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EPISODE 194 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. Cecilia Costa, who's a senior researcher for CREA Research Center for Agriculture and Environment with CREA standing for Council for Agricultural Research and Economics based there in Bologna, Italy. Cecilia, thank you so much for joining us on this episode. It's really our pleasure to have you on the podcast today.

Dr. Cecilia Costa

Well, thank you very much for inviting me. I'm really proud and honored and excited to be here.

Jamie

Well, we're happy to have you. I saw you just a few weeks ago in the Netherlands. I've known you for a while and really appreciate your work. I'm so excited to be able to talk to you today. We brought you on to talk about a really nice project that you and colleagues are doing in Europe. It's an EU funded project called BeeGuards Project.

So, we're going to go into some detail discussing that project with you today. But since you're a first-time guest, a lot of our listeners out there want to know how you ended up in the beekeeping world all together. So how did you find yourself ending up studying honey bees and working with honey bees? What ultimately got you where you are today?

Dr. Cecilia Costa

OK, yes, thanks. Interesting question. So, when I was a teenager, I used to go on holiday to the South of France in Provence. My aunt and uncle had a house there and this part of France is famous for its lavender production. So, in June the landscape becomes purple, and the air is fragrant from all the lavender blossoms and even the bees and the beekeepers love it.

And so that part of France is very much visited by tourists like us, and they want to all take back a taste of the Provence. The local farmers and artisans, they for a long time are being well organized on the local summer markets where all the tourists go. And so that is where I first

encountered beekeepers and their products. The French beekeepers were very good at showcasing their products and also the tools of their art. So, there would be these stands with beekeeping tools, outfits, veils, hive boxes, maybe also a frame of bees in an observation hive and also all the different kinds of honey. So, not only the famous lavender honey but also Gadig and chestnut honey. And I was so fascinated. Beekeeping then seemed to me like a sort of magical profession, being able to tame these stinging insects. And then I started learning about the honey bees themselves. And I thought, wow, I was even more enamored by all these female individuals that are working together in harmony and producing such a sweet product. So then when I went to university and enrolled in the course of agricultural sciences. I knew immediately that I wanted to follow the optional course in beekeeping, which was held by actually a fun and friendly and interesting professor, who, by the way, did some research in the US on pollination of alfalfa using leaf cutter bees. And then that's when I decided I want to become a beekeeper.

Then it was the professor who gave me contacts of a beekeeping association in a neighboring province that was organizing a course for beginner beekeepers. Then I did the course and then I got myself 2 colonies and then I got friendly with the association and started working there part time. And actually after my master's degree, I was working in a different field doing agricultural consulting, but I went on with my hobby beekeeping and I followed courses. So, for example, I remember I followed a course on Varroa control with oxalic acid. It was held by Dr. Antonio Nanetti, who is now my colleague. And then I also followed a wonderful course on honey tasting, which actually is a big thing in Italy, honey sensory analysis. We have many experts, and actually in our institute, just last week there was a course and there was a group of American people following the course.

Anyway, I wasn't so happy actually with my work, what I was doing professionally. And so, then I decided to send my CV to what was then the National Beekeeping Institute, saying I was available to work even just for the summer season based on their needs. And that's when I got to know Dr. Marco Lodesani, who then became my mentor and my boss who taught me about the importance of the Italian native honey bee subspecies. And that is when I heard of Apis mellifera ligustica for the first time and actually discovered that Italian bees are famous worldwide as I got even more interested. And then when the summer work finished, then I found a grant I could apply for and started working at the institute with temporary grants.

And then there was an open competition at some point, and I won it. That's how I became scientists in, what was at the time, institutes and then became career some years later. And in the meantime, I decided to get a PhD, and I was lucky enough to be able to do it within the framework of the projects that were ongoing at the institute. It was in the period around 2008 when the colony collapse disorder issue became prominent. And so that was the focus of my PhD thesis.

Amy

That is really fun. Dr. Costa, has anyone ever told you you're a really great storyteller?

Dr. Cecilia Costa

Well, actually this is thanks also to COLOSS. One of the task forces of COLOSS Bee Rap organized a workshop on storytelling.

Amy

Oh my gosh, yeah. You're telling the story and it's so descriptive. I can envision it as you're speaking. I'm listening to the timeline, and I can see it and I can envision it. And I'm just like, wow, she's really good at describing things. And it's hard. It's very difficult to do. So, I applaud you for that.

Jamie

Yeah, Amy, I mean, don't you want to go to France to the area where they produce lavender honey?

Amy

I know.

