

# Episode 153 PROOFED

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## SPEAKERS

Serra Sowers, Amy, Jamie, Guest, Stump The Chump

### Jamie 00:10

Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere. In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast. Hello, everyone, and welcome to another episode of Two Bees in a Podcast. Today, Amy and I are joined by Dr. Samir Kadri, who's a postdoctoral research scholar in the Department of Animal Production and Preventative Methods of Veterinary Medicine in the College of Veterinary Medicine and Animal Science at Sao Paulo State University in Brazil. And we're doubly fortunate because he is also a visiting scholar here in the University of Florida Honey Bee Research and Extension Laboratory. Samir, thank you so much for joining us on Two Bees in a Podcast.

### Guest 01:18

Oh, thank you so much, Amy and James, for inviting me for this talk. Yeah, I'm really excited to talk a little bit about Brazilian honey bees and how the beekeeping in Brazil works and about some research.

### Jamie 01:32

Great, Samir. That's truly the benefit of having you on but you are both a commercial beekeeper and a bee researcher in Brazil. So we're going to touch on all of your work and your experience with the industry in Brazil, as well as some of the research that you're doing now. So that's the first question that I'd love to ask you is, how did you end up becoming a beekeeper? And how did you end up becoming a bee scientist?

### Guest 02:00

So yeah, it's a long story about it. I started being a beekeeping a long time ago, maybe 10 years ago, because my parents live on a farm, [inaudible]. And in this farm, we usually find some wild swarms there. So when I was young, I try to catch these swarms, but I didn't get a good success on it. After

that, I entered the animal science undergrad course, and during the undergrad course, I'm really interested in how to keep bees, how to produce honey, during all the undergrad course. So then I start doing some training in a beekeeping area during my undergrad course. And after that, I started my own company doing consultancies in real estate for beekeepers. And during this period, I developed a small production of mead. It is necessary to have a good way to produce mead. And then what I did was I started buying honey from beekeepers, but it's not easy to buy a good honey with a really good quality because all the time, beekeepers say, "Oh, you're making mead. Probably I can sell you a prefermented honey to produce your mead." So this is what happened. So I started my own production just thinking about mead during my master's. After I finished this series of consultancies, I started my master's in beekeeping. And then during my master's and my PhD in beekeeping, I start my own apiaries to produce my own honey to have a really good quality honey to produce mead that I want to produce. During all these master's, PhD, I was increasing the number of hives that I had. Now, I'm producing honey, not just like for my mead, but just honey in jars, in buckets and barrels. So I grow inside the beekeeping more for honey production.

**Amy 04:18**

You know what, Samir? I don't think we've ever had a guest who told us that they were interested in producing mead and that's what made them become a beekeeper. So that's always really fun to hear, all the background stories of how people get into bees. Now let me ask you this. How many colonies do you have in Brazil?

**Guest 04:42**

I have around 500 to 600 colonies in Brazil in almost 20 apiaries around my city. So I live in Botucatu city. It's a city countryside, Sao Paulo state, it's around 250 kilometers from Sao Pablo City. So in the area that I have all this occur, it is a huge area that produces a lot of eucalyptus. It's the biggest eucalyptus crop area that you can find in Brazil, and all this eucalyptus, it's cropped for production to export. This is why in this area I have all these apiaries that I'm producing my honey, we have a huge production of honey from many beekeepers. We have three different associations that are inside all this area, and my city and all the cities that are around my city, it was mentioned in the last year, the city produces more honey in Brazil.

**Amy 05:48**

That's amazing. So, I'm excited to talk a little bit more about commercial beekeeping in Brazil and what that involves, and I know Brazil is a huge country, but in general, can you kind of describe the nature of the commercial beekeeping industry, and about the beekeepers in Brazil? So you already mentioned a little bit about the associations and how your area produces a lot of honey. Do you know how many beekeepers are in Brazil? And what do the commercial beekeepers primarily do as far as the industry goes?

