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EPISODE 213 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.

Hello everyone, and welcome to another episode of Two Bees in a Podcast. Today, we are joined by Dr. Cooper Schouten, who's a Senior Research Fellow and Director of Southern Cross University Bee Research and Extension Laboratory, an executive member of the Australian Honey Bee Industry Council, a faculty member in the Faculty of Science and Engineering for Southern Cross University in New South Wales, Australia.

Cooper, thank you so much for joining us on this podcast from all the way around on the other side of the world.

Dr. Cooper Schouten

Pleasure to be here, thanks for having me.

Jamie

Cooper, it's really great to have you. I love talking to beekeepers and bee scientists in Australia. So, it's a really a big pleasure for me to have you on the podcast. And since this is your first time with us, you know, before we jump straight into the topic that we're going to talk with you about today, which is improving beekeeping and starting beekeeping programs in other countries, I would love for you to tell us a little bit about yourself and how you got into beekeeping and also how you got into the position that you're currently in.

Dr. Cooper Schouten

Awesome. Yeah, well, I can put it down to one core person. His name is Professor David Lloyd. He was an undergraduate teacher of mine at the university here, and he then supervised me for my honors degree and then my PhD later. But during my undergraduate, I applied for a scholarship to work in Timor Leste, East Timor. For those who don't know, it's a pretty new nation. It's just above Australia, pretty quick flight from Darwin, only about two hours away from Australia. And it's one of the poorest nations in the world outside of sub-Saharan Africa in terms of multidimensional poverty. And I was working up there and this swarm just landed outside the building that we were staying in. And it wasn't an Apis mellifera swarm. It was an

Apis dorsata binghami, so the giant Asian honey bee and everyone kind of went running away except for David. He just kind of went walking towards this bee, and he was sticking his face up in it and checking it out. And I thought, I'm going to go and have a look at this, and it's just super fascinating. And I came back to Australia, and I got a job working for a commercial beekeeping company. They're running about 3000 hives and just fell in love with being out in the forest and all the flora and, you know, making queens and making nucs and processing honey and making up wax and yeah, just fell in love with it. From there, I ended up doing my honors and my PhD. I worked for a honey company in Papua New Guinea for almost a year up there in the Highlands of Papua New Guinea. It was unreal. And I now run about 50 colonies myself. I create a lot of problems for myself trying to make money out of bees, but I think it's important to practice what I preach.

Jamie

Cooper, you totally just stole my next question, which is, do you keep bees? So, that's so cool. I'm glad to hear it. I'm going to have to see you sometime in Australia and talk to you all about it.

Dr. Cooper Schouten

Absolutely. I can show you the world's worst bee loader as well while I'm at it.

Amy

So, Cooper, you know, one of my friends actually was in East Timor for the Peace Corps, and I think she wanted to start a beekeeping program. I wonder if you ever cross paths. But that'll be a conversation for another day.

Dr. Cooper Schouten

I mean, I think that's something that a lot of your listeners would probably relate to and have heard of the Peace Corps. They do some amazing work. And I've heard of a number of people that have been involved through my work in beekeeping and trying to support a lot of beekeepers in developing countries, saying that's from the Peace Corps.

Amy

Absolutely. So, when we were introduced to you to do this podcast, you were known for starting new beekeeping programs. I'm going to let you tell our audience what that means, explain the background of what this is. You know, are you starting beekeeping programs? Are you teaching how to beekeep? All of the above.

Dr. Cooper Schouten

All right, So there's tapes in that. That's a good question, Amy. So, I mean, when we step back from this, why beekeeping in the first place? Obviously, I don't need to convince your listeners

about how good bees are, but they're really good in lots of ways in terms of getting people out of poverty, not just because they're great for, you know, selling honey, but for lots of other reasons that really may not come to mind for a lot of people in developed nations. Once you've invested in the equipment, there's not necessarily a lot of ongoing reinvestments. Honey's a super stable product and some of the research we've done shows that in communities where those people don't have access to a bank, they're using their honey in terms of a savings account. So, it's like their honey money and they said spend that in times of financial hardship. And that's really important for them.