Jamie

Can't you smell it? As she was saying that, it's like, oh my gosh, I'm being transported there. So, Cecilia, good job.

Amy

Well, great. So, we brought you here today to discuss, as Jamie mentioned, BeeGuards. I've not heard of BeeGuards before and I'm sure some of our listeners have not either. So, can you explain to us what BeeGuards is?

Dr. Cecilia Costa

Yes, BeeGuards is a consortium of 27 partners from 16 countries, and most of the countries are European, but they're also partners from Israel and from Argentina. And we are a mixture of different entities, let's say. There are associations, research institutes, universities, and even small and medium enterprises, among which some companies and some beekeepers. And we are multidisciplinary. I mean, of course our basis is on apicultural technology, but among all of us we cover many areas ranging from hologenomics to IT, information technology, and we have experts on agroecology, on life cycle analysis and animal breeding epidemiology. The important thing is that together we aim to achieve a little step forward towards resilient beekeeping.

Now, what do we mean by resilient beekeeping? By resilient beekeeping, we mean a kind of beekeeping that is able to cope with the growing challenges that are posed by the effects of

ongoing climate change. And these negative effects on beekeeping include so we can see that there's ever more reduction in availability of food resources, honey production, honey yields are going down. Often, beekeepers face the fact that they need to feed their bees instead of harvesting honey. There are warmer winters, increasing temperatures over the winter increase the period of brood rearing and this in consequence increase is the reproduction of Varroa mite. There are ever more favorable conditions for the spread of alien parasitic species. So, we aim to support beekeeping and managing to cope with all these challenges. And also, we need a kind of beekeeping that is sustainable in environmental terms, in the sense that beekeeping is less reliant on chemical treatments, beekeeping that is not damaging to other pollinators and also overall to the environment in the sense of having a low carbon footprint.

So BeeGuards is the name of our consortium, but also of our project, which is funded under the Horizon Europe Framework for research and innovation actions. And actually, we wrote the project or the proposal following a specific call from the Horizon Europe on this topic. We started writing the proposal in September 2021. The submission was in two stages. So, the first one was a 10, we called it 10 pager, so say a concept note with the heart of the proposal. And we submitted this in February 2022. Then we had six months to write the whole proposal with all the details and with all the financial aspects. And this was due on the 1st of September. So, I had a really great summer working on the proposal all through the summer. But the nice thing then was that we got the outcome in December 2022 just before Christmas. So, we all had a really great Christmas present because we were awarded the project and then the award, the formalities of signing the so-called grant agreement with the EU. And we decided that we wanted some time to then plan the activities. So we decided to have the official start of the project at the end of the season, so in October 2023. So, basically now we have just completed the first year of activities, although it feels like much longer because we started writing the proposal, so brainstorming and putting down all the ideas actually almost two years earlier.

Jamie

So, Cecilia, this sounds like a monumental effort with a lot of very big goals, right? These aren't small goals and small objectives that you are discussing as part of this project. You talked a little bit about the grant writing process and the number of institutions and individuals involved. But I'd like to go back a little bit further and talk about the genesis of this idea in the first place. I mean, what created the desire to put together a proposal? Were you a team of small collaborators initially and you talked about it around coffee break one time and it grew? What's responsible for this idea originally?

Dr. Cecilia Costa

Yes, thank you, Jamie, for this question because actually it's really important. I mean, it didn't come from nothing. Actually, I would say the roots of BeeGuards go back about 20 years. So, there was a group of colleagues that met at the LB conference in 2004 who were involved in

honey bee breeding, and they decided that it was important to meet regularly to compare methods and establish, let's say, internationally recognized or validated protocols and methods. I mean, there had been some movement towards uniform protocols for honey bee breeding during an Apimondia Congress in 1972, sort of a year before I was born. But then there had been no more follow-up activities or not recent activities at least, say, in the 40 years later. So, this first group, we called it LB breeding group, started meeting once a year and then COLOSS happened. So, the COLOSS initiative came to life following the global alert on colony losses, which actually started in the US with the CCD phenomenon. And COLOSS started as a cost action, which is another kind of funding by the EU that funds, let's say, networking and meetings to avoid overlap on the scientific field. And so this COLOSS action was organized with four working groups to tackle all the different aspects of the phenomenon of colony losses.

The first was to identify the extent of the losses and this was the monitoring group. And then another group was dealing with pests and pathogens, and another group was dealing with pesticides and nutrition. And then last but not least sit there, there was the Diversity and Vitality group that was exploring how diversity and vitality of honey bees could affect their health and have a role in this phenomenon increased losses of honey bees. And actually, here I have to give credit to Dalf Buchler who convinced Peter Neumann over I think it was a beer at an Apimondia conference in Australia that it was really important to have this aspect considered. Peter Neumann is still and was already the leads and one of the minds behind the COLOSS and the cost action.