**Guest 06:21**

So in Brazil, it's really hard to know how many beekeepers we have nowadays because we have a confederation that organizes it, but we do not have a lot of beekeepers as professional beekeepers. This is something really hard to know. But we have how much money that we produce in the last year. So we produced, in the last year, around 50,000 pounds of honey. And we have around 3 million

beehives in Brazil. So with these numbers, you can see that you don't have a really defined beekeeping in Brazil with high honey production, so we have around 16 to 17 kilos of honey produced by each hive in a year. So basically, nowadays, we don't have really developed beekeepers in Brazil in general. But what is going on? This is all beekeepers, it's trying to improve the production. We are doing a lot of -- doing research and doing new breeding programs. Beekeepers are trying to increase production to get more profit from common beekeeping. So, now we are having a transition between the small beekeepers to medium or large beekeepers to be more profitable to the beekeeping in Brazil to get more money. So this is what is going on. And then how it works, basically, I will talk about my area, the area that I live in Sao Paulo state. A person that wants to become a beekeeper in Sao Paulo state, so basically, if you want to become a beekeeper, a professional beekeeper who receives money from your production, you need to be inside an association. What are the benefits to be inside an association in Brazilian or in the state? These associations make contracts with big companies that have large farms and then, with this contract, we are allowed to put some apiaries inside these farms. So I am inside free associations in my state. So the contract basically is a lead between an association and industries that produce eucalyptus, cane sugar, and oranges. And then these industries allow us to put inside our apiaries, and then we usually pay, depends on the company, an amount of honey for each bee hive that we put inside the farms, or an amount of money. Almost, at times, these companies gives back this money and this honey for the association and the association uses these monies to invest in infrastructure for beekeepers. So buying new equipment for honey extraction, buying some equipment to make it easier to sell honey in jars for people in certain cities. So this is what happens in Brazil in beekeeping nowadays.

**Jamie 09:43**

So Samir, you spoke quite a bit about honey production. So I'm curious, Amy and I are of course based here in the US, and the US honey production is obviously very important, but pollination is a really big business for beekeepers here. I'm curious, in Brazil, how do beekeepers make money? Is honey their primary production? Do they do any pollination? Are they paid for it? Do they do value-added hive products? You know, beeswax? Propolis? Do they sell packages and queens? What's the principal sources of income for beekeepers in Brazil?

**Guest 10:17**

In Brazil, the principal source of beekeeper income is honey. But we have really specific regions that produces kinds of products from bees. So, Sao Paulo state produces more honey. Minas Gerais state produces more propolis. We have a lot of beekeepers specializing in propolis for exportation. In some parts of North Brazil, we can find some specialized beekeepers that produce pollen. So we have this Goiás areas that produces different kinds of products from beehives in Brazil. But about pollination, in Brazil, we don't have this huge market as yours in the US. So nowadays, beekeepers pay the farmers to put bees inside the crops, to pollinate crops. It's completely different here as the farmers pay beekeepers to come and put bees inside for pollination. So this is why some new startups in Brazil are growing nowadays, trying to make this good link between farmers and beekeepers, and trying to match farmers and beekeepers that would do business with farms and farmers that wants the bees pollination, and trying to make income for beekeepers, when the beekeepers do this type of service for the farmers.

**Amy 11:50**

So Samir, I'm going to change topics a little bit. I just got back from Apimondia in Santiago, Chile. There are so many beekeepers from all around the world, right? You kind of you meet someone new, you start talking to them about bees, it's very easy to talk about bees for hours and hours. But something that everybody starts to discuss is some of the challenges that they face. So some of the problems that are going on, some of the issues. And so in general, can you describe some of the challenges that beekeepers face in Brazil?

**Guest** 12:32

So I think, nowadays, the biggest problem that I have in my area, that I have in my apiaries is the use of some agrochemicals from farmers. So we are losing a lot of swarms by farmers that don't use chemicals correctly. And that is a really big problem that we have in Brazil. And another problem that I'm having in my area because I'm in an area for honey production. So almost all our honey from Brazil we export. Sometimes, the price of the honey that we receive from people that buy for us for exportation is too low and can't pay what we spend to produce this honey. So this is another really important topic that needs to be discussed in Brazil and all the time, in conferences and the associations. You should improve the honey consumption from Brazilians. So we will sell our honey in the internal market and then we can get a better price than export in various for other countries.