And obviously for pollination, not just of large-scale horticulture, but even just for small-scale agricultural production, which characterizes the majority of the world's poor people. And those people are farmers. So, yeah, great way to get people out of poverty through farming and a really good way of doing farming without damaging the environment is through beekeeping. And so, a lot of work that I'm involved in, it's not necessarily about giving things away. It's not about top-down approaches. It's not even about myself going and providing the training. Yes, in situations we do do training, but we really like to look at the root cause of problems.

And so for example, if I was to go to a developing country, let's say for example, Papua New Guinea, where there isn't a lot of locally driven training as part of people's business models, by me doing that training, I'm only getting in the way of the root cause of the problem, which is someone there providing really cool outcome-based practical beekeeping training that's based on, you know, skills, and they help them to make money out of bees. So, it makes sense to not give people a fish, right, but to give them a teaching rod so they can sort of help themselves into the future.

Jamie

So, Cooper, when I hear you talk about this, I can imagine that starting beekeeping programs in various countries can be difficult, right? You're not sure what their resources are going to be, you're not sure what the local knowledge is going to be, you're not sure what the local customs and appreciation of honey bees are going to be. So, could you give us a big broad series of things that we would need to consider when starting a beekeeping program in an area, especially like in a developing country where you work so frequently?

Dr. Cooper Schouten

There's an excellent question, Jamie. Like you've got sort of alluded to, there's a lot to it and lot of considerations. I guess really, even though there's local context, we can't really take it out of the context of just human beings in general, right, in any place, and the person who is best to advise what sort of help they need is the person themselves, right? So, if we make the assumption that someone in our household needs our help in a certain way, you know, we might think that's what the help they need, but really, we might get it wrong. So, it's a really important

proposition, not just in developing countries, but even just in bee research in general. And you guys do an amazing job of this. And it's really about listening to your stakeholders, listening to the clients and the clients of the beekeepers themselves. So, a really important component is listening and observing and watching and trying to understand why beekeepers are doing what they're doing. And they often have a really good reason for it. I'm sure most beekeepers can agree that the only thing beekeepers agree on is that another beekeeper is doing something wrong. But it's usually just whatever works for them in their operation. And if it's working for them, then that's awesome. So, lots of different contexts and from a technical perspective, but also from a social perspective.

So, in terms of the flora in the tropics, it is super diverse and difficult to understand what the core flora resources are for bees and what's driving honey production and the types of honeys that are produced and the, you know, the chemical composition of the honeys that are produced or the way to pests and diseases. So, there's new and emerging pests and diseases in lots of the countries that we're working with. There's not just, for example, Varroa destructor, but there'll be Varroa jacobsoni. And then there's different species of, you know, overall, jacobsoni doing different things. There's some of those mites reproducing on Apis cerana only and some of them are reproducing on Apis mellifera only.

And so, it's quite a complex environment. With Tropilaelaps mites and you know, the small Asian honey bee, Apis cerana, there's some really interesting things going on in terms of pests and diseases. Another consideration is just technology and access to that. It becomes a really big conversation for people, you know, should they be using this type of equipment or, or that type of equipment.

And a lot of the time the solutions are just local bees, local inputs, local equipment. What people can get access to is something that they can build businesses on, and it can be sustainable. In case they break, they can go and purchase them locally. And genetics are another thing that's pretty interesting too, in a lot of these places, because they don't really have a lot of breeding programs as most beekeepers would, you know, understand them.

But in saying that, they've also got a lot of bees out there that are not really managed super intensively to the way that we do in lots of, you know, like in America and in Australia and across the world. So, you have really high levels of natural selection.

Beekeepers often don't have the money to go and buy chemical treatments for Varroa. And even if they did, you know, they might not have access to them because there's no shop. So, what you've got is really high levels of natural selection in a lot of these places, but not always in the direction that you'd like them to go.

So, they might be amazing at managing some of these mites by themselves and they'll show some pretty amazing characteristics for suppressing, for example, mite reproduction. And in

saying that, though, some of the bees are pretty grumpy. That's something you got a lot and not necessarily high honey producers. So, lots of different considerations.

