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EPISODE 207 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. Now I think, I don't know, maybe 6 or so episodes ago, Jamie interviewed me about the Beginning Farmer and Rancher Development Program that I'm doing here, and so we're switching positions today.

Jamie, I will be interviewing you, and so this will be another unique segment where it'll just be the two of us. I'm really excited to interview you today. But everybody, maybe you know Jamie's title, maybe you don't. Dr. Jamie Ellis is a Gahan Endowed Professor here at the University of Florida Honey Bee Research and Extension Laboratory. I don't think I need to do other introductions on him, but I'm really excited to interview you, Jamie, today about something that you are incredibly passionate about. I think it's really interesting because we have all these episodes with all these great guest speakers. We talk about their research, and we, at the University of Florida, try to be just kind of a one stop shop, right? We try to provide resources from all different perspectives and all umbrellas and categories of honey bees. I don't think we've ever really truly talked about something that you're truly passionate about. And that's what we're going to talk about today, which is wild honey bee research and just understanding the difference between basic research, applied research, and kind of getting into the research world. With that, Jamie, I'm super excited to talk to you about wild honey bee research today.

Jamie

Well, thank you for having me as a guest on Two Bees in a Podcast. I listen all the time. I'm so excited.

Amy

No, you don't. You don't. Oh, my goodness. Okay, well, why don't you let our audience know – we know a little bit about the introduction of you, but why don't you go ahead and tell our listeners a little bit about yourself and how you got into the honey bee world. And then I would love to hear about the wild honey bee research and kind of where that came about.

Jamie

Okay, absolutely. I can introduce myself for sure. Amy, you and I have done this now for a while. It seems like we forget that we get a lot of people who are brand new listeners and maybe they don't know our background. So, I'm happy to briefly talk about my background. So, I grew up in rural Georgia, a really, really rural area. In fact, I went to a small school, etc. My grandfather was a dairy farmer, so we lived nearby. We went to see him at the farm all the time. Loved it, loved that life. It was great. When I was super young, kind of in the 8-ish territory, I became interested in honey bees. It's not in my family. I have no reason to be interested in honey bees at that age, but I was, and I can think of a few things that kind of connected the dots. I remember when we would go, I would ride the bus to the elementary school. We would pass a person's house. That person had a beehive in the backyard. I thought that was cool. I remember maybe in my kindergarten or first year, someone came and talked about bees, and I very vividly remember a pamphlet that they gave out that on the back of that pamphlet, it had information about, you know, if you are interested in honey bees and beekeeping, write this address. And it was actually a Dadant address. There used to be a Dadant branch in Hahira, Georgia, and so, you know, that was a second thing. I remember having a dream about keeping bees, and so I pitched this idea to my parents, “Hey guys, I like bees. I'd like to do this.” Of course, I'm an 8-year-old. Parents, why would they get an 8-year-old bees? What do bees do? They sting. They can kill people. You know, that's kind of what was in the mind of my parents. And so I read up on them pretty passionately for the next 4 or so years. And then I had a teacher in middle school whose uncle was a beekeeper, and we were going over something in science class one day, and she said, well, something, something, something bees. I'm like, “Hey, I've always wanted to be a beekeeper.” And she's like, well, “I have an uncle who's a beekeeper. If I get you an empty beehive, will you promise to put bees in it?” And I said, sure. Of course, I couldn't make that promise. That's the kind of promise that needs to come from a parent.

But nevertheless, I made that promise. She showed up in my house, I don't know, a few weeks, a couple months later, and there's an empty beehive there waiting, waiting for me. And so, my dad knew someone who was once a beekeeper who gave all his bees to another guy. That guy, Joseph Miller, became a beekeeping mentor. He passed away a couple years after he started teaching me about bees and left me all of his beehives and beekeeping equipment. And so that was it. You know, I was firmly a beekeeper at 12, and had no mentor, you know, somewhere around 13, 14, 15 in there. And I just started keeping bees on my own on my grandfather's dairy farm.

I went to University of Georgia and worked in the laboratory there of Keith Delaplane, essentially the person at the University of Georgia who does their what I do here at the University of Florida. I was four years as an undergrad in his lab working in the bee lab. And then I did a PhD in South Africa. Both of those, both the University of Georgia and South Africa, were fantastic decisions. Especially South Africa really broadened my horizon on honey bees and bee research and what you could do around the world. It helped internationalize my worldview,

which I think is particularly important, especially for Americans. Beyond that, I came back, did a postdoc at University of Georgia, and then got hired in 2006 at the University of Florida, and the rest is history, as we say. I still keep bees. I have a few colonies in my backyard. I love it. I still love it, and I also love all the other stuff, the teaching, research and extension that you and I get to do with bees. And of course, this podcast is one example of that. I could go on for days, but I'll just let that be the brief introduction to how I got in the bee world.