**Jamie** 13:47

Do you have disease and pest pressures like a lot of other folks do? For example, how bad is Varroa? I know, also, for example, that small hive beetles had been found in Brazil relatively recently. Are those issues that beekeepers and their colonies face?

**Guest** 14:06

In Brazil, we have Africanized honey bees. So Africanized bees are really, really defensive and have a really good hygienic behavior. So when I came here to the US and a beekeeper asked me what is the difference between the beekeeping here and beekeeping in Brazil? I basically said that it's another word of beekeeping. We have completely different bees from the bees that you can find here in the US. We have Varroa mites, we have beetles in our colonies, but it seems that these Varroa mites and these beetles don't make it so bad for the bees here. So these bees, those Africanized bees that we have in Brazil, all the time trying to control the infestation of Varroa and the beetles. So this type of disease is not a really big problem for us in Brazil, but we have pests in our colonies, and it's easy to find Varroa and beetles. But we just have problems with beetles and Varroa when you have a really weak colony and swarms in the apiary. So basically, we don't do any type of control for Varroa, for beetles, for other types of diseases that you can find in the swarms. American foulbrood, European foulbrood, some types of viruses was related in some studies that people did in Brazil in some colonies, but it's not a big deal. It's not a big problem for us. And people don't care about it nowadays. But what's going on? After this problem that we are having now about farmers using a lot of agrochemicals, we're getting, all the time, really intoxicated swarms, intoxicated colonies that have a small size colony. And then when we get an intoxicated colony, sometimes it's easy to find some disease on this colony. So what is going on? People are starting to take care about some types of disease and tracking some types of disease because this is more related with weak colonies that get intoxicated from some agrochemicals.

**Jamie** 16:38

Well, given all that information, where do you think the future of beekeeping in Brazil is heading?

**Guest** 16:43

I think this is a good question because the future of beekeeping in Brazil, I think the principal point that we will need to take care of is try to make a good relation between beekeepers and farmers in Brazil, more linkage to agrochemicals usage in the farms. So this is one point that, all the time, bee companies that use different types of crops, go to associations and give talks to make a good relation between beekeepers. So farms are trying to track where are the apiaries around the farms. [inaudible] goals to pulverize agrochemicals near these apiaries to not have a lot of dead bees around. Yeah, this is the point that Brazilian beekeepers care, make a good relation between farmers and beekeepers so we don't lose bees to agrochemicals.

**Amy** 17:58

Yeah, definitely, Samir. We are also doing the same here in the United States, having to connect beekeepers with growers and just make sure that every everybody is on the same page, and educating growers and also educating beekeepers as well. So, as Jamie mentioned earlier, you are a visiting scholar with us at the lab here in Florida. Can you discuss your focus of research, and you had mentioned earlier that you did your master's and PhD in bees and you're now in your postdoc. So can you talk to us about the research that you're conducting?

**Guest** 18:37

So yes, I am here as a visiting scholar. So what I'm doing, Brazil, it's research to try to find what is the difference between honey production in Africanized honey bees? Usually, you see in the field, you have inside the same apiary, swarms like colonies that produces not a lot of honey and swarms that produce a lot of honey. These swarms, we can send any clinical signs of disease, and all bees together in the same apiary. So what I was studying is what is the difference in the genetics of these bees that makes the honey production go up or go down. So what I did during my PhD, I worked with some beehives in the University are doing the same management for honey production, while the bee hives with the same age of queens during the blossom in the same apiary, all the same conditions. So I collect the queens from all these hives and then I sequenced the DNA from these queens and I found the search for some mutations that can be related with these traits of honey production and other behavior traits. For example, offensive behavior, hygienic behavior, because beekeepers want to have hives with low defense behavior, high hygienic behavior and high honey production in Brazil. This is what everyone wants. After that, I entered in my postdoc, and then I tried to validate these mutations in other commercial beekeeping populations. So I did another field experiment with a larger field experiment with more than 200 hives, monitoring the honey production of these hives during three different blossoms with all the same type of management, but in different apiaries, different areas, different blossoms. I collect bees from these hives and I track if I find the same mutations that I found in the previous study. So after that, I test, by myself, if I have some disease in my hives that I can see inside in clinical signs, and then this is what was making my beehive not producing more honey as the other group. After that, I searched in the scientific areas with researchers that works with this type of disease diagnosis using molecular biology techniques. I found Dr. Ellis, so I made a contact to Dr. Humberto and Humberto made a contact with Dr. Ellis. I came here with some samples from Brazil, test if these bees that produce low honey or high honey, I have some disease that I can't find any clinical signs, but

I can find the molecular assays, the DNA or the RNA from viruses, bacterias or fungus. And after getting these results, I want to correlate this disease to the production and defense behavior and hygienic behavior change.

