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EPISODE 231 TRANSCRIPT

Jamie

Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere.

In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast.

Amy

Hello, everybody, and welcome to this segment of Two Bees in a Podcast. Today, we are joined by Krispn Given, who's a Senior Apiculture Specialist, Honey Bee Breeder in the Department of Entomology at Purdue University. I'm super excited to be introducing and to be hosting Krispn today, because I took an insemination training with him this past summer, and I just, oh man, Krispn, you know so much about queen breeding. So, I'm super happy to have you here today talking about breeding mite-biting bees. Welcome.

Krispn Given

Oh, thank you. Thanks for having me here. Looking forward to our conversation.

Amy

So, we always start out with the same question for everybody, and I'm excited to hear your story. Tell us a little bit about yourself and how you got into the honey bee world.

Krispn Given

Sure. Well, I can say I'm a second-generation beekeeper. My father kept bees when I was a child. We had various trees and plants that required bees. So, my dad decided to get them to pollinate our apples and our cherries.

And so, as a child, around the age of nine, I got started in the beekeeping. So, my first love was ants. I was always interested in the behavior of ants. As a child, I never really knew that. So, I would have these ant farms I would make out peanut butter jars, for example, and have them in my bedroom.

And then around, about, the age of eight, I got my first bee suit, and I started working with my dad with the honey bees. And honey bees kind of took over the ants pretty quickly because they're, without a doubt, probably one of the most charismatic insects on the planet.

And I just fell in love with them. So, I just started out just learning the basics. And then as I get older, as I went through school, basically high school, I produced comb honey for a while.

So, about the age of 14, I started producing comb honey. And then I met a guy named Strother Schume. He and I became best friends, and he was a great mentor of mine. And he was a Major in the Air Force, and he taught high school science for several years.

So, we used to work our bees every day, in the summertime especially, we would be out there. So, between us we had 100 colonies. So, every day we were out there doing little experiments and things, and that was a lot of fun.

We learned a lot from each other. So, after I graduated from high school, I bought my first car just before graduation and I paid for that with the comb honey that I sold. So, as I mentioned earlier, when I was a kid, you know, early, I always had this fascination for the insect world.

So, I was kind of a different child, so to speak. Most of my friends were more interested in other things, not honey bees or ants. So, later I discovered, you know, it was behaviors that I was interested in. So, as a child I didn't know that and growing up.

So, behavior is always fascinating to me. And then, for a few years, I worked as a chef. And then around 2003, I approached Greg Hunt at Purdue University about a job working in his lab with honey bees.

And I got that, and the rest is history. I mean, working with Greg and where I'm at today, I mean, I owe everything to him. So, he gave me that opportunity to start at Purdue and we became great friends. And he's one of the great honey bee geneticists.

He was the first to, for example, pioneer the mapping, the first one to map the genes of honey bees, for example, for defensive behavior thing. So, he was quite influential with me and my career here. And then he retired in 2018, and then Dr. Brock Harper joined us.

He's been here ever since. And so now, we're taking things in a little bit of a different direction as far as selection and things for our breeding program.

Jamie

I think that's a great origin story, so to speak. I love the fact that you started with ants. I also had a little ant farm in my bedroom but did not seal the jars well. So, I had to abandon that because I could keep bees in observation hives better than I could keep ants in their ant farm. So, I sympathize. All right, you found yourself at Purdue.

You guys have a really cool program. You've been part of a mite-biting bee breeding program, which sounds like a tongue twister. So, I would love, Krispn, for you to tell us the process just behind that. How did you discover this?

How does one breed bees or develop this type of bee? What is a mite biting bee? Just let us know the whole shebang.

Krispn Given

OK. So, Greg Hunt spearheaded the breeding program here in 1997, so in the beginning we just looked at the proportion of Varroa growth. So, we looked at colonies that grew the fewest mites and selected from those.

And so, we looked at, also, grooming behavior because Ernesto Guzman and Miguel Arechavaleta in Mexico. They did studies years ago in Mexico that found that grooming behavior was important.

So, we incorporated this in our breeding program. For years, you know, we did this. And then after I joined the university, we were looking at this. And then around 2007, we discovered that, you know, some of the colonies, for whatever reason, they just showed more damage to the mites.

Some mites showed legs missing or idiosoma was chewed out and things like that. So, we got thinking maybe we could ramp up our selection and select for mite biting behavior. So, you can kind of think of it as a hierarchical thing.

So, we're looking at colonies that show more damage to the mites and selecting the best off of that. So, the breeder colonies, for example, are based on last year's, the previous year's data. So, the colonies we would breed from this year, for example, or the colonies that were the best in last year.