Amy

That's fair. Wasn't there a couple years ago your middle school teacher had – there was some funny story about how like the world's kind of came back together at one point.

Jamie

Yes. So, it just so happens that my former middle school teacher retired from teaching and works at, I believe, a welcome center in North Carolina. I was talking about this at a meeting or on the podcast, I can't remember. But someone from North Carolina said, yeah, I stopped at a rest area on the way down to this national meeting that we were all attending at the time. And he said that person was saying, where you going? I said, well, there's a national meeting down in wherever it was. And the person at the rest area said, well, I used to know a guy who keeps bees. He was in my middle school class. And then they both made the connection that it was me and I was speaking at that event. So, that person reached out to me at that meeting and gave me the phone number of that teacher, Miss Wilcher. I actually called her a couple years ago as a follow up and thanked her for connecting the dots for me. So, that was really cool. That's a cool experience. It's neat to be able to tell that story and then someone remembered and made that connection. It was cool.

Amy

That is really funny. All right, so back to the wild bee research. I would love to hear a background about your interest in wild bees and where this came from. I know you had mentioned doing some of your studies in South Africa. Was that where it came from, or why wild honey bees? And maybe tell us the difference between, you know, the bees that we have here in the United States and whether they're wild or not.

Jamie

100% happy to do this. So, OK, I started keeping bees right when I was 12. So, I went to the University of Georgia as an undergrad. That would have been when I was 18. So, for six years I kept bees, and that was my knowledge of honey bees. Then I went to the University of Georgia. The researcher there, Keith Delaplane, had done a lot, at the time, applied research. And I know later in this interview we're going to talk about research from a basic and applied perspective, but essentially, he did a lot of applied research. And then, you know, it was partly because of him

that I went overseas to South Africa to do my PhD, or maybe him all because of him because he planted that idea in my head. Okay, so I was over there, and I came home halfway through that time and married my fiancé and took her back with me to South Africa. Her background is actually in wildlife biology. So, she did wildlife biology at University of Georgia. And while I was in South Africa working on my PhD, she decided to do a master's at the same institution. And because her background was wildlife biology and because we lived in Africa, she's like, I'm going to study some of these amazing African animal species that we have here. So, I would take her out to her field sites, and I would hear her talk about the behavior in biology and ecology of these wild African antelope species that she was studying at the time.

And I was reading a lot of books on honey bees. I was studying small hive beetles at the time, which is clearly an applied pest. I was like, gosh, this is interesting. Well, I got the job at University of Florida. University of Florida is a land grant institution, and at land grant institutions you have to solve real world problems. You have to find out from beekeepers what their problems are. Then you have to go study those things. But in my heart, in my soul, I enjoyed that kind of work, but I really passionately wanted to study wild honey bees, which leads to that kind of second question you ask, what is a wild honey bee?

Now, those of you listening to this podcast around the world may use this terminology differently, but the correct way and certainly the way that we use here in the lab is a wild honey bee colony would be a colony that is in its native range and has no history of domestication. In other words, it did not derive from colonies that were once managed. So, to give you an example, we have no wild honey bees in the United States. That's kind of a testy subject because a lot of people talk about the wild honey bees. We don't have wild honey bees. You can only be wild where you are native. And Apis mellifera is not native to North America. So, the bees that we have nesting in trees, etc., here are feral. They have escaped domestication there some point in their colony's life or their parent colony or their parent colony or their parent colony or their parent colony.

But at some point in their ancestry, they derived from a managed colony that was here in the US that would have swarmed into the environment. And maybe it's 5th generation feral, but it's still feral. So, almost everything we know about honey bees comes from studying honey bees in white boxes from the managed setting. We move them around, we can take out the combs, we can observe them in our observation huts and, and, and, and, and…. But this species which we make huge claims about being so important to us in agriculture, and here's definitively what they do from a biological perspective, and, and, and, and, and… this species that's so important, we know so little about in their native habitat. So, mellifera is native to Europe, the Middle East and Africa. Even in some of those places, Amy, it's hard to make the claim that they're wild.

So, for example, there are places in Europe that maybe Varroa took out a lot of the wild colonies. This is, you know, hypothetical. So, a lot of the bees living in the feral environment derive from bees that were managed. Even some of those places, it's difficult to say with certainty that you're

working with wild honey bees. So, when I talk about the wild honey bee research we do, we tend to go to areas in Africa, specifically South Africa, and there's the obvious link that I had there to my grad student days, and a lot of the work that we do on this concept of wild honey bees is in South Africa because we believe we can find populations that beyond a reasonable doubt have no ancestry of management.