**Jamie 22:26**

Well, Samir, that's interesting research. We're happy to have you here. I listen to you talk about beekeeping in Brazil and all the work that you're doing, you're really doing a lot. I mean, you're managing five to 600 colonies, you have a successful honey production and mead business. On top of that, you're studying diseases and pests and selected lines of bees that you personally selected for high or low honey production. But I do want to shift gears just a little bit after listening to everything you've discussed. Brazil is home to other types of honey bees, principally, stingless bees, many species of stingless bees and you tell me that you also keep stingless bees. Can you tell us just a little bit about your experience keeping stingless bees and making honey with stingless bees?

**Guest 23:14**

In Brazil, you can find a lot of different stingless bees, it's really completely different beekeeping. In Portuguese, it says, meliponicultura. It's a person that works with Melipona and Trigona in general. So what I do in Brazil because you maintain apiaries with all these hives, basically, I get swarms in traps to introduce in my apiaries when I lose some colonies inside. But sometimes, I get some Melipona or Trigona swarms in my traps. These traps are made for Apis mellifera but sometimes I get these Melipona or Trigona inside, and then they move all these Melipona and Trigona swarms for specific boxes that are used in Brazil to keep it inside. Depending on the time of the year, I have more or less stingless in the bees in my own house inside the city. This is something that is really cool in Brazil because we have Africanized honey bees. For Africanized honey bees, we have some laws that it is forbidden in urban areas. But stingless bees, as the name says, don't have a sting. It's not so different as the Africanized honey bees you're allowed to have inside urban areas. So I have all these stingless bees inside my house inside the city. Sometimes, it's for hobby that I have this bees, it's not profitable for me. But sometimes I harvest honey from these stingless bees. We have a huge difference between honey production inside the different species that you can find in Brazil. Some hives, from Trigonas, you can harvest almost 100 grams of honey during the year, but some some species of Meliponas, you can harvest 10 kilos in a year. So you have this huge difference and it's completely different how it is inside the nest of stingless bees compared to Apis mellifera bees. In Apis mellifera bees, you have all the honey come in vertical, but in stingless bees you have all the honey combs horizontal. This is talking about brood. Now, when you talk about the honey, stingless bees have some small cups inside the hive. To harvest the honey, you need to search this honey with syringes or a vacuum pump, completely different in Apis mellifera where you can have the frames inside that you move and centrifuge and come back. So it's another role in the bees' area.

**Amy 26:25**

I think this series is not going to be good for me because all I want to do is go and visit and see. I just want to work stingless bees. I would love to see the honey harvesting process. I'm sure I could find a video online somewhere but I want to see it in person. But it makes me really excited to hear you talking about beekeeping in Brazil. Alright, Samir, so the last question that I have for you, you



discussed eucalyptus honey and how that is your primary production. The last question that I have for you is what other types of honeys are very popular in Brazil?

**Guest 27:05**

Depends on the area. Brazil is huge. So you can find a lot of types of honey in Brazil. Talking about Sao Paulo state, we have, principally, four in my area, four different honeys. So we have eucalyptus honey, orange honey, wild honey that you harvest in the end of the year in December, January, in the summer period. And another type of specific wild honey is Cipó-uva. This one we harvest during the winter. So, it's wild honey that we harvests in the end of the year. Depends on the area because we have large forests with a lot of different types of trees inside. You have light honey and dark honey. Eucalyptus, in general, it's a dark honey. Orange is light honey too. So we have more production for eucalyptus honey and wild honey, more brown honey. For light honey, it's more hard to produce and have a higher price when you sell it. But in other states, you can find a lot of different types of honey. You can find [inaudible] honey from crops that people produce. The Brazilian pepper in some areas of Brazil, a lot of beekeepers produce it. In South Brazil, you can find [inaudible], it's a Japanese grape, the name of this kind of blossom. It is a light honey with a good price, which was produced in the south Brazil. So we have really specific productions in really different areas in Brazil.