Amy

So, Cooper, I think your research is like my dream job. We take groups to Thailand, and we took them last year, saw the different Apis species, and it was just incredible, you know, to see because we don't have those species here in the United States. And there's nothing like going out, being in the forest and seeing them with their own eyes, right? And so, I'm really excited to continue this conversation with you. You just mentioned basically doing a needs assessment in the area, right? Like identifying the needs, asking these individuals what they are needing and what kind of training they would like to do. It sounds like you work with a lot of different countries and so I'm interested to know where around the world you've done work, and then how do you identify some of these areas that you are starting beekeeping programs in?

Dr. Cooper Schouten

Yeah. Like you said, it's an amazing job and it's such an incredible opportunity to be able to see lots of these different beekeeping contexts and not just for the benefit of the beekeepers there, but also for the beekeepers that we have back here in Australia and globally around some things we do.

So, I'll touch on that in a minute, but in terms of where I've worked, I've done work throughout Indonesia on multiple different bee species there. I was mentioning before Apis dorsata and communities that are hunting honey from that and looking at how they're selling the honey and challenges to production and what's happening with the populations of the native bees.

The Apis dorsata binghami in Indonesia, as well as some stingless bees, Apis cerana, and beekeepers that are actually managing that that bee. It's a pest in Australia that we have here now in far North Australia. But for many beekeepers in the native range for that, as you guys are aware, you know, it produces some honey and to some beekeepers, that honey money is important to them.

So, throughout Indonesia, Timor, I've currently got projects that are funded by ACIAR, so that's the Australian Center for International Agriculture Research and those projects are in Fiji, Papua New Guinea and Solomon Island. So, I've been working in those three countries for close on about 8 years now. So, it's a lot of fun, but also a lot of responsibility too.

And I think that, you know, when I present to the beekeeping industry here in Australia too, they kind of want to know what's going on overseas and why I'm spending so much time over there. And maybe for a lot of your listeners, that might seem a little bit, you know, why are we investing in some of these things? And there's actually a number of reasons why we might be doing beekeeping.

It's not just about, you know, doing something that feels good. It's not just for the ethics of it. And I mean, I think that is a really important component. There are a lot of people out there, and it's something that drives me in my work every day. I've got a photo on my wall right now that I'm looking at of a beekeeper. His name's Caraway.

He lives in the rural areas of Papua New Guinea. His house is made out of grass, mostly. They'll wake up and eat a sweet potato. You know, to have fresh water, he has to walk to the bottom of the mountain to go and get that. There's a lot of people in the world that are existing on not much money. About 40% of the world's population living on less than $7.00 a day. 10% of the world have only got about $2 a day to live on.

And so, you know, it's not just the right thing to do and about ethics, but it's also about having good neighbors. You know, for a lot of beekeepers, you don't want a neighbor next door that's going to throw stuff over the fence and just make your life bad in lots of different ways. I won't go into details. I'm sure you all have many stories you could conjure, but you know, it's kind of like the geopolitics of this so that we want neighbors around us that are our friends. We want to, you know, we see Papua New Guinea and these countries around us like Indonesia and Fiji and PNG around Australia and it's the same no doubt for America. The countries you have around us, makes sense for these countries to be our friends so that we can communicate around what our needs are and that can enable trade and not just for goods, but also services.

So, for example, no doubt a lot of beekeepers and particularly commercial larger scale beekeepers in America, they exist because you have access to skilled and semi-skilled workers that are there on time and they're hard-working people. And the same is true in Australia. We need to have access to hard working people.

And so, there's an opportunity to be able to have relationships with governments and other countries around Australia so that some of those beekeepers in those countries can get cool experiences, come to Australia, make some money and they can take those really cool skills back to their country to support their own families.

Another really important reason is biosecurity. So, we don't want lots of pests and diseases spreading around other countries. And so, the only way we know what's happening in those countries is if we go there and have a look. It seems pretty obvious, but things aren't static. You know, some of these pests and diseases of honey bees and other pests and diseases of lots of other crops and livestock, they're not static.

You know, at one point in time, they might not have been that damaging. And now they are, they have, they've changed, they've undergone natural selection and through time, they're becoming more damaging. And so, we need to keep our finger on the pulse. And there's only one way to really gain experience and to grow our capacity and knowledge and skills in managing some of these pests and diseases is to actually go there and help people how to identify them, monitor

them and manage them so that when we get these pests and we're not sitting on our hands and we're ready to rumble.