In other words, we think the colonies themselves have been and are truly wild, and so we can study them as if we were studying populations of elephants or giraffes or kudu or blue whale. And that's the thing is I am just, especially as I get older, utterly fascinated by the ecology of these bees that we have taken out of the wild and put into our boxes. There's so much fun stuff that people are doing with wild honey bees today and you know, we're trying to be trendsetters in that space since there's not a lot of work.

Amy

You know, I think about how difficult it is sometimes to do research on honey bees just in boxes, right? And I'm thinking about some of the research that's going on. Can you talk about the types of research that one would do with wild honey bees? How would this work? What does this look like? What kind of questions are out there?

Jamie

I love that question, Amy, and our approach is that we cannot take anything for granted. So, what do I mean by that? Well, almost everything we know about honey bees again comes from our knowledge of studying bees in white boxes, right? The managed hives. I'm using that white box idea as this concept of the managed hive. But we can't assume that what we've discovered in a managed box is what actually occurs in the environment.

So, Amy, honestly, every research topic is up for grabs when we talk about wild honey bees. Just something simple like nest density. When you leave honey bees to do what they do, what is the number of colonies that they will put per unit area of different habitat types? How far apart do honey bee colonies like to nest? How many queens does a typical honey bee colony in the wild have? We cannot take anything for granted. And again, I want to point out that I work at the University of Florida. That's a land grant institution. We have an obligation, a mandate to solve beekeeper problems and we have a lot of research in this space.

But the way I feel about this, Amy, is that there are students and postdocs and technicians, etc., who come here not wanting to study that, but rather wanting to study more of the basic type research projects. So, I feel like it's our obligation as an academic institution to provide training and all of that space. So, I don't feel guilty about studying this. Recently, we are opening and expanding a branch of research in our lab that's focused on wild honey bees. And to give you an example of all of you who've listened to this podcast know that relatively recently, in the last few months, we interviewed Kaylin Kleckner, who's a PhD student in our lab. She was on this

podcast that she was talking about her research. So, this is an example, Amy, of the type of research that one can do in the wild. So, I'll reiterate about Kaylin's research. Kaylin is interested in knowing why honey bees' nest where they do. In other words, if they're out there in this environment, you can use GIS technology to ask questions like, are honey bees always choosing nests at these altitudes? Are they always choosing nests in this proximity to water? Are they always nesting when blooming plant densities reach this many blooming plants per acre? We're able to look at those kinds of things. She's asking how related are neighboring colonies in the wild, right? If a lot of these colonies sprang into existence by swarms from another colony, you can actually get a fairly related network of colonies in an environment. Well, maybe colonies are cousins or siblings or aunts and uncles to other colonies in the environment, right?

So, it's just stuff like that. What are the disease and pest loads of wild nesting honey bee colonies? Do worker honey bees drift freely between neighboring colonies in the wild? Where are they nesting? Are they in trees? Are they in grounds? What do they like about certain cavities? You know, all this research that Tom Seeley did with managed hives here in the US, we know they like to nest 15 to 30 feet off the ground with an entrance that's about two inches in diameter facing south with about forty liters in volume cavity. These are things we can't take for granted with wild honey bee colonies. And those are some of the research questions that our lab specifically are beginning to chip away. But we're not the only ones doing this kind of work. There's a lot of neat stuff happening out there.

Amy

Well, that leads me to my next question. What other stuff and what other research is happening outside of our university that you know of?

Jamie

Yeah, one of the things that's cool is I'm not the only one who's caught this disease, so to speak, this passion for wanting to know what this elegant species we study does. I think about Grace McCormick in Ireland at Galway University, where she's looking at native populations of wild Irish honey bees. There's this really neat organization, an international organization called Honey Bee Watch, and they don't use the words wild and feral quite as much as I do. They tend to use managed or unmanaged because they're studying feral populations as well as wild populations depending on where the Honey Bee Watch members are, but they're looking at things like nest density and where are they nesting. I think these two folks I'm about to mention aren't specifically studying wild bees, but the questions that they are asking can be layered on to wild bees. For example, Derek Mitchell, he's from Leeds University, we've had him on our podcast a couple of times. He's studying nest properties under this concept of extended phenotype. So, what does that word phenotype mean? Well, let me explain it and then get back to this wild bee thing. A phenotype is basically the manifestation of the genotype. So, let me explain that in more

detail. A genotype is just basically the genes that you have, right? So, your genes, Amy – Amy, what color are your eyes?

Amy

Brown.

Jamie

Okay, so mine are brown, so that's a bad example.

Amy

Can you tell I don't like the color of my eyes?