**Jamie 29:01**

All of these honey sound amazing. I just want to try out some of all of them. I'm curious, Samir, as my last question, is the Amazon area a good place to produce honey? People always think about the plant biodiversity in the Amazon rainforest. I'm curious, is it a very good area to produce honey?

**Guest 29:21**

Really good question. All the time people ask me this question. In Amazon, first, it's really hard to keep bees in it, in production, because we have a huge humidity in Amazon forest, so it's really hard to keep bees, classic bees in areas that have like a huge humidity. So what people usually haven't said about the Amazon forest, it is stingless bees production. So we have a lot of Melipona that produces a lot of honey, and you can produce this honey inside the forest. And sometimes, the government can keep these Meliponaculturists, the beekeepers that works with Melipona, inside these forests to preserve the forest. These people who live inside the forest can get money from the forest without destroying the forest. And this Melipona produces a lot of honey and sells with a higher price when you compare it with honey sent by Africanized honey bees in Brazil.

**Jamie 30:34**

That's fascinating, Samir, I really appreciate you sharing that. Hey, thank you so much for joining us on this episode. It really sounds fascinating about all the work that you do as well as being a beekeeper. I'm not sure how you're able to wear both hats and do so much work as a scientist and beekeeper. But thanks again for sharing your experiences with our listeners.

**Guest 30:53**

Thank you so much for inviting me for this amazing podcast.

**Amy 31:13**

So I really liked this series, Jamie, of just speaking to beekeepers talking about the different types of beekeeping. It's always fun to hear. I mean, it's not fun, but I like hearing challenges that beekeepers have in different countries, because sometimes they're exactly what I would have expected them to be. And then other times, I hear things and I'm like, "Oh, wow. I didn't really consider that before." So it was nice to have Samir on discussing his experience as a beekeeper and also a researcher.

**Jamie 31:44**

Yeah, absolutely. I mean, first of all, Brazil is a big country, right? So there's so much diverse beekeeping, probably even within that country. And then to compare what we do here in the US or what folks do all over the place, it's just very different. There are always some common threads when you speak to beekeepers elsewhere. I mean, he mentioned pesticides as a potential issue for him and some industry-related issues and honey prices. All of those are common, but there were some surprises. I mean, when I asked him a follow-up on, well, what are the big issues with bees, and he mentioned prices and pesticides, okay, that's fine. But then I said, well, what about Varroa? What about small hive beetle? And he said, well, we've got African bees. So what about those things? So, it's really interesting to hear about some of the things we struggle with so much that beekeepers in other countries don't have to deal with because they just have a different strain of bee. It's really neat to hear his experience in Brazil and him be able to share that with our listeners.

**Amy 32:40**

I also had no idea that he kept stingless bees, so that was fun that you brought that up. I didn't know that he had kept stingless bees. What has your experience been working with stingless bees?

**Jamie 32:54**

So it's funny. We actually talked about that this morning at breakfast. I will say to our listeners, our lab meets once a week for a breakfast meeting. Today, we're recording this podcast, we happened to meet this morning before the podcast. I was talking to Samir about keeping stingless bees in Brazil because I was in Brazil, I don't know, a decade or so ago, and where I was visiting the University of Sao Paulo, they had, in Ouro Preto, which is a city away from Sao Paulo, they have a bee lab there. Half of the folks study honey bees and the other half study stingless bees. While I was there, it was my introduction to stingless bees, I'd never seen them before. And they have multiple species of stingless bees there at their research apiary. If you know anything about stingless bees, they don't sting, right? That's in their name, but they do defend themselves. And they all defend themselves slightly differently. So I would go and knock on a box of one species to see how it would attack me. And then once I got those bees off of me, I'd go knock on a box of the next species and see how they would attack me. Some of them pull your hair, some of them try to go up your nose and in your ears. Some of them try to bite you, some of them spit propolis at you, some of them even have a type of acid product that they spit at you. So I was going down, letting them attack me. In Thailand, beekeepers have stingless bees. There are just stingless bees all over the place in the tropics. And generally speaking, their diversity is amazing. Their nest structure is amazing. They don't really keep them in the sense that there's much management. It's moreso they just provide a house for them and the bees thrive in that little box, and then they'll go through and collect the honey. One of the things that's unique about stingless bee honey, it's usually, wherever I am in the world trying it, it usually has a very high moisture content. It can be