Jamie

So, Cooper, I really think we could talk to you for days about this topic. It's actually quite fascinating. Sounds like you've been a lot of places. I'd love to hear about beekeeping in each of these areas, the honey they produce, the bees they use, the problems they have. But I do want to pivot a little bit. You are a faculty member, you know, at a university, and so I'm sure that this is just one component of your overall program.

Would you mind sharing some things kind of in the other space that you work in regarding honey bees? Do you teach? What type of research do you do, if any, those kinds of things?

Dr. Cooper Schouten

Thank you, Jamie. Yes, and thanks for acknowledging that too. You're right. That is a component of my work. It's a big one. It's something I'm passionate about.

But yeah, I've got a diverse portfolio of work, just like many academics do. So, yes, I do teach. We're teaching an introductory agricultural course at the Uni and we're having conversations now about how we can get beekeeping better involved within our undergraduate and postgraduate teaching courses.

So, one of the classes has about 160 students in that each year, which is a lot of fun. And I love connecting with the students. And we get out there and do a lot of practical things and we go and visit farms, and we talk to farmers and listen to the challenges for production and, you know, environmental issues and yeah, lots of different concepts.

So, we're also setting up a bee research and extension lab here. And I think that your lab, Jamie's, it's very aspirational and it's really, I think from a global perspective, maybe I'm not sure how much you see it, but I think you guys are really exemplary in a lot of the work you're doing and very inspiring to us, particularly to someone like me as a young bee researcher and seeking to not just do research for the sake of it, but do research that can really help to drive innovation, practice change and increase production and profits for beekeepers and the well-being of our bees and beekeepers in the globe beekeeping community. So, yeah, in the bee lab, we've got a bunch of different things going on, as you could imagine. So, we've got setting up a bee club. We meet each week and do a bunch of beekeeping. We're running field days with local bee clubs.

We've got training in AI and queen breeding and all sorts of different things. We've got workshops and seminars and a whole bunch of other research projects too. I don't know how much detail you want me to go into in each of those, because there's quite a number of them.

Amy

Cooper, I love hearing about, first of all, I am 100% extension. So, my entire job is to work with beekeepers of all different sizes, connecting them to the research. And so applied honey bee research is my favorite thing in the entire world. You mentioned that, and I would love to hear a little bit more about some of the research that you're doing that is directly applied and can impact the beekeepers around you and around the world.

Dr. Cooper Schouten

Thanks, Amy. Yeah, something we're super passionate about, you know, this is all about not just doing research for research sake, but doing it because they're answering the questions can help beekeeping businesses make informed decisions to save money, to not use as much product or to use products more efficiently or effectively, to be able to have answers to questions that they face. And at the end of the day, you know, a lot of this work that I do overseas really helps me to align my research to things that can, you know, see demonstratable change and impacts within the life of projects based on the information that you can sort of develop.

So, something that we're really passionate about, not just doing the research, but then also ensuring that that's in the hands of beekeepers, something that we find that works really well, and you'd no doubt see this a lot in your extension work, is that some of the best people to teach beekeeping are beekeepers themselves.

And this is really farmer to farmer or extension agent to extension agent because they live and breed these things. And I do my best to try to make some money out of bees, but there's no way I could hold conversation at the same level and way which a commercial beekeeper does. But my job is to really facilitate the science, that is, not just the science that we're producing, but that is already out there.

There are so many amazing pieces of science that can really help to make more money out of bees or do things more profitably. And yeah, it's going to make sure that's in the hands of beekeepers. And I like to be led and driven by what the needs of beekeepers are. So, I have a big responsibility in listening to beekeepers around what problems they're facing in their operations and then try to come up with some practical ways to test them. And often they'll be involved in the research themselves, and we get them into the Uni or we do trials and that'll be a part of it in in their businesses.

Amy

I think that's great. You know, sometimes I definitely understand catering to the beekeepers and asking if it's a need, right? I mean, every once in a while I'll even send an e-mail out because I think I have a really great idea and I'll be like, OK, beekeepers, if you don't like this idea, just let me know. Or if you like this idea, let me know. Otherwise, we're not going to move forward with it because I want it to be helpful for you.

Dr. Cooper Schouten

Yeah, absolutely, absolutely. You know, it's interesting. You have to have the wisdom to know the difference between something that's just interesting versus something that can really create impact and change. And there's such a need for lots of other types of science that over time can cumulatively build things and knowledge so we can answer other questions that then become applied and practical.