Jamie

But my daughter's eye color is blue. Okay, so I have the genotype for eye color that expresses itself as brown. My phenotype is the expression, the physical manifestation of my genotype. My genotype is just brown eye color, so I express brown eye color. My daughter's genotype is for blue eye color, so she expresses blue eye color. So, the physical manifestation of the gene is basically the phenotype. If your bees are defensive, that's a phenotype. If they collect more or less honey, that's a phenotype. If they're hygienic, that's a phenotype. If they're yellow, that's a phenotype. If they're black, that's a phenotype. If they like propolis, that's a phenotype. All of these things are manifestations, they're physical manifestations or behavioral manifestations, of the genes.

Okay, well, Derek Mitchell is studying the nest as an extended phenotype. So, let me explain that then. Beavers build dams, right? They collect sticks and put it around. They build a dam. Turtles have shells. Hermit crabs don't make their shell. They go get shells that other things have made and move into them. Bees move into cavities and build wax and all this stuff. The nest of a bee, the shell of a hermit crab, and the dam of a beaver are an extended phenotype. It's not part of the beaver, it's not part of the bee, it's not part of the hermit crab. They didn't grow these things, but the genes that they have told the beaver, the hermit crab, and the honey bee to build these things, and the reason I use the turtle is because the way that the shell is a phenotype of a physical turtle, the beaver dam is the shell of a beaver. The hermit crab's shell came from another organism. The honey bee's shell is their nest cavity.

So, Derek Mitchell is studying this extended phenotype of the nest and the thermodynamic properties, how air moves, how heat moves, how all of these fluids are directed by the bees as they fan at the nest entrance. Another good example is Dr. Michael Smith from Auburn University, who's looking at how bees build their combs and their nests and how these extended phenotypes are important to the survival of the bees. Well, all of this could be extended to wild honey bees. And it all starts with just finding the colonies.

The Honey Bee Watch program is fun because it's basically like a citizen science project where people are finding all these wild or feral colonies and then uploading them to this website. And once you have them, then you can do all these cool things that I'm talking about with them, which is essentially what Kaylin's done. You all heard it. She spent a lot of time searching for colonies, and then once she found them, then she could layer all these types of questions that just aren't answered for wild honey bees. I just get excited. And then, Amy, to make it even more amazing, you can multiply those questions by the number of subspecies of Apis mellifera that there are maybe 30 to 35, because there's no reason to believe that Apis mellifera capensis does the same thing as Apis mellifera caucasica, or Apis mellifera ligustica does the same thing as Apis mellifera lamarckii.

So, my point is, our bee from Northern Europe to Southern Africa through the Middle East has all of these extended phenotypes, behavioral attributes, all of these ecologies, as it were, that we just haven't even begun to understand.

Amy

So, you're talking about, you know, searching for these colonies, looking at density. And for those that have not listened to all of our episodes, specifically the one where we interviewed Kaylin, can you talk a little bit about how they find these nests? I mean, where do you even start? You're standing in the middle of the field and you're looking for wild colonies. How do you do that?

Jamie

Oh my goodness I love this. I could just do this research forever.

Amy

This is fun.

Jamie

Yeah, so again, everybody, you should go back and listen to Kaylin's episode. I don't remember those number off the top of my head, but I'll be happy to elaborate. Here's the deal. When I was in South Africa as a grad student, I would drive my wife out to her field site because South Africa, they drive on a different side of the road than the US and they use a lot of manual or stick shield vehicles, and my wife didn't want to learn how to do either of those. So, I drove her out to her field sites, what she was hunting for and studying kudu and bushbuck and daika.

And these are African ungulate species, and people there study elephants and lions and giraffes and all, just all kinds of things. Well, they have to find these animals. They track them, they wait for them to appear. Well, we have to do that with wild honey bee colonies. Sometimes the people who live in an area just know where they are and can recommend them. But to be fair to the

science, you really need to be able to find these things. And the way that Kaylin does it, she just uses bee lining traditions with a twist. And probably all of you are aware of bee lining. You catch a bee in a box and you do all these complex things and over time you can follow the bee back to its nest. Well, we appreciate that art, but we don't really have time for that art. So, what we do is, I call it a version of slopping the hogs, which is a very Southern slang. It just means when you throw out the food, all the hogs will come eat it. Well, that's what Kaylin does. She puts out sugar water. And the reason we use sugar waters to avoid the spread of diseases and pests, we don't want to use honey. We put out sugar water and she scents it with anise or anise, depending on how you want to refer to that. We know bees can detect that. When she puts that into the sugar water, it attracts the honey bees in the area. They will fill their bellies on this sugar water, and then they'll make a direct flight back to their nest. And basically, Kaylin was creating these bee superhighways that she was using to follow these highways back to the nest and the environment. And over 16 square kilometers of area, she found all the nests that she could find in this area and was able to use that information to establish nest density. But really creating these bee superhighways was the strategy she used to identify these nests. And then once you find them and GPS them, oh my goodness, the research questions are nearly limitless.