Amy

It's funny to hear that sometimes it's just the informal meetings that come together for these ideas.

Dr. Cecilia Costa

Right. So, this working group actually did produce evidence that the origin of bees or queens can play a role in colony survival with what is now what we call the J experiments, actually quite famous. I would like to say, well, it is listed on the COLOSS website as one of the COLOSS achievements. But European standards, at least it was quite big experiments involving many, many partners and over 600 colonies belonging to many different genetic lines, several different European subspecies, and it was performed in over 20 apiaries across the 11 countries. And these colonies were in the field for two seasons, and they were kept without Varroa treatment. And what we found in the end was that the colonies with that were headed by queens of local origin, these survived longer compared to the colonies that had queens of non-local origin. And also, that other agriculturally favorable traits such as honey production were tendentially higher in the colonies of local origin.

So, this was a big collaborative effort that many of us participated in together. And when the cost action finished and it seemed that COLOSS was over, we decided to keep together. And we actually had one meeting where we formally all signed the declaration saying that we wanted to keep on exchanging knowledge and working together within what we call the Research Network for Sustainable Bee Breeding. This happened in 2013. And then the following year, COLOSS also decided that it wanted to keep the efforts ongoing even though the official EU funding had finished. And so COLOSS became an association with an official legal status. And so then our research network, which we call Research Network for Sustainable Bee Breeding became and still is COLOSS task force. And within this task force, we meet regularly, so we usually have one – well, now, we had the gap with COVID. There's one physical meeting or workshop per year where we share knowledge and achievements related to the main themes of conservation of honey bee diversity and honey bee breeding. And together what we have done is we produce guidelines and protocols. Like, there was one protocol that you can find on the website, which is for assessing the suppression of mite reproduction rates. And then we use this for a common experiment for screening European honey bee populations for this trait that resulted in the publication and over the years, partners have collaborated in projects and publications. And the main focus, as I said, always to study Apis mellifera biodiversity and to see how breeding programs can use methods to breed that are resistant, for our resistant bees. So how we can integrate traits that consider vitality and our resistance in breeding programs.

For example, one big project was called, again funded by the EU, was called Smart Bees, in which honey bee breeding programs were initiated in several countries or populations where they didn't yet exist. And then a really important project for BeeGuards was a study commissioned by the EU to promote breeding of Varroa resistance stock. So, we made a proposal, several of us are SBB partners and the EU Commission liked it. And here again we had a large-scale field study on European level. In this project, we also involved many beekeepers. We had two levels of testing, one in which there were say expert testers that compared potentially Varroa resistant lines that we had identified at the start of the project coming from the different countries involved. And then we also had a level called commercial beekeeper level. So, we involved several hundred beekeepers across Europe, and we asked them to compare these Varroa resistant lines. So, we gave them queens from these Varroa resistance lines. And we asked them to compare them with the stock that they normally used, either their own bees or the bees that they normally would buy and use, and we asked them to assess them for the apicultural traits because we're interested in the Varroa resistance, but also in bees that would actually be used by beekeepers.

So, we asked the beekeeper level to assess to compare these Varroa resistant lines with their own bees and to give us the simplified data on what the agricultural characteristics of these bees are. And in this project, we again found that genotype environment interactions do play an important role in the expression of all these traits, both the Varroa resistance, but also the honey production or the behavioral traits. But importantly, we did see evidence that the lines that have been

selected for resistance did have lower mite levels and that several of these lines were capable of maintaining low mite levels even in absence of treatment.

So just to summarize, you see there is a long history of about 20 years of collaboration and of projects on breeding for about our resistance. So, when the Horizon Europe Call for Resilient Beekeeping was published, we realized that we were the right people to apply and to present a proposal, and also that it was a great opportunity to have funding to continue and to expand our work in the field of promoting breeding bees for Varroa resistance.

Amy

Definitely. It sounds like you all have no shortage of work that you've done and that there still needs to be done. So, under the BeeGuards framework, can you describe some of the projects that are conducted?