quite prone to fermentation, but otherwise, it's just fascinating. There are so many species of stingless bees. It's many lifetimes of study if one were interested in researching these critters.

**Amy 34:53**

Geez. I thought stingless bees -- when you say that, it makes me think, oh, really cute bee that's not going to sting me. I don't know how I feel about getting acid spit at your face.

**Jamie 35:03**

They're not defenseless. But I knew that it wasn't going to be as painful as a sting. So I'm like, let's just see what these things have. So I would literally squat right in front of a hive, knock on the box with a bare face, with no veil. I just wait to see what they would do. And yeah.

**Amy 35:19**

And then you put your human face back on.

**Jamie 35:21**

Yeah, exactly. And then I put my human face back on. But I would go right down the line just doing that just over and over and over to see how each one would attack me. I don't know why I chose my face. Probably, in hindsight, I should have used my hand but I figured that I'd appreciate it most if they were swarming around by my head.

**Amy 35:39**

Gotta go big or go home, I guess.

**Jamie 35:40**

That's right.

**Stump The Chump 35:46**

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

**Amy 35:57**

Hello, and welcome back to the question and answer segment. So Jamie, the first question, so here at the honey bee lab in Gainesville, we have an observation hive room. When people walk in, it's noticeably a different color. And the light in there is the color red. And so the first question that we have is that this person heard that bees cannot see the color red. And so they're asking so what do the bees see, and is this true?

**Jamie 36:22**

So bees cannot see the color red. How they see red is they see it as the color black. So the simplest explanation, and again, I'm not a vision expert, but the simplest explanation is that humans see further into the red spectrum than do bees. Bees see further into the ultraviolet spectrum than do humans. So we overlap a little bit in the middle and can see some common colors. But red, they translate as black, while we can see it as red, UV patterns, they see all over the place whereas we see nothing at all. And from the UV perspective, again, the question was what do bees see when they look at the color red?

I'm going to go to the opposite end of the spectrum. A lot of flowers that bees visit that to us look yellow or red or whatever, if you look at them through the UV perspective, they will often be incredible patterns on petals that we are unable to see. We might translate that whole petal as yellow or the whole petal as red. But given that bees can see into the UV spectrum, they can see things on flowers and in the environment we are unable to see. Now, back to the other end of the spectrum, the red end of the spectrum, just like what you said, the reason a lot of scientists observe observation hives under red light is because it minimizes the disturbance to bees. The whole point of an observation hive is to study the behavior of bees. You're doing something to the bees, and then recording behavior. And if you've ever had an observation hive in a dark room and flipped on the regular light, you'll hear the hum of that observation hive change. It's a very noticeable change. They see the light, the bees all run up to the top of the observation hive, it really changes what they do. And so when you're using observation hives for purposes of research or answering experimental questions, you want to keep that behavior of the bees as normal as possible. And so a lot of those studies are done under red light. Now, make no mistake, the red light that we are creating in our own observation room, it's not true red. Bees are able to see some light in that but it's not nearly as disturbing to their behavior as is regular light. So the shortest answer to the question what did they see instead of red, they see the color black.

**Amy 38:56**

This is going to take me back to my scuba diving world but with the UV light and the deeper you get in water, the color red is the first to go away. And so yeah, it's kind of interesting. I mean, I don't know if we have a lot of spearfishers who are listening on but when you're scuba diving and spearfishing, you're down at like 100 feet and you shoot a fish and the blood comes out as green. It's pretty crazy to see. It really messes with your mind.

**Jamie 39:22**

That is kind of crazy. Maybe bees will do well that low in the water since they don't have -- I'm just kidding.