Amy

You just talking about it makes me want to go stand outside and watch bee lining, just bee highways.

Jamie

Amy, it's fantastic, and we're only talking about one species. There are 11 other species of Apis for which we also know very little about the wild populations.

Amy

So, as we're talking about wild populations, you know, how is that applicable to beekeeping management practices? Some of the stuff that we look at, you know, we talk about the stressors of honey bees. How does this all kind of tie together?

Jamie

It's really interesting to process this question, and unfortunately, Amy, it's going to be a bit of a long answer. And so the way that I think about this is when I was considering being an entomologist, my advisors and predecessors would talk about the distinction between two types of research that are generally recognized in academia, applied research and basic research.

Some people called basic research like the hard sciences or the hard research, and applied researches kind of the applicable. It's in the name. Applied is applicable, which means it's research to solve a problem that people want to act upon. So let me give you an example.

Controlling Varroa applied research, developing a nutritional supplement that's good for honey bees, applied research, developing research strategies to breed for hygienic bees, applied research. And the reason it's applied research is because it has direct application to a group of individuals who want to apply what you've discovered. They want to use this to make better queens, feed bees better, and so forth. So, at land, I keep saying the University of Florida land grant university, at land grant universities, we have a mandate to do applied research. You know this, Amy, we have to go to our beekeepers in the state and say, what are your problems? Hear from them and then go and try to do research that addresses those problems. I call that our Honey Bee Husbandry Research branch. All the research that we do to make bees healthier and keep bees better. So, disease control, pest control, nutrition, toxicology, honey bee queen research, all of this is beekeeper-oriented research, very applied. You find a question, you come up with an answer, and then that answer translates into some sort of behavior change that results in healthier bees, more bees, etc. Every field has this. Fertilization rates for crops, right? Flea and tick control for dogs. Every field that you can think of has branches of applied research. Well, the second branch that my mentors and predecessors would talk about some basic research. The best way for me to describe that is basic research is essentially research for the sake of knowledge gained.

And now this is tricky because basic research may seem basic now, but it could lead to application downstream, even if we don't know how that might happen. So, for example, there's been big debates over the last decades on whether or not we should have a space program. Why does it matter if we collect dust from the moon, right? Why does it matter if we orbit the Earth? We're spending billions and billions and billions of dollars and we could just be putting this into cancer research or virus research or things like that. And the argument from a research perspective is any time you do basic research, you are discovering things for the sake of discovery. That is true. But often the process of doing basic research creates new knowledge that leads to application or creates new methods that make new knowledge that lead to application better. You'll hear the NASA folks say this all the time. Think of all the different technologies that we have today because we had a space program and 40 years ago, people would have said that's just basic research. What a waste of money. And now we have all of these things that at the time weren't immediately obvious, but because we did basic research, now that led to applicable research.

For example, you could argue, is it really necessary to know why honey bees in Africa nest where they nest? Is it really necessary to know if colony A that's 10 meters from colony B in the wild in Africa are related or not? You could argue this is basic research. It's knowledge for the sake of knowledge, right? You could also say, hey, someday this could inform conservation programs for bees. Maybe knowing where they prefer to nest will give us indications of habitat that we need to conserve as sanctuaries for honey bee populations if they are ever struggling an area. So, the basic folks will always argue that even if we're not aware of application now, there may be some application 10, 20, 30, 40, 50 years from now. And one of the human attributes is discovery for the sake of discovery. And the argument for the basic branch of science beyond

leading to application is it's okay to just to want to know how things work, and that's kind of the distinction that people have made between basic and applied. Amy, I could go on for days about this because it's even split hairs in departments, right? The basic folks don't like the applied folks, the applied folks don't like the basic folks, and blah, blah, blah, all that mess. Here in our lab, we do basic and applied research because we are interested in both, but we also have different clients. Beekeepers want applied work, that's true. But students and postdocs are also our clients, and some of them want to go on to basic research fields. So, it's our obligation to provide that. And frankly, Amy, we can do both and do both well. So, I think it's okay to have this kind of mindset. And I know that especially in the political realm, there's always arguments when they talk about funding cuts, politicians get all antsy about basic research. Why would we fund that stupid stuff that has no application? But you could certainly make a case that application is coming even if we're not aware.

Amy

Yeah, definitely. You know, something that I didn't realize before I was in academia was, I mean even discovering different and new methods of things, right? Does that fall under basic?

Jamie

It all depends on, like if, for example, if we're developing a method to track bees in the environment and it's a method specifically used track bees in the environment, we're like, oh, well, that's not so helpful because we're just hunting wild bees in Africa. What does that mean? Well, maybe that same method and technology could be used to hunt feral populations in the US, these populations that have persisted 20 or 30 or 40 years in the face of Varroa. And maybe using this technology that we've created to find wild honey bees, you could find Varroa resistant populations here in the US. So, method development can be applied, or basic, depending on the intent, but it also can have applicability in both reals, both basic and applied research.