So, we select top performers and we cross those best to best, but we also keep other traits in check. So, for example, when I started here in the springtime, when I make up our early nucs, we often had chalkbrood. About 70%, a lot.

So, we were able to breed that out within about three years. So, that was not too hard to get that out. Even though you're selecting – bbecause you hear a lot of single trait selection, it's very difficult, but you're keeping all the other things in check too.

So, if you have any type of disease, EFB or whatever, Rockwood, you can kind of work on that too. So, the process is never ending. So, you have to keep selecting on the trait.

Amy

Yeah, Krispn, I remember in your class you were talking about how, you know, you do select for specific traits, but sometimes that does mean that there are other traits that don't dominate as much, right? And so, looking for that middle ground is really important as well.

And I know that you've been looking specifically at working with mite biting bees. So that's what you're kind of known for is breeding mite biting bees. And so, let's focus on that trait and can you tell us about the purpose? So, what is the purpose of mite biting bees and then what results have come out of this?

Krispn Given

Yeah. So, as I mentioned, in 2007, we started looking at mite biting, and one thing that we noticed in the early efforts of this, we're at about 3% and then around 2015 we achieved about 50%.

So, it's a heritable trait. So, colonies, basically, that groom themselves more, the high groomers also chew more of the mites. One factor that's significant with the mite biting, so mite biting colonies chew more mites and remove them from the colony.

There's less reproduction of mites. There are fewer mites in the colony. So, the overall health of the colony is better because, as everybody knows, I mean Varroa mites are by far the number one problem still. But they are also what we call vector parasites. So, they're an obligate parasite to honey bees and they vector viruses, so like deforming virus, etc.

And so, the more mites, especially in the past, you know, there was a higher prevalence of the viruses, whereas now it seems like the virus is becoming a little more virulent with fewer mites in the colony, which is challenging.

So, the biggest impact is that this reduces the mite population.

Jamie

All right, Krispn, this is one of those things that beekeepers think about, that I think about, other scientists. So, you've got this stock, right, and it gets into the hands of beekeepers. How can they continue that stock in their operation? I mean, I kind of know the answer, but what can beekeepers do to continue managing that stock?

And then what would be like your responsibility as a breeder and creator of a stock to continue to manage that stock? So, kind of look at it from both the beekeeper perspective and the creator of that stock's perspective.

Krispn Given

Sure. Yeah, that's a great question. And that's one that comes up a lot more frequently in the last, especially the last 5-6 years because there's so much information online and there's a lot of good information. So, beekeepers are well informed. So, if somebody, let's say somebody buys a VSH queen or a mite biter queen and then they put it into their population, what's the frequency of that trait?

Is it going to be influenced by that population? And the answer is yes. So, the frequency of certain traits will reduce through time if they're not selecting on that. So, for example, if you take a queen and bring it from our lab and bring it to your lab and then you'll raise daughters, through time, you're going to lose the trade that gets diluted out.

So, in some cases you'll have deleterious effects where there's deleterious allele, so to speak, that work out. So, if somebody seriously wants to bee breed, you know, breeds for specific traits for their area as well, they need to have, you know, at least 100 colonies and select on that trait themselves.

Whatever it is, it could be color, it could be gentleness. So, these are traits that could be selected for. And all these traits that we've talked about in the honey bee world are in all the stocks of bees out there. So, the bees, sometimes in your backyard are the best bees.

And the last few years, I've been telling beekeepers this in my talk. So, I'll say, look, the best bees are in your backyard. So, local bees, locally adapted stock. So, to maintain those traits, it takes a lot of work.

So, it means you got to get out in there, you got to go through all the combs in your hives. You got to measure the traits that you're interested in, or you know, the easiest way is to start out, you know, with a population of at least 100 colonies. So, you do what we call pre-selection.

So, you get whatever stocks you think perform well in their area. So, that's something to really think about. It's a specific area because the environment will affect traits also. So, you can have a trait that performs well in this area and maybe it won't perform as well in the other.

So, you got to kind of tweak the traits as you're selecting for them, wherever you're at, whatever part of the world you're in. So, this requires, you know, advanced beekeeping skills and focus and attention to details and be able to map out problem areas and solve them through breeding.

So breeding is effective. We've proven it works, but it takes a lot of work. So, that's the difficulty with a lot of beekeepers is they don't have the resources or the time to select on these traits. But there is a trend now, which I'm really happy to hear and be a part of, which is there's more people interested in breeding. So, that's exciting.