But there's some really amazing basic and applied science questions that are out there that still, you know, it's surprising to me at times that they haven't been answered. There's lots of really practical things that can really help us to inform the risk appetite around what decisions we're making in business.

Jamie

So, Cooper, I'm wondering then also, so you're doing all this applied work. It sounds great, in my opinion. Your beekeepers are lucky to have you. I mean, you're young, you're energetic, you're saying all the right things. You've got a good mindset with regard to how to, you know, address needs for beekeepers. I'm curious when you're overseas, when you're doing a lot of these beekeeping extension opportunities, you know, for these developing countries, etc., do you conduct research both on behalf of beekeepers there, but also on other topics that just because you're there, they're things that you're able to do?

Dr. Cooper Schouten

Yes, super question. It's a bit of a tricky one. So, at times, I wear different hats. So, I'll be doing some training where you know, for example, we might be looking at integrated pest management for Varroa and Tropilaelaps in Papua New Guinea Highlands, right? And the idea is that I'm not really driving the teaching better.

I'm there to support some of the team who are local Papua New Guinea and people, they are experts. They've been keeping bees for a long time and just supporting them to deliver the best possible training that they can, that suits their content text, in their language, for their people, in the way that their people learn best.

But in saying that, at the same time, there'll be some questions that we really don't know about, for example, Tropilaelaps, in that context. And so, I'll work with some of the people there. There'll be local beekeepers and also local researchers to try to answer some of those questions. So, for example, I literally was in Papua New Guinea 10 days ago. We just got back. We've already ran a field day and been at a conference since then. We were, you know, around that training, there was lots of other things happening around World Bee Day and around, yeah, other types of training and, and industry sort of activities around their beekeeping association and industry boards and things like that.

But we were running some research on detection methods for surveillance around Tropilaelaps. So, trying to grow, there's a recent article looking at hair removal strips where you kind of ripping off the brood cappings and observing the Tropilaelaps running out and comparing that to other methods that we know like the bump test, phoretic washing, alcohol washing, eDNA swabs, and we're also doing brood uncapping and things like that.

So yeah, we've got a huge data set now and we're just crunching the numbers now. It's pretty interesting. So, yeah, often there's quite applied practical sort of science that we do on the side, but we're also doing a number of industry development type things and then we can use the science pretty quickly in practice.

So, the next time I go back with some of the training, I will look at some of the data around monitoring Tropilaelaps, which is relevant to the beekeepers there. Obviously, they've already got Tropilaelaps, so the question isn't really about surveillance for them, but that's pretty important for our industry here in Australia, no doubt for you guys in America too.

Jamie

I'm assuming at some point you get to sleep, Cooper.

Dr. Cooper Schouten

I'm looking forward to that.

Jamie

At some point in the future.

Dr. Cooper Schouten

Yeah, it's definitely a weakness, Jamie. We've got to learn how to say no. But how can you in bees and beekeepers and industries?

Jamie

That'll never happen. Don't ask me and Amy for advice.

Amy

Yeah, we're not very good at that. OK, my last question, this is a non-beekeeping related question. I have seen some of the publications that you have. Please tell me you're a scuba diver.

Dr. Cooper Schouten

I love the ocean. Yeah. I grew up surfing, diving, fishing, just camping in the environment. And, you know, I think that was a core reason that drove me to doing what I'm doing now is that, you know, just that passion for the environment. Obviously, bees aren't underwater. I don't see a lot of

bees when scuba diving or spearfishing, but yeah, you know, just the passion for the environment and, you know, beekeeping is a means to make money without really damaging the environment. I don't know of any other type of agriculture. It's almost mutualistic. So, yeah, but do you dive, Amy?

Amy

I'm a big diver, yes. So, when you're talking about Papua New Guinea and Australia and just every -- all the places.

Dr. Cooper Schouten

If you're ever in Australia, make sure you give me a ring, I'll take you out to go and see some whales and go for a dive.

Amy

I cannot wait.

Jamie

She's not just a big diver; she's like a huge diver. Like she does cave systems and all that stuff, Cooper.

Dr. Cooper Schouten

Wow, much more brave than I am. Very cool.