Amy

I think that's fair. All right, as we're ending this episode, was there anything else that you wanted to add?

Jamie

Yeah, I just want to say that, I mean, I know I get told this a lot, but I think it's true for everybody. I have a passion for both of these types of research. And I tell you, the older I get, the more I just want to study wild honey bees because I feel like what we learn from them can provide long term answers. And just kind of one fleeting example of this is we kind of head out of this interview, I just think recently the last 10 years or so, our research on wild honey bee populations in Africa where we've looked at genetic diversity, it's ridiculous, like ridiculous, ridiculous, the genetic diversity of some of these populations we're studying. Why am I saying

this? Well, because I firmly believe the answer to most of Apis mellifera's problems is already coded in the genome of one of the subspecies somewhere in the native range. Just seeing the diversity in South Africa makes me know that these honey bees have overcome tremendous obstacles and they already have programmed in their genome the answers to some of the biggest issues that we're facing, Varroa resistance, disease and pest resistance, ability to withstand droughts and other climate related issues. And that's not just African mellifera, it's true of the Middle East and elsewhere. So, I just love this kind of work. If you're a prospective student out there listening to this podcast, reach out to us if you're interested in both fields applied and basic. But certainly in basic, the sky's the limit because we know so little and have so much we can do.

Amy

I know. It seems like the bees have it all figured out and we're just trying to figure out what they've figured out.

Jamie

What a great comment. We are only discoverers. We are like those people who hopped in ships to go around the world and figure out what's going on, because the bees are already doing it. We just, through experimentation, get to discover those secrets. What a fantastic job to be in academia. I just love it. And this is a good example of the kind of thing that we get to do.

Amy

Absolutely. All right, listeners, I hope that you have follow up questions for this episode either about wild honey bees, Jamie's interest in wild honey bees, different types of research. And Jamie, thanks so much for your time today.

Jamie

My pleasure.

Stump the Chump

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

Amy

Welcome back to the question and answer segment. Jamie, the first question we have is that this individual ventured out to one of their newbie yards with their son and on the way out mentioned that, you know, those hive tools that are half painted red, half not painted, it's just silver and red. Well, this person's convinced that the bees don't like these red hive tools, these red painted hive tools. But what do you think about this? Is this true?

Jamie

Yeah, I like this question. I actually got this question via e-mail as well and answered it directly to the questioner. And here's what I said in response. So, a couple things could be happening, maybe a trio of things, and maybe what's really happening is outside of the trio of things I'm going to offer you. But first thing first, we know bees can't see the color red. They translate it as black. And we know when bees get defensive, they often attack dark colors because a lot of their natural enemies are dark. I make the point to say that it doesn't matter what color the thing working the hive is. We all have dark areas that are very sensitive. You know, eyes, our nostrils, our ears, our mouth, those are dark regardless of the color of our skin. And then if you think about the natural predators of bees, bears, honey badgers and things like that, they're just prone to attack dark things when they are agitated. I don't think that's what's happening here.

My second possibility is when you are holding a hive tool, and I didn't ask this individual if they wear gloves or not, but if you're holding a hive tool, that's the part that's working the hive. And if you've got gloves on, I could see you being kind of aggressive towards that hive, getting stings in your gloves and maybe just having alarm pheromone deposited on the hive tool, in which case the hive tool would command attention for the next few minutes while they're working those hives. I noticed that this particular questioner is saying, you know, when I'm working even my mellow hives, they're coming out to where the red handled hive tool is. That may be true, but it may not be because of the hive tool. It may be just that there is a high concentration of alarm pheromone that's on gloves, things like that.

So, my third possible option is it's also possible that the hive tool is just coated in something that's attractive to bees, right? You're working honey, you're working propolis, you've got wax and bees just like that stuff, and they could just be flying out of that. You know, the individual doesn't say they're getting more stings as a result of holding this hive tool. They're just saying that the hive tool gets a lot of attention. I've used red hive tools myself in the past and don't believe I've noticed that particular behavior towards the hive tool. But I do think now that this individual brought to my attention, I may pay closer attention to it when I'm working at hive of the red hive tool. But I think it's probably just a coincidence in this particular individual circumstance.

Amy

Yeah, my hive tool is blue. And, you know, I wonder if I wonder if this individual would use a blue hive tool, whether the bees would come out and fly around them, and that's the only thing that changes to see what happens.