Amy

Krispn, you just gave one of the difficult parts of breeding. I know there are lots of difficult and challenging parts in breeding bees. Can you share with us, just kind of at the top of your head, what you think are some of the most difficult or challenging parts of having a breeding program?

Krispn Given

One that comes off the top of my head, I mean, honey bees are really sensitive to inbreeding, for example. So, if you have alleles, these are just variations of genes, that are alike, you'll have 50% brood mortality. So, they have what we call diploid drones.

So, we know drones are haploid, and so you can have a diploid drone. So, the bees, for example, eat the larvae within a few hours after it emerges, after it hatches. Another difficulty is, first of all, you got to think the breeding, you know, it's not really a goal, it's a process.

So, in that process, you have to constantly select. So, for me, it's like walking on a tightrope. It's like a rope with no ending. So, you figure out what traits you want, you have an assay, you follow it, you get the results you want, but you constantly have to select on the traits.

So, as soon as you take your eye off the ball and try and relax from the selection pressure, then you may start losing a trait. So, some traits hang on longer than others. So, it's constant selection. So, you have to constantly select for the trait.

You can't ever stop selecting. So, the hard work continues. Another hurdle for beekeepers and researchers is learning to control the mating. So, we have high rate of polyandry. So, we know a queen goes out and mates on a wing.

So, you need to control the matings of the queen. And there's also a high rate of recombination. So, the chromosomes, for example, there's pieces of chromosomes that break off. And so, every time you have these recombinations, that creates a hurdle for the breeder.

So, to accelerate the trait selection, we have to control this, and how we do this is with the use of instrumental insemination. So, you can collect germplasm honey bee sperm from multiple drones and then you can inseminate those into your queen.

So, then, you'll know the exact lineage and the crosses that are being performed. Or if you're fortunate enough to have a closed population like they do, in, say, Ontario, Thora Island, I think they have. Well, even in that situation of a close population, you can accelerate the traits quicker through instrumental insemination.

Jamie

All right, Krispn, that's fascinating. It sounds to me like a lot of time and work. And so, I'm going to ask a question related to that. How much time, can you give us a sense of the work that goes into a breeding program, seasonality, and I'm guessing as well that this has great cost to the one running the breeding program?

Krispn Given

Yes, and that's absolutely right. It's a full-time gig. I mean, if you have – like, right now in our lab, we have an undergrad. I've been fortunate the last decade to have undergrad help. So, just for quantifying the traits you need to – so we do what we call surrogate cage assays.

So, we want to try, and by putting mites on bees and timing and how long it takes to respond to the grooming behavior or just assessing the mites under a microscope. So, we'll bring in mites from the lab, and then we need somebody that can view all those.

So, from 100 colonies, they put the mites on the slides belly up so we can see their legs and assess the damage. And it's a 40 hour a week or more job just in itself. Any of the logistics of just maintaining the colony.

So, one thing that's really important to remember is you need to master queen rearing before you do this. To have a successful breeding program, you need to produce the pure queens. And this requires specialized beekeeping skills.

So, once you have all that under your belt, that really helps. You've got to maintain your queens and then your drones that you produce, and then you need to keep good records. And having, as I mentioned, 100 colonies or more requires a lot of resources.

So yeah, it can take a lot of time and resources to execute this well and maintain it. So, consistency is important once you find something, but you don't want it to become too complex. You don't need all these fancy graphs and charts.

I mean, the simplicity, like Harry Laidlaw years ago, he's considered, you know, the pioneer of honey bee genetics. That's one thing he always talked about, was the quality of the queen. In fact, he said, you know, 80% of having a great colony, it's just having a great queen in there.

So, if you have a great queen, a lot of your problems, a great queen has mated with many individuals that are different. A lot of that's already taken care of. So, the other 20%, we, as bee breeders, can solve effectively and we've shown that this works, but it takes a lot of time. So yeah, it's a full-time gig.

Jamie

Let me ask you a quick follow up, Krispn, and it's funny, it's not related to the question I asked you, but you were saying something that made me think about this question. With regard to these mite biters that you guys have and all this work you do, are you in the maintenance of the stock phase or are you continuing to improve, because you just mentioned scoring mites and you'd mentioned earlier going from like 3% to 50%.

Are you improving the stock or are you just trying to maintain it? And if it's the former, like improving, what is your goal? Is it 60% mite biting? Is it 80% mite biting? Help me understand maintenance versus improvement in this context.

Krispn Given

Yeah, it's constant selection and it seems like it's plateaued around 50%, which is amazing. We'll have individual colonies that may have, you know, 100% or some may have zero.