Dr. Cecilia Costa

So, we depicted the BeeGuards project as a bee, and inside the bee there are all the work packages or activities that compose the whole BeeGuards project. If you look at this figure that you can actually find on the BeeGuards website, you can see that at the center of the bee, there are two activities that are called innovative beekeeping management and innovative breeding strategy. And these are the real heart of the project around which all the other activities are connected. So, the idea is that Varroa resistance is unlikely to be achieved by a single beekeeper. So, it needs to be an effort by many beekeepers, but not all beekeepers are breeders. So, beekeepers can contribute by their management. Beekeeping management can support the selection of resistant bees. So, what we propose to do is to promote the integration of elements of natural selection both in the beekeeping management and in breeding. In the management, what we propose is to control Varroa by an induced brood break in the early summer, which will be followed by oxalic acid treatment that will target the mites that are on the dispersal phase on the adult bees.

And then over the season we monitor mite levels. And in the winter, instead of based on a calendar date treating all the colonies in the apiary, only treating the colonies that have a higher Varroa infestation level. In this way, we have a chance to identify the resistant colonies. So, the ones that won't need the treatment are the ones that will survive, and potentially to use them as breeder queens and to enable the fact that the drones from these resistance colonies will fly and mate with the queens. And this brings me to the innovative breeding strategy. Here we want to prove the German approach of tolerance mating stage, which is used by the German association for Varroa resistance is actually effective. Also, we want to spread and adapt to this concept to other areas. And here the hypothesis is that drones that are carrying resistance genes will be the ones that mate successfully with the queens.

But to be able to give these resistance drones the chance to show their superiority, we have to have colonies that are not treated. So, the point is we have mating stations, isolated mating stations, where we take colonies that have not been treated over the winter and that have survived, and these are the colonies that are used as drone producing colonies. And so, in BeeGuards we want to test these approaches so we will have a comparison. So, we have apiaries in which we compare this innovative management of inducing brood interruption, and we compare this with the traditional method, whatever is in use in that country or location. It could be amitraz strips for example. And also, we compare the traditional set up also for mating. So, the same genetic lines are on the one hand managed according to the innovative management. So not treated or treated based only on a threshold and it will be the non-treated colonies that are sent to the mating station.

But we also have the same genetic lines that instead are treated, and they all go to the mating station for drone production without caring about the Varroa infestation levels. In this way, we aim to have a comparison at the end of the project, which will be in three years' time to have sufficient data to promote these methods also with beekeepers. So, these comparisons are done. So, especially for the innovative management, it's done on an institutional level with again, big field study, 15 partners, 11 countries, a total of over 400 colonies. But starting from the next season, we want to involve beekeepers also. So, actually, we have prepared a website, a simplified protocol for beekeepers to use instead. The breeding activity is quite complex, and we do it only on an institutional level. Within the last year we will give several hundred queens to beekeepers to test them in their apiaries. And so also to get their opinion also from the point of view of the agricultural traits and to see them, let's say, in a real commercial beekeeping ratio.

All the other work packages, let's say, or most of the almost all the other work packages rotate around these field studies. Samples are collected within the field study that then go for example, for the hologenomics study. So, this is a new kind of approach in which it's not only the genome of honey bee, but also of all its associated microorganisms that are considered and also the genome of the Varroa mites. So we have collected samples of honey bees and Varroa mites that will be analyzed with this approach. And then there is a specific targeted experiment involving two countries with different landscapes, in which we look at the effects of also the genotype and the nutritional landscape from the point of view of the hologenome. But basically, we want to see how the different management can affect the hologenome. Another aspect is that more than half of the colonies are equipped with digital devices. And on the team, we also have expert modulars and the ultimate aim is to devise a decision-making tool that will support beekeepers in deciding when to treat and when to feed and that also can give information for breeding by using new resilience traits. One thing that we have in mind is the duration of the natural winter brood break and so these devices can, we hope, assess the presence of the brood throughout the winter. We know that this is not the same for all colonies, even in the same location. We want to see if this is a trait for resilience. Yes, and then there are some activities related to raising awareness and

helping the beekeeping sector to be prepared for the arrival of potentially invasive alien species such as which is really a big concern now in Europe.

But I know so for you in the US, if you check the BeeGuards websites in the following days there should be published a really cool leaflet brochure on Tropilaelaps with images and videos. So, something to check out.

Jamie

So, it sounds like you guys have a very expansive network, various partners throughout Europe. You guys are doing a lot, right? You just gave us a lot of updates, and I'm sure an organization of this size, you've experienced some successes and challenges. You don't have to go through all of them, but could you briefly list some of the successes and challenges that you have had with BeeGuards Project?