Jamie

That's how science works, right? You say questions just like this because the person said, my son came home from college this weekend. We ventured out to one of my new apiaries. So, let your son use the blue hive tool and you use a red hive tool and see if your son gets more or less

attention than you do. But my guess is, is this just coincidental, that this will probably wane. But I don't know that for sure. And since I don't know it for sure, I figured I'd just offer those three possible explanations. One being, they're translating it into a dark color. Number two, that it might just be coded in alarm pheromone, which, by the way, I don't know how long that stuff's stable, so that shouldn't last every time they go into the apiary. It seems like it'd have to reset. Regardless, the third is that there's just stuff on it that bees are otherwise attracted to – honey residues, propolis, wax, things like that.

Jamie

All right, for the second question that we have, you know, one of the things that I've realized, Jamie, is it's difficult for us to see the queen and the egg sometimes. And you know, we've talked in past episodes about AI and what that could look like in the bee industry. So, this question kind of leads to that. Is it is anyone working on AI programs where they can just take a picture on their phone of a frame and that AI program either identify queens or resources? You know, it's difficult for some people to be able to find her or see eggs. And so do you know of any programs or is there any research going on with this?

Jamie

Sure, 100% to the latter question. There's definitely research going on with this. Actually, this has been one of the holy grails for a lot of people for a long time. I remember when I first got into bee research, you know, at an academic setting, people were talking about chipping their queens so that when they walk by the hive, they could have an external reader that tells you the queen is still present in the nest, things like that. But people are really starting to expand the possibilities with AI. There are some programs available. I mean, we've used them here in the lab. Don't ask me the names of them because I've forgotten them all. But there are some programs that we've used in the lab where we take pictures of combs and then we run those pictures through this program. It'll tell us how many bees are on the frame. If we shake the bees off and take a picture of a frame without bees, it'll tell us the number of cells that have capped brood or honey or pollen, some of them most being good enough to detect eggs and your larva. But you've got to have a good resolution picture for that. So, there are already programs powered by early versions of AI, essentially machine learning, to be able to do these things.

Now, if you look online, there are definitely people who are advertising technologies, like you can take a picture of your bees and it will tell you how many of them have Varroa, which to me would be a very difficult thing since Varroa is often on the underside of the adult bees. But nevertheless, people claim that it can be done with machine learning. If you feed enough pictures of frames with queens marked into the machine learning, it will at some point get good enough to find queens consistently, and people are absolutely working on this thing.

I would say beyond queens, they're working and doing this for a lot of other diseases and pests and other conditions of the hive. And so let me just say a couple things about practicality. Questioner mentions pointing their phone at the frame and identifying the queen, but let's face it, that's cumbersome. Can you imagine every frame you pick up, you've got to point your phone at it and then you have got to flip your frame and point your phone at it? I think where technology will really go will be the some of these AI assisted goggles or glasses that you see a lot of companies starting to advertise now where you're wearing a pair of glasses that is itself already screening what you're seeing and able to point it out kind of like in your field of vision. I'm not saying that exists for bees, it doesn't, but it really is the next logical step because these things do exist for other stuff already. That's where I would see the technologies going.

I think an intermediate step might be pointing your phone at frames and getting that information, but I feel like it's inevitable before we're all wearing bee goggles, so to speak. When we're looking at a comb, we're seeing things, but then all of a sudden your glasses tell you, beep, here's the queen. Boop, this one's got deformed wings. Boop, there's a small hive beetle. And I feel like that kind of technology is inevitable. To go even beyond what the questioner asked about because they just want to find queens, there are companies out there that have fully mechanized hives where a robot type hive is pulling frames out, scanning it, determining what's necessary from a food or a treatment perspective. If you go to some of these really big national or international trade shows, you can see some of these smart hives kind of being advertised. They haven't really hit mainstream yet, but there is all of these technologies going into honey bee health and management. I feel like this is inevitable. I certainly feel like it's inevitable in the beekeeping world, even if it's not happening, you know, necessarily at the pace we all want, I do feel like something like this is very, very inevitable. So, the simple question, is anybody working on this to find the queen? The simple answer is absolutely.

Amy

Yeah, I think that's great. You were talking about some of the stuff one of our undergraduate students is working on, an app just looking at taking a picture and identifying different resources in the frame. But sometimes, you know, that nectar gets a little confusing or if you have a glare from the camera, and so you've really got to feed the program with all this information.

Jamie

Well said. I mean, that's the machine learning part of it, right? If you just train these AI programs on one frame, let's just pick on queens, they'd only be able to find a queen when it's in that situation. That's the time that it would be able to recognize that queen. But if you train them on thousands of frames where you tell the machine this is the queen in this image and you do that for thousands and thousands of frames, they get better and better and better over time. Being able to identify queens in a number of situations, I mean this individual's basically saying, finding the queen is the most difficult thing I do in beekeeping. So, until these types of programs are

available mainstream, then you should really purchase your queens marked because that's the old school way of trying to find these things.