One problem is we may not have enough mites, especially in the spring. So, with the constant selection pressure, we have fewer mites, and in the spring, we may not have hardly any because, of course, all the mites are in a brood. You get your first round of brood 90% or more, the mites are going to jump in there.

So, just having that constant selection is important. If we could achieve, you know, 90%, that would be awesome. But again, there's other factors. We also often check our breeder queens for just general hygiene with liquid nitrogen.

So, if we get like 95% or more, that's kind of what we want. So, we check that, and it's nice to have. Years ago, when we started the program, when we got all these different queens from different sources, we got some VSH bees. Back then, they were called the SMR, suppression mite reproduction from Tom Glenn. But we don't select on that trait, but it's in there. Every so often we might see that pop out. So, it's constant selection, and if we can maintain this where we're at now, I'm really happy with that.

But we've also, since Brock Harper joined us in 2019, we're applying genomic selection. So, this is where we're looking at different markers associated with certain genes, certain traits. So, in the past, we only, primarily, looked at the phenotypic, so what we saw, we bring in, we just basically select off. So now we're incorporating genomic selection.

So, this is exciting. And if we can prove that it works, we can look at many traits at one time and select upon them. So, but yeah, if we can just maintain around 50%, that's really great.

Amy

So, Krispn, you're talking about just getting breeder queens and how beekeepers are now kind of incorporating that into their practices and learning how to rear queens and inseminate queens. And I was just wondering, how does someone, or where does someone purchase breeder queens?

Krispn Given

Yeah, that's a great question. For years and years, I mean, hundreds of breeder queens went out the door here. So, through Greg and I, our efforts and our breeding program, there was a really

big wave. You know, it started around 2014. The beekeepers are really finding out what we did and hear what we're doing.

Actually, this was 2013 when that really started. And I said, hey, you guys need to get this out the door. Mite biting is important. But Greg and I felt, well, it wasn't really ready for prime time then, you see. So, around 2013 this wave started, and then we started going out in 2014, I believe, quite a few.

And so, a co-op was formed that was inspired by our program. So, they called this the HHBBC, the Heartland Honey Bee Breeders Cooperative. And what happened was, eventually, 7 states got involved, and every year we would have what we called an insemination fest.

So, they would come here, they would bring their stock, in some cases, you know, their best locally selected stocks. So, these are all serious bee breeders, and we would cross them with the mite biters. So, they would bring their unmated queens, and then I would inseminate those and then they would build or they would get pure mite biter queens, Indiana mite biter queens.

And then they would take them to their states, and they'd produce daughters off of those and then they would go out to the beekeepers there. So, we funneled queens out through the HHBBC. In Indiana, another breeding program started, and this was called the Indiana Queen Breeders Association.

So, we've been really fortunate through the years to have a commercial beekeeper that's worked closely with us. So, Dave Shenefield of Clover Blossom Honey is a second-generation beekeeper and his son, Derek, who now is taking over a third generation, they've worked with us since the beginning, and they've supported breeding.

So, they take Indiana mite biters, for example, to California and check and test them to see how well they perform in an environment, for example. So, we've been really fortunate with that. And then we work with the IQBA.

The Indiana Queen Breeders Association. So, they'll be coming to our lab next year. So, all these, there's about 35 breeders, they'll come here, and then the same thing. We will inseminate queens and then they will take the queens back to their operation and produce daughters.

And we also have a beekeeper in Pennsylvania, also a breeder, Jeff Berta, that has Indiana mite brothers that he takes to Florida every year, and he brings back to Pennsylvania and distributes them. So, we've been really – Florida, among others.

I know I'm not missing everybody, but those are the big ones. It's just really great that we've inspired other breeding programs to start, or co-ops, and that's starting to take hold again. I mean, people are now in the last four years, three years, there's a trend. People are starting to get

interested in breeding bees because that's what we need. Because, if you think about it, most people are queen rearers.

There's a difference between queen rearing and bee breeding. Sometimes, one thinks they're breeding, but they're not. They're just producing queens. So, queen rearing is producing many, many queens, superior queens, the best queens you can produce, and selling them to the industry, you know, beekeepers, whatever.

And whereas, bee breeding is where you're selecting on a trait. So, there's a big difference. So, it's real exciting to, you know, have more people coming back. So, it's kind of picking up again because of the resistance to Amitraz, miticides, with Varroa and things. That's part of this increased interest.

Jamie

Krispn, one of the things I appreciate about your program is that you guys aren't just like breeding and selecting and all of that stuff to produce a good queen. You're actually sharing that knowledge and technology with beekeepers. You guys, you and a partner with a product developer provide a lot of queen education.