Dr. Cecilia Costa

Yes. Well, as a BeeGuards coordinator, my view may be biased. I mean, for now I see mainly successes. I have to say I am very proud of the whole team. So, all the test apiaries were set up on the islands of Malta where they had terrible attacks by Hornets on the colonies. But all the apiaries are set up, all partners are very dedicated, participated in a workshop where we demonstrated all the methods, bee samples, Varroa samples have been collected, have been shipped, which also seems like something insignificant, but actually in real life can be quite a problem. And they've been received by the partner who's in charge of the hologenomic analysis. Pollen samples for nutrition and immunity essays have been collected already. Some experiments have been done on heat resistance traits. I have to say that the breeding work package even started before the official beginning of the project.

Another success is that a new model for viral reproduction and development, which considers the context of the colony in a new way, is well underway. And we have already in place a plan for the life cycle analysis and the team that is going to study pollinator competition, which is a big issue in Europe at the moment. Also, they have a good plan underway. And as you know, the communication team are very lively. That's why I'm here today.

But yes, there are some challenges. One practical challenge that we have, I mean a bit of a setback that we've had till now, has been the deployment of the digital devices. And actually the company that is producing them is actually a partner in the project. And so that means that they are actually very dedicated. But they had various problems that they couldn't control, such as delivery of components from the Far East and a new firmware which turned out to be not compatible with their existing system, and problems in figuring out the suitable mobile data company. Because then, of course, these devices are shipped all across Europe to different countries with different data companies, although we're all in the EU. And then they had a key engineer who, I mean, that's a private company. He found another job. So, we don't yet have all

these really cool devices in the field yet. So, this is a bit of a challenge. I don't mean it's something that we had foreseen, but I'm quite confident that they will soon be in the field, and they really are very cool devices. I mean there is a sensor that we call a comb, and it spreads across the hive so it can really capture the temperature in several different points and give us an idea of where the cluster is over winter and how long the brood rearing continues, which is really a key characteristic for Varroa control, but even more so now with the risk of the arrival of the Tropilaelaps mites.

Some other challenges are finding data on cotton density, which we need for the study on pollinator potential competition. And of course, what I see as the biggest challenge is involving beekeepers and actually then spreading the message and getting beekeepers to try this innovative method. This is the biggest challenge I see.

Amy

So, when Jamie asked you that question, I can tell that you're definitely a glass half full type of person because you really focused on the success. We can tell just by hearing you how proud you are of this project. I think that passion and being proud and standing up for projects that you believe in, I think it's fantastic. And I'm sure that that has a lot to do with the success of the project and the program as well.

Dr. Cecilia Costa

Oh, thank you, Amy. That's so very nice to hear.

Amy

Yeah. So, my last question for you is about the future of BeeGuards. It sounds like there's so much going on. I'm sure that there's a vision for the future of the project. Can you describe to us about the future and maybe what to expect or things that you all are working on?

Dr. Cecilia Costa

Yeah. Well, I'm very much focused on the duration of BeeGuards at the moment. We still have three years of project activities. And yes, I'm very much a half full, but I'm aware of how many things we have planned to do. It is always a challenge keeping everything running smoothly. But there's several BeeGuards initiatives that we actually hope will live on. So, I'm looking at it now.

I'm telling you from the practical point of view. So, this digital network of apiaries, we hope that this will then stay. This network will continue to produce data that will be useful for decision support systems in the future. Also, there is a tool for beekeepers and bee experts, which is called Wiki-bee-dia.

So, this will be a compilation of BeeGuards' results, but not only also best beekeeping practices, we're just starting to compile this. And the idea is that this will then live on well past the end of

the project. We need to decide who we want to donate these initiatives to at the end of the project. And in terms of a more, let's say longer term vision, well, we hope to collect evidence that will convince more and more beekeepers that reduced Varroa treatments, threshold-based Varroa treatments supported by breeding for Varroa resistance are the way forward for beekeeping, and that these methods can be advantageous for beekeepers and for honey bees themselves, this is the way and that we will succeed at making beekeeping a bit more resilient and sustainable.

Jamie

Cecilia, it sounds like you guys have done a lot. You got the right team put together, you've got lofty ambitions, and I think it'll pay big dividends for beekeepers. We're going to make sure and link your website to BeeGuards on our show notes so those of you listening to us around the world can go and have a look at what you guys are doing. But Cecilia, thanks so much for joining us. I really think it's a great effort that you talked about, and I really look forward to seeing where you guys head in the future.

Dr. Cecilia Costa

Well, thank you. Thank you, Jamie. And well, thank you for having us, for giving us this opportunity to talk about BeeGuards. Seeing that you're interested, I can tell you that BeeGuards is also active on Facebook, Instagram, LinkedIn, and there our communication team is posting updates of our daily activities. Well, there's like from fun things to our daily activities, but also publications and videos, some specific to BeeGuards and all others also even more global. We also have a YouTube channel where we will be posting more videos. And we also have our own podcast channel, if I may, interviewing BeeGuards members and he asked them about the different aspects of the projects. If you can, you can find these podcasts on beeguards.eu and soon on Spotify.