Jamie

Well, man, I really appreciate you joining us, so much. I know it's always hard to get the US Times and the Australian Times together at the same time, but Cooper, I've really enjoyed having you on this interview and I wish you the best of luck. And hey man, hopefully we all, Amy and I and Cameron, can interact with you and work with you and help you in the future and collaborate on some of these great projects you have.

Dr. Cooper Schouten

I really look forward to it. Thanks so much.

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, one of the podcasts that we had in the past, we talked about, and actually I think we've talked about this often, is

about reorienting bees either in small stages or larger distances, right? It's like that 2-foot, 3-foot or three miles type of thing. This person's asking about whether changing the environment interferes in front of the hive entrance. Does that work?

Jamie

Yeah, so this is actually, I think, maybe the third or so time we've discussed this topic. In fact, I think right before this one, maybe in the past episode or two, we even talked about it again because people are asking this 3-foot, three mile, 2 feet, two-mile thing. So, we've kind of covered that. And now this questioner is asking about a different component of that, which is, well, a significant change in the environment after you move the bees might be enough to reorient them. So, for example, if you move them from the backyard to the front yard, maybe you put them beside a tree and that pushes the reset button. Maybe you stuff the entrance with grass such that only a few bees can come and go and kind of slows them down on the way out of the front door. And maybe that will reset them and cause them to go, wait a minute, we're in a different spot, rather than just come boiling out to go forage and then end up going back to the old nesting side. The problem is all of us use these techniques, me included. I've stuffed grass in a lot of colonies that I've moved from the front yard to the backyard.

But really, these things only have anecdotal support. If we want to be technical, it's always best to move bees 3 or 4 more miles away for a couple weeks just to push the reset button before moving that colony back. And to elaborate on this a bit more, I don't want to go into great detail because I really think we've talked about this a lot recently.

But it's this idea of if you need to move your bees a short distance within, say, the same apiary area or the same yard, etc., do you need to move the bees away for a small amount of time to get them to forget the old site before you move them back to the new spot that you want them to be?

Or can you use other techniques like slowly moving the colony a couple feet, maybe a meter or so, every day for a few weeks before you get the colony where you want it to be? And you know, we talked about those till we are blue in the face. So, the question here is, is, are there other techniques you can use, like changing of environment, any other physical thing that might cause the bees to go, wait a minute, I'm not quite in the same spot that I was in. And like I just said, really all this stuff has anecdotal support, but not experimental. I'll just kind of fall back on this idea that if you really need to do it, the safest thing is always to just move them away and then move them back.

I mean, you can always play around and see what works for you. You know, usually when I move bees to a new site, it's multiple miles away, so I don't worry about it too much. But, sometimes, if I move them within the same yard, I might put a dummy or a catch hive to catch any bees that drift back to the original spot and then slowly move them overtime. But honestly, it's not a huge, huge deal.

Amy

All right. So, the second question that we have, I guess this is another follow up from something that we've answered in the past. There was a past Q&A where someone asked about plastic queen cups and whether the color of the queen cup made a difference.

And I think, at the time, you couldn't find the article where you had written the answer for this in the American Bee Journal, but we found it right after we were done recording. So, we're just going to add it to this one as a second question. So, basically, can you tell us and follow up on whether queen cup color matters?

Jamie

OK, so I was thinking about this and sort of losing sleep because like you said, we just dealt with this in a very recent podcast. And just to broaden a little bit for folks around the world who might be listening to us, you're probably aware that you can rear queens with the help of bees, but you can mass rear queens, right? If you wanted to be a queen producer, you could graft or collect, with a small tool, a very young honey bee larvae, usually in the 12-to-24-hour age, pick that larvae up and you put them into a queen cup that is man made. And then you do that with lots of larvae into lots of queen cups, and then you give that row of queen cups with those larvae in them to a colony that will construct queen cells, etc. All of you know this. Now, because humans are humans, we started off with the real thing. Queen cups were made out of beeswax.

You can still buy pure beeswax queen cups anytime you look in your equipment catalogs and want to rear queens. They're still available there. However, we are always looking for ways to improve things. And out of that was born plastic queen cups and plastic queen cups are manufactured by different manufacturers.