**Amy 39:26**

Maybe, we are in a beekeeping podcast, not a scuba diving podcast, so we'll move on to the next question now. Okay, so the second question we have, is how does a pollen basket cling to a honey bee? We see those pictures of those pollen baskets on the back of the bees, on their hind legs, and how do they stay on there? How the heck, also, do bees fly with those baskets on them?

**Jamie 39:49**

Yeah, so this question makes me chuckle. Again, I know it's hard to know sometimes when you have just the basic question, like what was the individual's understanding of the system when asking the question. I giggled because when I was a child, I heard the word "pollen basket." Well, basket, to me, is like this thing in which you can carry stuff. So I always thought that bees, honey bee specifically, on their hind legs had this layer of skin they could open and stuff stuff into it, like a built-in.

**Amy 40:25**

Like a kangaroo?

**Jamie 40:27**

Well, yeah. Like a kangaroo. Imagine that, yeah, just on the back. I was about to go, is it hamsters that can stuff stuff in their cheek? I was thinking something like that. But a kangaroo is another good example. So imagine having kind of like a kangaroo pouch on your hind legs. That's what I thought it was. I thought the bee would pull open this kind of sheath of bee skin and pack pollen into it. Well, that's obviously not what happens. And so to answer this question, the basket itself is not clinging to the bee, it is the bee, it's part of the bee. So it's kind of hard to describe this over a podcast, but I'll do my best. Make sure, folks out there, Google "pollen basket" and then look at the images and you'll see what I'm talking about. But imagine, I'm doing this now to kind of be able to explain it, I've got my hand before me resting on my desk, such that I'm able to look at my forearm. Okay, so I'm imagining this forearm is the hind leg of a bee. Imagine down one side of my forearm, I've got these stiff, long hairs that are growing. And on the other side of the forearm, I've got these stiff long hairs that are growing, and the hairs on both sides are pointing at one another. All right, that is what the pollen basket is. Essentially, it's a stiff row of hairs on either side of the back leg of a bee. So when that bee collects pollen, she moistens with nectar, and she packs it between these stiff row of hairs. And so maybe another way to paint this picture is put the palms of your hands together. Now open your hands up, but point the fingertips towards one another. It's almost like you've got your hands together about to catch a football. Well, imagine holding a volleyball with your hands, with the butts of your hands touching one another, almost where you wear your watch, holding a volleyball like that, that's how bees are holding a pollen ball on their hind leg. It's almost like two sets of cupped hands collectively grabbing that volleyball, one hand on both sides of the volleyball. That's the imagery here. So the hairs are part of the bee. There's nothing that could fall off in that context. And this stiff row of hairs, almost like fingers, are holding on to this nectar-moistened pollen ball on the hind leg while the bee flies back to the nest.

**Amy 40:34**

Yeah. Interesting. I'm still looking at my hands right now, like okay.

**Jamie 43:01**

I know. I was struggling with that one. I'm sitting here, how do I describe this? But again, the idea is like where you would wear your watch, the very bottom of your hands, make sure you touch the bottom of your hands and then open your hands as wide as they can be. Imagine trying to hold a ball with your hands touched at the bottom. That's kind of how a pollen basket functions.

**Amy 43:23**

Interesting. All right, so for the third question, what does the word "eusocial" mean? I've heard that before, but I have no idea what it means.

**Jamie 43:39**

First of all, for those of you who are not familiar with it, the word is spelled e-u-social. It's all one word, e-u-s-o-c-i-a-l. So the prefix you-eu means truly. So eusocial means truly social. And so that's probably not very helpful at all. Eusocial means social.

**Amy 44:01**

Yeah, thank you.