Amy

This is all really great information. Is there anything else that you wanted to add before we end the episode today?

Dr. Cecilia Costa

Yes, thank you, Amy. If I may, just a little advertisement. I wanted to say that BeeGuards will be present at the next Apimondia 2025 conference, which will be held in Copenhagen, and we will be at the Apimondia stand because Apimondia is a BeeGuards partner. The last thing is that there will be just a little investment for my country and institution that we will be hosting the next conference of epidology, the LB conference in 2026 will be held in Bologna and we are organizing it together with the University of Bologna. So I hope to see many of you at these

future beekeeping apiculture events. And Amy and Jamie and colleagues, thank you so much for inviting me. It was really, really great to be here.

Jamie

Well, great. Good luck with it all and thanks again.

Amy

Jamie, I think one of my favorite things about this podcast, we used to record in person and then we would have our guests come in person, and then COVID happened, and we ended up being able to open it internationally. So, the beauty of being able to bring in someone in our industry internationally to share projects and to share resources of what they're doing. It's just really fun to be able to bring someone and just share that with our listeners, don't you think?

Jamie

Well, I think the key is one of our goals with this podcast is to get information out as quickly as possible to be scientists and beekeepers all around the world. There's so much stuff happening that we almost have a limitless well of resources to pull from. So, it's great to have to Cecilia.

It was great to have BeeGuards highlighted because yet again, we have another organization that's working on behalf of beekeepers and honey bee colony health that has this interconnected network of folks who are working hard to understand factors that cause colony issues, mitigate those factors to ensure that beekeeping sustainable well into the future. So, yeah, I mean, it's great to be able to have international guests because we also have an international audience. So, we want to make sure people around the world know this is not a Florida podcast, it's not a beekeeping in the US podcast, it's a global beekeeping podcast. We think we're able to hit those target audiences. The beekeepers around the world have wonderful guests just like Cecilia, speaking about great things, just like BeeGuards.

Amy

Absolutely. And we'll be sure again to link the BeeGuards website to our additional notes, which is also on our website. So can't wait for our listeners to be able to go click around explore to see what some of the projects are and some of the other things that people are doing around the world.

Stump the Chump

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

Amy

Welcome back to the question and answer segment, Jamie. So, the next three questions I have, I went and spoke to one of the Florida Beekeepers Association meetings and talked about our trip

to Thailand. So, there were lots of good questions. Two of the questions that we have today are related to some of the bees in Thailand and then we have a question that is unrelated to the bees in Thailand. Well, it could be related to the bees in Thailand, but let's get started. So, the first question that we have was about Apis species. So, we've discussed different Apis species throughout this podcast and there are -- how many species are there?

Jamie

Well, let's just say over 10. We are probably close to recognizing around 12 now, and I can go over those quickly.

Amy

Sounds good. Well, the question is really about the different castes. So, the castes within those Apis species. Do they all have the same developmental timeline?

Jamie

So fortunately, this will be a question I can answer easily, and the answer is no, they do not all have the same developmental timeline. Amy, if you had asked me what the developmental timelines of the different species are, then I would be stumped.

Amy

OK, that's next week.

Jamie

Let me just elaborate on that a little bit. You're right, there's multiple species of Apis. So, Apis is the genus name for honey bees. So, there are two dwarf honey bees, Apis florea and andreniformis. So that's two species. There are at least 5 cavity nesters. We know mellifera, that's the bee we keep. That's the bee mostly this podcast covers. There's also cerana, koshevnicovi, nuluensis, and nigrocincta. All four of those occur in Asia.

There is growing evidence that the bee that's in India or in parts of India that has historically been a subspecies of Apis cerana is, is possibly going to be elevated to the species level and that would be Apis indica. So, we're kind of waiting on that. The jury's still out.

But with the case of the giant honey bees, there's historically dorsata and laboriosa, but formally Apis dorsata breviligula and Apis dorsata binghami. Breviligula and binghami are subspecies historically of dorsata, but probably to me they are now elevated at the species level. So, there's probably at least 4 species of giant honey bees. So dorsata, breviligula, binghami, and then laboriosa. So, if you're keeping track, that's what? There's 11, possibly 12. So probably up to 12.