They're different colors, probably different components. And we were asked recently does the color of the queen cup matter? I don't think it does. I didn't find any evidence that it does. But it was kind of bugging me because I knew that I'd answered a similar question in the American Bee Journal where I do the Q&A series, which is one of the United States' two kind of national level publications for beekeeping. And so, I was able to go back and find that question and answer. What the questioner was actually asking was rather than queen cup color, they were asking about plastic versus beeswax, and does that matter? And they were kind of coming at it from the microplastics angle.

If we're putting these plastic queen cups into our colonies and we're rearing queens in them, is there a potential downstream problem? And again, it wasn't necessarily, well, red queen cups are better than blue ones are better than green ones. It was more like, plastic or wax. What's the best? So, I did manage to find a few publications that I outlined in the American Bee Journal for this question, where people would graft queens in the bees in the pure beeswax queen cups and they graft larvae into plastic cups. And then they let bees make queens out of them. They compared all

sorts of fitness parameters, you know, size of queen, production of colonies, just the things you would expect to look at. I think I cited 4 papers in that article. And at the end of the day, the beeswax cups versus the plastic cups, it really didn't matter.

One article might suggest that plastic cups were better than wax cups based on the things that they measured, another article might find that wax cups were better than plastic cups. There was an article that found some parameters were better with plastic cups, some parameters they measured were better with wax cups.

So honestly, I don't think the wax versus plastic matters that much. So, then, the original question was, well, within plastic cups, does color matter? I'll just kind of stick with my original answer, which was I've just seen no compelling evidence in the literature to say that that matters.

Amy

Sounds good. I'm glad we came back to the original answer.

Jamie

I'm glad we spent all that time to say exactly what I said last time.

Amy

That's funny. OK, so for the third question that we have, this is really, this is hilarious. So, our listeners probably don't know this, but we do have a podcast editor. His name is Jeffrey, and we also have someone who transcribes all of our episodes, so her name is Alayna. She goes through. She, word for word, goes through every single episode. And so, I feel bad for both of them Jamie, because they both have to listen to our voice over and over and over. Can you imagine just your full-time job being listening to both of our voices?

Jamie

I feel bad for them.

Amy

Yeah, well, you know, I'm convinced that these two individuals know more about honey bees than any other person in the entire world because all they do is listen to just information and research about honey bees. So, all that to say, the third question actually came from Jeff, our podcast editor. He listens to the podcast, and then he starts thinking about some of this stuff. So, he’s just gone ahead and asked questions himself. So, the third question for today that he's asked is what compels drones to mate if they die afterwards? And if they're not selected to mate, they go back to their colonies, we assume, and how are the drones treated if they're not selected? You know, like womp womp.

Jamie

Well, Jeff, if you're listening to this, you stumped the chump because I can only speculate, I can't tell you. Well, I can answer the second question for sure, but the first question I can't. So, the first question is what would compel a drone to mate if it was going to die afterwards? Well, we can't assume that drones know that they're going to die afterwards, right? So, it's not like they're going, well, I really want to mate more than I want to be alive.

So, I'm going to go out and mate knowing it's going to cost me their life. It's just, this is just how they're biologically programmed. If you think about it, and you've heard me talk about this before, really from a biology perspective, mating, reproduction, it's the drive, right? It's among the strongest drives in all living organisms.

And so, for whatever reason, colonies have this structure where the drones die when they mate. It kills them. And you're asking a good question. Surely, there could have been systems in which the drones develop a way not to die in the process, and they get multiple opportunities to mate with other queens.

So, this raises a lot of really interesting questions. Drones are expensive, somewhat, in colonies to make, right? If you think about it, let's just say the standard unmanaged colony, the standard unmanaged colony is probably going to make somewhere between one and three queens a year, right? And they're going to make one for sure, probably, because they're going to try to swarm. So, they're going to have to replace the queen that left. There's often that secondary swarm or tertiary swarm. So, the average colony is making one to three queens a year because you also get supersedure, etc. But the average colony is also making 5000 drones a year.

So, if it's one to three queens a year, I'm just going to make the average two. If they're making 5000 drones a year, that means for every one queen that a colony makes, they make 2500 drones. That's a lot of investment in an organism, the vast majority of which will never fulfill their purpose. I mean, that would also be a good biological question. Why do they invest so heavily in all these drones when the vast majority of them are never going to be able to mate right? They just die. So, let's unpack this a little bit. So, my answer, while I don't know for sure, is that drones dying in the process must afford those drones some added benefit of maximizing their mating behavior.