I mean, I know for example, Amy was talking about it, right? She came up there and learned from you guys how to instrumentally inseminate. So, can you talk about that aspect of your program? So, not just queen production, but beekeeper education.

Krispn Given

Yeah, so that's part of my job too. And I mean, bee breeding and teaching instrumental insemination. We also offer a queen rearing course every year at our lab. We have 20-25 students for that and we also teach instrumental insemination.

So, I got that down on three students only. So, that's all I allow. So, they get better training because there's so much work involved. So, the origin of Apis engineering, I had a student, I think it's been about 10 years ago, in 2015, Dale McMahon, he took my instrumental insemination class and we got talking.

He's one of my best students. He picked up the skills really quick. And I'd been working with Greg for years, I heard many stories about Harry Laidlaw, of course. But one thing Harry Laidlaw did at UC Davis, he designed his own instrumental insemination device.

So, in the back of my mind, I always thought, because Harry was, based on all the stories I heard from Rob Page and Ernesto Guzman and Greg Hunt, I thought, wow, it'd be great to produce my own instrument because I got really interested in instrument insemination.

So, lo and behold, Dale McMahon comes along and it turns out he's a mechanical engineer. So, back then, I taught really big instrumental insemination classes. So, I'd have up to eight students sometimes, and I always have people, you know, helping me with these, a couple of people that had a lot of experience in that work, so assisting me.

So, I said I would really like more instruments because I need more instruments for training, because at that time I only had, I think, 3. So, I'd have students bring their instruments. So, Dale looked up one of these European instruments I had and said, oh, I could make you one of those.

I thought, OK, all right, because I've had other people tell me this and they bring me something. I'm like, oh my gosh, this is not going to work. So, two weeks later, he comes back to our lab and he has two clones of the stands he made, the bases.

I was just amazed. I couldn't believe it. And then I was like, yes, yes, this is it. So, it turns out he was building custom motorcycles, and he did that for many years. And in fact, two of them were in a national motorcycle museum.

So, we got talking, and we're making these clones. He made three of those, of these instruments that I had. And then we got working together and thought, hey, let's just design our own instrument. So, the genesis of it came through that collaborative effort because the technology hasn't really changed that much, you know, since the ‘40s.

So, what can we do to innovate it to make it better? So, through the years we kind of perfected the instruments. So, the queen station and the micro station. So, the queen station is pretty much the most popular model that's available out there.

And many of these have been sold around the world. And it's just like I pinch myself sometimes. I think, am I working? So, just to have this happen, to be a part of it is just amazing. And it's like a dream come true.

So, he does all the machine work, everything is built in-house. So, one thing that's unique, Amy mentioned, you know, we could not only produce the instruments here in Indiana, they’re American made with it, but the training is also done there, that facility. So, you get to see the machining, CNC machine, something.

So, it's a really great process. And something in the future we're hoping to do is just kind of show that process and some video maybe where you show, you know, the block of aluminum and then the final product. So, it's a lot of skill sets and it's just amazing.

So that's kind of the genesis of that. So, Apis engineering is going strong and Dale's just told me, just got done a couple days ago talking to him, he's finished building about 20 more queen stations. So, it's a lot of work.

Amy

Well, Krispn, we had Dale, actually, on a podcast a couple of episodes ago and I didn't know he had built motorcycles that were in a National Museum. That's cool.

Krispn Given

Yeah, he's modest, very modest. Yes, he just kind of got burned out on that. And he did that for years. And I think you can Google it. It's called Lady Liberty.

Amy

OK, we will. So, Krispn, you're talking about some of the classes that you provide. How often do you do your classes? I know you don't take in a lot of students when you do them. Do you move around the state? Do they come? I know that for insemination, they go and work with Apis engineering, but you know, for production or for a queen rearing class, you know, how is that kind of set up?

Krispn Given

Yeah. So, at Purdue, I teach instrumental insemination here also. So, the class, like for next year, it's completely booked, and I think the following year, I've got 2 spots available. And then, queen rearing. So, we teach queen rearing and instrumental insemination here.

Then I also teach instrumental insemination at Apis Engineering. So there, Dale, he wants to have at least three or four different classes a year there, which is a lot. It's a lot of work because you got to have the resources, you got to have the drones ready. The drones are the most difficult.

So, it's a lot of preparation. So, here at Purdue, I have the one class and that's typically, you know, in end of August versus September and then our queen rearing in courses in June, and that fills up really quick, especially, you know, after January, around February, really get a lot of people signing up pretty quick for that. So, that's pretty exciting.