I went through that exercise to say if you just focus on mellifera, the bee that most folks around the world keep, right, that very popular bee with a natural distribution in Europe, the Middle East

and Africa, that bee by itself has 30, 30 plus maybe, depending on who you ask, subspecies. And within mellifera, the developmental times differ. For example, there's some subspecies of African honey bees that develop about a day faster than some of the European derived subspecies that we keep here in the US. So even within mellifera, you get different developmental times, even though we tend to say things like, an egg for three days and then from egg to adult for workers, 21 days, for drones, 24, for queen, 16. That varies within the subspecies of mellifera. So if it varies at that level within mellifera, you know it's certainty between florea and dorsata and everything in between, there are differing developmental times. I don't have them all memorized but for sure.

Amy

Well, why not?

Jamie

I know, I know. I do a good job keeping up with the species, those 11 or 12 species, there's no way I could remember all the developmental times. But the short answer is they don't all have the same development mental timeline.

Amy

OK. So, as you were talking, I'm trying to think who makes the decision of what is an Apis species and what stays a subspecies? I mean, who is in charge of that?

Jamie

Yeah, so that's a big, long answer. But the shortest possible answer is there are varying definitions of species in biology. So, a lot of biologists will call a species one thing and another species another thing. But probably, I don't know, this may be an overgeneralization, but probably the best general definition is when members of the same population are capable of breeding and producing fertile offspring. So, what do I mean by that? Well, if you allow Apis mellifera ligustica, an Italian honey bee, say, queen, mate with Apis mellifera scutellata drones, those would be drones from African derived honey bees, if you allow those two to mate, they produce offspring, a hybrid offspring that's capable of producing fertile offspring itself.

They are the same species. They can interbreed and produce fertile offspring. If you do something, the best way to think about it is like a horse and a donkey. Horses and donkeys are capable of mating and producing offspring. They produce a mule, but mules are sterile, which is why horses and donkeys aren't the same species. So, in the case of Apis, one of the easiest ways to think about species is just to say, well, they're incapable of mating and producing fertile offspring. That is true. But they are also biologically quite different and their distributions may not overlap. So, for example, it's really easy to separate Apis mellifera from Apis florea and Apis dorsata. They've got very different natural histories, different body sizes, different molecular

traits, etc. But clearly, it's trickier when we think about something that used to be Apis dorsata dorsata, one subspecies, Apis dorsata binghami, another subspecies, Apis dorsata breviligula, another subspecies. And what's elevated breviligula and binghami to probable species status is there are genes that are different enough between those groups that make them different. They're morphometrically different, things like wings, bodies, shape, etc. They have genetic differences. They have, in most cases, distributions that don't overlap. So, there's this pile of evidence stacking up to suggest that these things aren't just subspecies, that they are in fact truly species. Of course, that kind of telltale way is to see if you can cross and produce fertile offspring. And I don't know if that work has been done, but I'm sure it's waiting to be done.

In the case of something like Apis cerana indica, when there's a whole lot of different Apis cerana subspecies, what would elevate indica would be something similar morphometrically, it's just different enough. Genetically, it's different enough. And then people will have to look at behavioral attributes and see if it's just different enough to be elevated to species. But I'm seeing the literature on that one and it's getting convincing enough to me that that we very soon could ourselves be recognizing it as a species.

Amy

Very cool. All right. So that kind of leads me into the second question. So, in Thailand when we were there, we went to a stingless bee farm, we saw lots of stingless bees, and one of the questions was asking if the stingless bees in Nicaragua or in Brazil, we hear about stingless bees there as well, are they the same stingless bees that are the ones in Thailand that we saw?

Jamie

So, the quickest answer is no, but the most correct answer I guess would be, well, it's possible, but let me elaborate and let me elaborate on it this way. If you listen, listeners, to that very first question about Apis, I made the point that Apis is the genus name for honey bees.

Now, that's a tricky statement, and I kind of did it on purpose because I knew this stingless bee question was coming. Stingless bees also produce honey, and in areas where stingless bees live, sometimes people refer to them as honey bees. And I don't want to beat you guys to death with super nerdy entomology talk, but –

Amy

That's what this podcast is all about.

Jamie

Yeah, but Apis is the genus for what we would call the true honey bees. Heck, even bumble bees make a type of honey. So, it is true that other bees make honey, but that doesn't make them, quote, true honey bees in the sense that Apis bees are the true honey bees. So, back to stingless

bees. There's lots and lots and lots of species of stingless bees distributed mainly in the tropics or the warm areas of the world. For example, we do not have them in Canada and the United States, but they do have stingless bee species in Mexico and the islands scattered across the Caribbean, Central America, South America.