For example, it's complete delivery of their semen to the queen, right? Even when the drones die and they kind of fall out of the queen, they leave behind a piece of tissue, which is a mating sign that people have debated the function over.

Most recently, it looks like this mating sign is used by the subsequent drone to mate with the queen. But the idea is that drones are just investing everything they have in the delivery of semen to the queens, right? And mating flights are so uncommon, for queens, that is. And mating is such a risky behavior. There's no reason to believe that if a drone can mate multiple times that the chances of it even being able to mate a second time in a DCA are so astronomically small

that it would almost be better to die and invest everything into the queen with which you do get to mate.

So, let's think about this for a second. There are thousands of drones at a DCA. So, the fact that this drone gets to catch the queen and mate with her means that he's won the lottery already. So, if he were able to survive the process and go back to the hive to go out to another DCA for another day, the chances of him finding a queen and being that one in 5000 or one in 10,000 to get to mate again are so, so small that, biologically, it just benefits him to invest everything he has in that one mating.

And that's potentially one of the reasons that they die doing this, because it's just a full delivery of semen in every way to the queen in a way that they kind of maximize. The other thing too is it's not really just the delivery of semen that's the problem for them. The problem for them is that they lose so much hemolymph in the eversion of their endophallus.

Their phallus is stored inside their body, and they lose so much hemolymph to it, pushing it out. So, it's really the act of docking with the queen that ultimately kills them, not the delivery of semen. Maybe there would have been a better mechanism for using less hemolymph blood to force out that endophallus, but I still believe that they have a better chance of maximizing mating success when they basically give their life doing this.

That's just supposition, and maybe someday someone will have a much better answer for it. The second question you asked then was how are drones treated when they're back at the hive? Well, let's go back to this math. If a colony's producing 2500 drones, but they're only producing one queen -- Let's just say that as an example, one queen for every 2500 drones and the average queen makes with 15 males. That means a standard drone has a 15 in 2500 chance.

Amy

Yeah. Yeah.

Jamie

So, the vast majority of them will never fulfill their purpose, never ever fulfill their purpose. So, the vast majority of them are having to navigate life in the hive. So, in some cases, the workers feed them. They often feed themselves. If you find drones, they often congregate on the outermost frames of the brood nest. They can be groomed. They fly out every day looking for queens at these DCAs. And someday, this particular flight is their last flight. If they make it all the way to fall and the weather starts turning cool, the workers kick them out of the nest where they die of starvation and exposure. So, you know, for those drones that never fulfill their mating purpose, they kind of hang on until life runs out on them, right?

It's not a bad life, they otherwise don't have to do any work, but it's just kind of a fairly well-documented, do nothing, be taken care of life until they're no longer needed.

Amy

Yeah, definitely. About a couple of weeks ago, I took an instrumental insemination training, and it was hosted in Indiana. And Krispn Given was talking about drones, and he asked the class, he was like, you know, have you ever noticed bees leaving the hive and the difference between workers and drones? And he basically was just describing that drones, before they go out and before they actually leave, will hang out at the entrance and they'll kind of groom themselves to get themselves ready, you know, for mating. And so that kind of has just stuck in my mind since he told me that was like, oh, yeah, the drones are getting ready to go mate. So, they have to look good and have to groom themselves and have to be clean and have to, you know, comb their hair over to the side before they look for those queens. And it's just a fun thing to think about.

So, yeah. All right. Well, thank you so much, listeners, for all of your questions. We are always, always, always wanting you all to submit questions to us. So, don't forget to do that, whether it's through e-mail, whether it's through social media, we are on Facebook, Instagram, or X.

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

Visit the UF/IFAS Honey Bee Research and Extension Laboratory's website, UFhoneybee.com, for additional information and resources for today's episode. Email any questions that you want answered on air to honeybee@ifas.ufl.edu. You can also submit questions to us on X, Instagram, or Facebook @UFhoneybeelab. Don't forget to follow us while you're visiting our social media sites. Thank you for listening to Two Bees in a Podcast.