Amy

So, Krispn, I sat down with you, I spent a couple of days with you, and I could just pick your brain forever. I learned so much, you know, and actually, my experience from being in the class with you, I'm going to be presenting to the Florida County beekeeper groups in 2026.

So, that's kind of like my presentation for 2026, which I'm really excited about is just to share everything that I learned from you. So, I am considered one of your success stories as far as train the trainers go, so I appreciate it.

Krispn Given

Yeah, and I appreciate everything you've done, just in a short time. The work you've done to create interest in Florida pretty remarkable.

Amy

Yeah. So, as we wind down, is there anything else that you want to add to our listeners?

Krispn Given

The only thing I would probably want to say is this. We just need more people that are seriously interested in bee breeding. So, I say seriously. So, people are willing to do the hard work that it takes, and it's proven that, you know, there's not a lot of traits, you know, a lot of different characters that we select for in a box.

But the ones that we do have, I mean, they're all manageable if you start a program or a co-op whatever. So, having more interest in bee breeding I think is something that's starting to happen.

Amy

Alright. Well, thank you so much for joining us today. We'll be sure to link your information. If you don't mind, we'll link it to our additional notes and resources. I'm sure there will be many out there who have follow-up questions for you as well.

Krispn Given

All right. Thank you.

Stump the Chump

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

Amy

All right. Welcome back to the question-and-answer segment. Jamie, today, we've got three questions.

The first one being one of our listeners had emailed us and they saw this new invention, and it basically uses heat to kill Varroa. And so I'm wondering, I know that in a past Q&A, we've probably talked about heat and what that does, but let's kind of delve into it a little bit more. So, what's the deal with heat? Can we use heat to kill Varroa? And if so, how come Varroa haven't been dying in Florida?

Jamie

Amy, I was a grad student at Rhodes University in South Africa, and from 2001, January 1st, 2001 through 2004, and during that span, and I forget which year, Apimondia had a conference

in South Africa. It was in Durban. And I went to the Apimondia conference, and at that conference I saw a researcher talking about using electricity and heat to kill Varroa in combs.

And then the bees would remove the dead bees and the Varroa out of the cells. That was my first introduction to using heat to kill Varroa. Since then, the next 15-20 years, people really started branching out and looking a lot at using heat. And a lot of it was based on the idea that Varroa don't do well at a certain temperature, and it's a temperature that honey bees can tolerate.

So, if you can raise the brood nest temporarily to that temperature, it would kill a lot of Varroa. You'd get on top of that issue. The bees would be just fine and they could rebound. And all of the contraptions that were being built at the time to raise the temperature in the honey bee hive were actually a little elaborate and somewhat expensive and to think about it too, a little bit cumbersome.

And I'm not knocking this idea of using heat to control Varroa. I'm just saying it hasn't looked overly practical to me at this point. A lot of these things are things the size of a super that would go on a hive. Well, they have to have electricity, and then a lot of these are being developed by companies, but not really field tested by researchers.

So, there's not a ton of data to support the efficacy of a lot of these things. And the creation of these heating devices seems to outpace the testing of these devices. And the questioner who, you know, person who submitted this question actually had a very specific one that they linked to and wanted us to watch.

And it was a whole box that you could put frames into that would generate this heat for Varroa. And again, I'm not against this idea of heating hives to control Varroa. I just don't know that it's practical, number one. Number two, I don't know if it's economical, right?

And number three, I'm not sure that it works at the level that makes the economics and practicality out of it work.

Think about it from a practical standpoint. Anything that has to generate heat needs electricity to do that. So, are you going to use solar panels? Are you going to have a plug in all of your apiaries? How are you going to power this thing? Number two, how precise is it? Do you risk killing brood? You know, those kinds of things.

How long do you need to do it? How quickly do bees rebound? A lot of these things are hundreds of dollars, which makes it where, you know, a beekeeper may be able to afford one or two. Are they going to do this at the hobby level? Well, maybe not because it might be cost prohibitive. Maybe they will because they like this idea.

Are they going to do it at the commercial level? Probably not, because you've got to use this kind of slow technology over hundreds or thousands of hives. So, you're not hearing me be a

skeptic about the science, you're hearing me be a skeptic about the use. And I'm not against the idea, but I think there needs to be a lot more data on the efficacy of the existing products before I would recommend that people use them, even though I find this idea very intriguing.

Amy

Yeah. The other just kind of follow up for this question was the questioner was asking specifically about young Varroa. So, do you think that there would be a difference between, you know, the stage of development with Varroa related to heat at all?