If you struggle, if you don't do that and they requeen themselves, I would have another beekeeper come over and work your hive with you when you get a new queen and let them mark them, so that at least the old school way, you can see that queen.

Amy

Okay, so for the last question. So, this individual is from Ohio. They have five other hives that survived the winter. One of the hives is down to about 500 bees. There's another cold snap on the way. In the hive, they have honey. The hive is insulated, and this individual is basically wondering, should they just leave this hive alone and let nature figure it out and let that cold snap come and just let nature take its toll? Or they're also thinking about caging her, the queen, and then putting her in a strong hive and using her for a split. So, I think there's a lot that goes with this question. You may have pieces of it you want to answer, but basically, what should this person do with the hive that's down to about 500 bees? It's about to be cold. There is a queen in there. There are some resources. What would you do?

Jamie

Yeah, a lot going on, a lot of moving parts in this question, but there's a couple of ways that I think about it. So, let's deal first with this colony that's got only 500 bees. So, the colony is doomed. It's not going to recover from this. When I think about that, there's a few things that go through my mind.

Number one, I've got to protect the resources. Those combs are important. The stored pollen is important, the honey is important. Other colonies could use these things. I could use these combs for a split in spring, etc. So, I'm thinking about protecting the resources. Number two, you know, the soft spot in my heart says you've also got to protect the bees. They're not dead yet. And so I'm thinking about the bees. And then, number three, I'm thinking about that queen, which is exactly what the questioner's saying. Hey, I've got a dying colony, essentially, can I just put that queen in a queen cage and store her as a banked situation in a stronger colony so that I could use her in a future split? So, the short answer to that question is yes, you can cage that queen. You can bank her in another colony until you are ready to use her in a split. Now, we could chase a lot of rabbits and say, but do you want to use her? Because there's a reason that colony's dwindling. Maybe it's not her fault at all. I'm perfectly okay with taking that gamble, putting her in a queen cage and banking her in another colony until you need her. Just keep in mind, you know, if she's a year old, if the colony was failing, you could bank her, she could not get attention and still die. There are all those risks, but you don't really lose a lot because at the end of the day, she's probably not the most valuable resource that's in this dying colony.

So, with those 500 bees that are in there, I would just shake them into a weaker colony in the apiary, and I'd let that be that. So, I would cage the queen and bank her, I'd shake the 500 bees in a weakish colony in the apiary, and then I would do whatever it takes to protect those combs and resources.

Now, you might argue, and rightly so, that they might be weak because of something in the resources. Maybe there were diseases or pesticide residues or something, but that's usually a gamble I'm willing to make with combs and resources. My guess is it's probably not those things, it's probably something else that caused them to be weak. So, I would freeze those combs, store them, I put them on another hive, etc., just to make sure they're available for me to do that. So, I bank the queen, I shake those bees into a weaker hive, and I do whatever it takes to protect those resources, unless I had strong reason to believe that that colonies dwindling was due to something in that nest.

Amy

Right. And what about banking that queen and putting her into another colony? Do you think there would be any issues as far as you had already mentioned, just the workers not taking care of her or maybe seeing her as a threat? Do you think that would happen?

Jamie

Well, what I typically do in a bank situation when you are banking a queen in a queen right colony, I try to put that bank queen in the uppermost super so that she and her pheromones are away from the actual queen in the nest who's free running in the bottom box. And I'll put her probably in the uppermost honey super. If this individual's coming out of winter, and they mentioned they're in Ohio and there's probably another cold snap on the way, I'm going to work under the assumption that it's still cool there and that their colony is not very big. You know, it's not multiple supers. So, I would just put her in the uppermost super.

I was thinking about this before I decided to answer it before we came online, and I was thinking, would I add workers to that queen cage from that queen's original colony or not? I think my first thought was I put workers in there from her original colony, they take care of her a few days until the bees in that box decide to take care of her. But I think that they would have a better chance of getting that queen to get some attention if they just left her alone in that cage. So, I'd probably put the queen alone in the cage, put her in the uppermost winter super, and as long as that colony is very sufficiently strong, then she'll get attention.

But listen, this is a gamble anyway, so even if she dies, the beekeeper hasn't lost much because I would argue that the most important thing to protect in this story would be the resources, and that it's easy to get more bees in spring. It's easy for them to make a new queen. It takes time and resources to make more wax and store honey and pollen.

Amy

All right. Very good. So, those are our questions for today. Thank you so much, everybody. These are all coming in through emails. So, if you have other questions for us in the Q&A, don't forget to send us a message on social media if you want to. We're on Facebook, Instagram, X, or just send us an e-mail.

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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