying but queen breeders know this. That's why they increase the drone density above that would be natural in these mating yards. And furthermore, queen breeders will set up satellite drone source colonies a half a mile to a mile around the mating yard where the queen's are kept. And so as a result of that they've got these nucs, these mating nukes that the queen the virgin queens are being born into, and from which they're leaving to go to these DCAS in the same apiary that will have a lot of drone source colonies. And then half a mile or so around these mating yards, they will put drone source colonies under the knowledge that they need to flood the area with drones that they are selecting just to ensure that queens went on their mating flights will encounter the drones that they want them to encounter more so than drones that are from feral colonies or other managed colonies and then the nearby area less so. And that's how they deal with it. So you're right. To avoid inbreeding queens are going to fly further away. And so it actually benefits queen producers to flood the area with drones. And that's not just the area where the queens are kept, but also the area around them to ensure that those drones are available at DCAs. Does that make sense? It does. But how do you ensure so how... how do they ensure that there are drones? You know, like we're trying to avoid getting too many drones, right? And

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so, we were like, alright, we need to put drones in these areas. Great. And what they do, Amy is, you know, if you think about it from this perspective, we almost always think, Oh, it's so important. The source of the queens that we are producing those queen breeders have to go out and grab from the absolute best queens. Well, that's only half the equation, right that only produces daughters that we that are sold to beekeepers. But that only means that you know, half of the the puzzle's been addressed the other half of the puzzle is drones and so good queen producers aren't only selecting queens from which they will graft, but they're also selecting queens, from which they will allow to make drones and what they'll do is let's let's just say it really simple. Let's just say that they have two fantastic queens. Well, they might graft from one of those to make the daughter queens and from the other of those they will add frames of drone comb so that those colonies would produce more drones than they ordinarily would. And so that is a drone source colony. colony that has been given a frame or two or more of drone foundation, so that they are producing more drones than they ordinarily would. And they are selecting those colonies based on good queens the same way they would select colonies based on good queens for the purpose of grafting. And so they might have two or three or four colonies from which they're grafting, and five or 10, or 15 colonies, that they're allowing to make lots of drones. And five or 10 of those colonies may stay in the same apiary as the virgin queens, right, the ones that are leaving their hubs to mate and five or 10 or so of those colonies might be scattered around half a mile or more away from those mating yards in order to ensure that good selected drones are present in the environment as well.

Amy 50:48
That's pretty cool. So we've got queen breeders I'm probably going to become a drone breeder.

Jamie 50:54
Each his own Amy to each his own.

Amy 50:57
The third person's asking: Is honey from hives treated with Apivar is that safe for human consumption?

Jamie 51:03
Yeah, so, Amy, this is an important question to consider. And so, let me let me just preface by saying the label for all products that are labeled for use in honeybee colonies will specify whether or not supers that are you know used to collect honey can be placed on those hives while the product is being used. So, for example, in the case of Apivar it will say on the label that you can or cannot put supers on that will collect honey that will be for human consumption and Apivar in fact says you cannot, right, so there cannot be supers on hives. Supers that that are that bees are putting honey into that humans will consume that honey cannot be eaten if it's collected, while Apivar is in the colonies. And in fact, a lot of products will say that there's a buffer period after the strips are taken out that you can then put supers on for marketable honey. And I know I feel like I'm getting tongue-tied and all of that. But let's just say and I hate to use a product like Apivar because I don't have all the labels memorized. But let's just pretend that there's product "A" right and Product A says that you cannot put supers that will have marketable honey in them on hives while the products being used, and for a period of four weeks after the product has been taken out. And if you follow the label, then the label will basically direct you on how it's appropriate to super or not super and to or to harvest or not harvest or to consume or not consume the honey that was being owned. So if this listener managed to produce consumable honey,

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while those strips were in the hive, then it should not be eaten. It should not be eaten even if it is the best looking, most amazing looking, no doubt the best tasting honey that you will ever been able to put on a biscuit. You still should not eat it if it was collected, while strips were actively in honey bee hives. And again, to avoid getting myself in trouble, all the labels will tell you what the withdrawal period is whether or not supers can be on while bees are producing honey. Now, it's important to know you can actually keep supers on throughout the life of all the products if the labels permit. It's just a bit more often than not, you're not allowed to eat that honey. So some beekeepers will say, "Well, I'm in the middle of the honey flow, but my bees are dying because of Varroa. So I'm going to elect to use product X. And but I'm just not going to eat that honey, I'm going to make sure that honey is distributed amongst my other colonies for food for their food, not for my food." But at the end of the day. The label is the law and the labels specify all of that information to avoid you you doing something you shouldn't do with regard to consumable honey.

Amy 54:08
That's fair, I think it's really funny because anyone who's listened to any of not just us, but anyone you know anything through IFAS anything through just scientific education, the label is the law, we repeat that so many times. And I think I saw on Facebook one time, you know, someone had asked us a question in the comment section. And one of our listeners had responded and said I'm sure Amy and Jamie would say that the label's the law. So go read the label and find out yourself.

Jamie 54:33
Well, it is true at me that the label is developed in a way to to address the problem that needs to be addressed in this case, Varroa, while protecting the host in this case the bee as well as the consumer in this case the human so if we follow the label to a tee, then we should be okay. If we violated the label for example produced marketable or consumable honey while product like Apivar in the hive, then we cannot eat that honey. No matter how good it looks. That's that's why that information is on the label. So it's made to kill the mite, but protect the bee and protect the beekeeper and the consumer.

Amy 55:13
Absolutely, we actually have one of our guest speakers that's coming up here in the next couple of weeks, we'll be talking to us about the science behind the label and the whole process that goes behind the label. So I'm really excited to release that episode when it comes out. Alright, so that was our question answer time don't forget to send us emails. Contact us on social media. Send any of your questions in the comment section as a direct message. Whatever is easiest for you all. Hi, everyone. Thanks for listening today, we'd like to give an extra special thank you to our podcast coordinator, Megan Winfrey and to our audio engineer James Weaver. Without their hard work, Two Bees in a Podcast would not be possible.

Jamie 56:12
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!

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