There are also stingless bees in Asia and Africa and Australia in those warm, tropical, subtropical, warmer climates. And so stingless bees, there's lots and lots of species. So there's no reason. I'm obviously not a stingless bee expert. So it's mellifera. Apis mellifra has been moved around the world, so it's conceivably possible that some of these Thai species have been moved or vice versa from Brazil, but I would just say the knee jerk reaction is those two places definitely have their own species, regardless of if some of the species have been moved around for honey production purposes. My guess is there's incredibly limited movement of stingless bee species outside of their native area because you don't really have to move them because people would already have their own stingless bee species where they are if you're living in these tropical subtropical areas.

So, the stingless bees in Thailand would not be the same ones as in Nicaragua or Brazil or Australia or places in Africa for that matter. Yeah, there are lots of different species. They're actually quite fascinating bees, really fascinating natural histories and biologies. They're amazing and they're totally worth seeing. Even if you're as in love with Apis Mellifera as I am, it's worth just checking these things out if you ever travel to the areas where they are native.

Amy

Yeah, absolutely. I fell in love with them when I met them. So pretty cool bees. OK, so we went from the first question that had to do with Apis species, the second question was about stingless bees, and now we're going to get into a question about stings. So, beekeepers, they harvest venom. And the questioner is asking, how do beekeepers harvest venom? And why the heck would you want to harvest venom? Like, what is venom used for?

Jamie

So, I'll do it kind of the reverse order, and I'll make a point to say, I'm not a medical doctor, so I'm not making any claims positively or negatively about this. But generally speaking, when people harvest venom, it is what they consider for medicinal purposes. I've known people who will take a little bit of venom, or harvest it for use, however it is that they feel like they're benefiting from it. So, often the harvesting of venom is linked to a perceived medical benefit associated with its use. How it's harvested is actually quite interesting. I'm going to talk about the way that I'm familiar with. I'm sure there's a few other ways, but I'll talk about the one that I know most. It essentially relies on getting bees to sting something to deposit their venom and then you going back and harvesting it later. So let me give you an example of what I have seen people do. A friend of mine, Gordon Klaus, gave us a venom collector one time that I think he

had picked up in in Eastern Europe. And the premise of this Venom collector was that you would take a small sheet of glass and wrap it in what we call Saran wrap. And I'm sure if you're listening from around the world, you may not be familiar with that, but it's a thin layer of plastic that you can put over your food dishes after you've cooked them for preservation purposes, just a thin layer of clear plastic. So, you take this piece of glass, you wrap it in this thin layer of plastic, the Saran wrap. Then you put that onto a machine that pulses electronically. So, imagine something like a queen excluder without the wires being as thick as what you would see on a queen excluder, those laying on top of that sheet of glass that's wrapped in Saran wrap. As bees walk over that metal wire, it will pulse electrically and cause the bees to sting the sheet of glass. Now, since the glass is wrapped in this Saran wrap, this plastic, they are stinging through the plastic and releasing venom that essentially goes between the plastic and the glass. So, essentially, you put this in a hive, you close the hive up, it pulses, you leave it there. I don't know how long, an hour, 30 minutes, however long you want to collect. Any bee that encounters it while it's pulsing will sting that sheet of glass. Then you can turn the machine off and that will allow the venom to dry between that plastic and that glass. You come back, remove that glass, remove the plastic around it, and essentially on that glass, you will have dried crystallized venom, and you can use a sharp knife or a razor blade to scrape that crystallized venom or that dried venom off the glass and collect it into a vial.

That is the way that I have seen it harvested. Now, I will just want to throw out a lot of warnings here. Just breathing that stuff that you are scraping off can cause problems for you. So, you have to be careful because it's a lot of venom deposited onto a place. You've got to collect it very carefully. You really need to know what you're doing. You don't need to be creating dust because you're then breathing in venom dust. So, there's a lot of trick subtleties and nuances to venom collection, but basically it relies on a machine that shocks the bees, causes them to sting a surface on which they deposit the venom, then you can come back and harvest it later.

Amy

While you're talking, it just makes me think of how creative beekeepers can be when it comes to harvesting certain things, right? It's like, oh, okay, I never would have thought that venom dries and you would have to take a little knife. And then I'm just imagining venom dust getting everywhere and having a pretty bad reaction. That’s what happened to me. But anyway, all right, So, thank you so much for answering those questions. For our listeners out there, do not forget to send us an e-mail or send us a message on social media if you have any questions for the Q&A segment of our podcast. Thanks for listening to today's episode.

This episode was edited and produced by our podcast coordinator, Mitra Hamzavi. Thanks, Mitra.

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.