Jamie

So, I have to confess naivety. I guess that means I was stumped on that particular question because this is me just imagining. I can imagine that young Varroa are more vulnerable to heat stress than older Varroa. But you know, their bodies haven't hardened.

They haven't sclerotized, those kinds of things, but I've not seen the data to support that one way or another. So, I'm afraid to go out on the limb with that. But with that said, I do know that people have used heat in targeted ways, and there's been some evidence of reduction, reproduction or survival. But I just, I don't know, to me, there's still a lot of things that need to be worked out in order for me to be making that recommendation.

Amy

Yeah, definitely. OK. So, the second question that we have here is about a new product that's out that's an oxalic acid product. It's called VarroxSan and it's here. I guess they're OA strips. And so, the question really is what are they?

How is it, you know, distributed? And then the other question is, you know, there are approvals within our country to be able to use some of these products. So, who approves this? What does it go through?

Jamie

Yeah, it's an interesting process, so I'll do that part first. So, companies obviously want to make products to help people control things, in this context. You know, companies want to make money and the EPA or the FDA, depending on the type of product, want to make sure that it's safe.

And so, in this particular case, you know, you've got to have the efficacy data to support the registration of the product that happens at the national levels, like the EPA, for example, in this case. They would review this efficacy packet, they would review the safety data associated with the packet.

All of this data is generated and submitted by the company that's trying to market this. And once it passes kind of at that national level, it will be farmed out to states where the states can register these things for use from those states. And often, the equipment supply companies know, if you contact your local equipment supply company, say, hey, I want to buy VarroxSan, they'll be able to say, well, you know, it's not registered in our state or it's registered in our state.

And my guess is, around the world, it's a very similar registration process where there's some sort of national or federal level scrutiny of the product, the safety of it, the efficacy before it, you know, works its way down to local availability. So, that's kind of how it works in the US.

You know, here in Florida, certain things would have to be registered kind of with that in mind. It would be available to Florida beekeepers, but they may not be available to California beekeepers, as an example. So, the registration process takes time. It takes a lot of money. That's why beekeepers have limited access to chemical treatments they use in their colonies because there's not a lot of money to be made selling Varroa controls and other things to beekeepers.

That's expensive to register. The beekeeping market's very small, all the things that you can think of. OK. VarroxSan is a strip. I believe it's made of cardboard that has oxalic acid that is formulated such that it's a slow release. When we think of oxalic acid application in colonies, we often think about it as a drizzle, right?

It's dissolved into water or sugar water drizzle between frames. Or we think about it being vaporized where crystals of oxalic acid are heated and then the gas passes through the nest. In this case, it's a slow-release formulation that's impregnated into the strip, and while the strips hang into the hive, they're releasing the oxalic acid over time.

So, your colonies get a steady dose, hopefully over time, and you get reasonable Varroa efficacy. I've seen some data. As are all data related to Varroa control, it's got efficacy, but it's, you know, seasonably. Some seasons seem to be better than others, and there are some conditions in the colony that make it better than others.

While, for example, it can work throughout periods where there's brood in the hive, it works better when there's no brood, those kinds of things. So, it is a new product, at least new in the US. Maybe it's been used elsewhere. And it's another tool that beekeepers around the US are starting to get access to for Varroa control.

People really like oxalic acid. They've convinced themselves that it's safe for bees and safe for humans and all that stuff. So, it's neat to see a new formulation of OA approved for use and bee colonies, at least here in the US.

Amy

Jeez, Jamie, you know, we are at like episode, I don't know, maybe 230 or so right now. And I'm just wondering, we do three questions for all of the episodes we've had, at least three, I think, we've had. How many of those do you think out of the total number have we had related to Varroa?

Jamie

You know, we have to look this up. It's so crazy that you mentioned that, Amy. While you were asking me that – you know, our first question was about controlling Varroa, this question – while you were asking me the VarroxSan question, I was sitting here going, you know, we get a lot of questions about Varroa.

Amy

I know.

Jamie

You pointed it out, too.

Amy

I was just thinking about it, like the treatment, like there's so many questions and it's so crazy because our listeners are the ones coming up with these questions, right? And it's like, wow, it's a never-ending list of questions about Varroa.

Jamie

Yeah, we said earlier you'll never run out of things to study. I mean, think about Varroa. Just the fact that there are so many questions tell you there's so much we don't know and so many things that are changing all the time.