**Jamie** 44:04

So let me explain it this way. There are 20,000 species of bees on the planet. And those species of bees range in natural history from solitary, meaning they live completely alone to, eusocial, like honey bees. There are three characteristics that scientists use to categorize levels of sociality. Those three characteristics are cooperative brood care, that means individuals are taking care of other individuals' young, they are collectively working to raise the young. Number two, there is a reproductive division of labor. That means somebody reproduces and somebody else doesn't. And number three, there's an overlap of generations. In other words, the queen and her offspring live together. So if you are solitary, you have zero of those three traits. If you are eusocial, you have all three. So honey bees, are eusocial. They're cooperative brood care, there are lots of workers working in the nest to take care of the offspring that don't belong to them. There's a reproductive division of labor, there is a queen producing offspring, and the workers are not. There's an overlap of generation, the queen mother is hanging out with her daughters. And so all three traits of sociality are met in honey bees. So they are eusocial. Bumble bees are also eusocial. They have all three of those characteristics. Solitary bees would have none of those. They wouldn't work cooperatively to rear young, they don't have a reproductive division of labor, there's no overlap of generations. Now, it's important to know that since there are three characteristics, and you can have zero of those, and you can have three of those, there's also a group in the middle that has some combination thereof. So the three levels of sociality are solitary, we talked about it, presocial, and eusocial. Eusocial's what we've just had explained. So presocial is the one in the middle that varies in the number of those three traits that they have. Maybe they've only got cooperative brood care. Maybe they've got cooperative brood care and a reproductive division of labor. So those level of presocial, there's sub social, and there's parasocial, and within parasocial, there's communal, quasisocial and semisocial. So there's these stages of sociality represented amongst the species of bees, but eusocial would be the one that has all three of those traits.

**Amy** 47:04

What would be an example of presocial?

**Jamie** 47:07

A presocial bee --let me scroll down -- presocial has four categories. A subsocial category, and a parasocial category that itself is split further up. So let me give you an example of what that means. Communal bees have zero of three met, quasisocial bees have one of those three met, and semi-social bees have two of those three met. And so within those groups, communal bees, for example, some Halictid bees, or sweat bees, they don't do any of those three things, but they might share a nest. So for example, there may be one hole that goes into a ground and multiple bees go down that hole and excavate their own chambers off of that central hole. They don't rear one another's young, they don't hang around for the young to emerge but they're using the same nest site, so it would be like communal. Moving up from that, quasisocial means that you might have multiple reproducing members of the same generation sharing a nest. Some examples of this would be like orchid bees. There are some where you get multiple members sharing the same nest and from there, you can even take the next step in the semisocial where you have members cooperating in brood care, you might even have a reproductive division of labor. And again, some sweat bees will fit those. And so it's really remarkable. One of the most remarkable families of all bees is Halictidae, the sweat bees because sweat bees have

all levels of sociality represented amongst its species. Whereas the 10 species of honey bees, for example, they're all eusocial. There are no solitary honey bees, but sweat bees have all three levels. So there's this whole branch of research in entomology where folks are studying the development of sociality. They're looking at different bees that occur in these different categories. It's really kind of remarkable. It's really, really interesting to see.

**Amy** 49:08

Yeah, that's amazing. I mean, even just the eusocial aspect of honey bees, that's complicated enough, I can't imagine getting into if honey bees were different socials.

**Jamie** 49:21

Yeah, I tell you, Amy, one of the most amazing things about this is there's people who are studying this, and what they're looking at, for example, is they're looking for genes that are responsible for the development of sociality. So the idea is that being solitary is the earliest way these bees would have existed and so there would have been changes in them over time that ultimately led -- there's benefits to living in social structures as opposed to solitary structures. There are laboratories looking for those genetic changes that happen as bees transitioned from solitary to social and trying to figure out, what are the social genes? What things are necessary before critters will will congregate and start taking care of one another's offspring?

**Amy** 50:07

Very cool. All right, so those were our three questions for today. We hope you all enjoyed our questions. Don't forget to send us an email or send us a message on one of our social media pages.

**Serra Sowers** 50:19

Thank you for listening to Two Bees in a Podcast. For more information and resources on today's episode, check out the Honey Bee Research Lab website at [UFhoneybee.com](http://UFhoneybee.com). If you have questions you want answered on air, email them to us at [honeybee@ifas.ufl.edu](mailto:honeybee@ifas.ufl.edu) or message us on social media at UF honey bee lab on Instagram, Facebook and Twitter. This episode was hosted by Jamie Ellis and Amy Vu. This podcast is produced and edited by Amy Vu and Serra Sowers. Thanks for listening and see you next week.