Amy

That is crazy. All right, the third question, we're going to go back to basics for a second. You know, sometimes we really nerd out on honey bee stuff here, but sometimes you get really technical and sometimes we get really into advanced stuff. Jamie, I don't know if you noticed that, but I would like for the next question to be for some of our beginner beekeepers out there who are just learning about swarm management and just the swarming behavior in general.

So, let's talk about the queens and what happens with queens with swarming and, you know, especially when beekeepers are starting to learn how to make splits, that is, you know, simulating that swarming behavior. And so, let's talk about the queens.

What are they doing? Who's leaving? Who's going? Who's staying?

Jamie

You know, people ask me a fair amount what's my favorite thing to discuss at beekeeper meetings? Because I go and talk to beekeeper clubs all around the world, just like you do, Amy. And I always say I never get tired of talking about honey bee biology. I love honey bees. I love their biology, ecology.

I just love what they do, how they do it. I mean, come on. They're, without question, one of the most remarkable organisms on the planet. And just, you're asking me about swarming, which is just intuitively in our mind. It seems so simple, but gosh, what a complex, poetic and beautiful process.

And what about queens? How do queens play a role? Well, let's just start with a mature colony where they're queen right. They've got their queen from last year. They're coming out of winter. They've got, you know, the queen from last year. Is it laying? Life is good. The colony's growing, and it's swarm season.

That queen is too heavy to fly. So, the workers that feed the queen will reduce the feeding of the queen, and they'll hop on her back and vibrate her, which causes her to run about the nest. And through this diet and exercise, the queen loses weight. The workers themselves make the decision to leave the nest.

And while they're leaving the nest, they'll rush that queen that's now down to her flying weight out with them. So, it is generally true that the first queen to leave with the first swarm is the old queen in the nest. It's not always the case.

There are some minor exceptions. But usually, that first swarm, called the primary swarm, is the one that contains the mother queen in the nest. And a lot of people will be like, well, gosh, that's kind of risky. Why don't they just send out the first virgin to emerge with the swarm and leave the mother queen in the nest?

And that's because queens fight with other queens most of the time. So, if a new virgin queen emerged, it's possible that the parental queen, the mother queen, and the virgin queen would fight to the death and you get no swarm at all. It actually benefits a colony to swarm with the mother queen.

That way there's only one queen running around the nest at any given time. Therefore, in the primary swarm, it's usually the old queen. Now, the bees, at that point, the old queen's gone, half the bees left. OK. The bees remaining in the nest now have 10, 15, 20 queen cells that are various stages of development left behind in the nest.

The bees determine do we want to swarm again? If they want to swarm again, this will be the second swarm or the secondary swarm. They will allow the first virgin to emerge from her cell, but they will surround the other cells and not let those virgins emerge.

And the first virgin to emerge will go out with the swarm before she mates and starts laying. So, you get the secondary swarm led by the first virgin, then the bees left behind in the nest can decide, do they want to swarm again. If they do, it will be the second virgin leading a third swarm.

That'd be the tertiary swarm. So, you can get colonies that are very strong that can swarm more than once. But the first swarm is usually the one containing the old queen. The second swarm, the first virgin queen, the third swarm, the second virgin queen. I don't, off the top of my head, remember the statistics related to the percentage of colonies that will issue a second and third swarm, but it's reasonably high.

It's not an odd occurrence it happens every year in your apiaries. Maybe not every colony, but certainly every year. At some point, the parental nest, the parental colony says we have swarmed enough. The next virgin that emerges from her cell will go and kill the remaining virgins, which the worker bees allow to happen.

And then she becomes the reigning matriarch in that nest. Really fascinating process. Tom Seeley and colleagues and others around the world have done a lot of research on how those decisions are made, and how the worker bees keep things like this from happening. It's just a very, very, very amazing process. So, thanks. Yeah. That's a great question.

Amy

That is a fun question. You know, you like talking about swarms, Jamie. I love being in the middle of a swarm. There's nothing else like it.

Jamie

How therapeutic.

Amy

I know. Oh my gosh. I actually think there's a video of you and I right before Bee College, standing in the middle of a swarm, just having, you know, having a meeting.

I think we're just like planning, like program planning. There are just bees all over. And we're just like, well, so I guess this is going to happen. That's fine. All right. Well, there you go. Listeners, don't forget to send us a question if you have them, any follow up questions on our Q&A, we'd be happy to answer them in any way that we can. So, send us an e-mail or send us a message on one of our social media pages.

Hey everyone, thanks for listening today. We would like to give an extra special thank you to our podcast coordinator, Jeffrey Carmichael. Without his hard work, Two Bees in a Podcast would not be possible.

Jamie

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