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SPEAKERS

Amy, Honey Bee, Stump The Chump, Guest, Jamie

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, and welcome to another episode of Two Bees in a Podcast. In this episode, we'll be joined by Dr. Victoria Soroker, who is going to be talking with us about pheromonal communication in honey bees. Then, Amy and I are going to dedicate an entire segment to how you, as our listeners, can help us improve this podcast to make sure that it is providing for you the information that you want to hear and information that you can use to be better beekeepers who keep better and healthier colonies. And of course, we'll end today's podcast with our question and answer segment. Hello, and welcome to the segment of Two Bees in a Podcast. Amy, I've got a question for you. Have we talked at all about honey bee pheromones since we've been doing this podcast?

Amy 01:39
I don't think so, which is really exciting that we're talking about it today.

Jamie 01:43
Exactly. I was thinking, I was like, how many episodes are we in so far this year?

Amy 01:47
I think 40.

Jamie 01:49
40.

Amy 01:50
40 episodes.

Jamie 01:51
That's mind-boggling that we've actually gone that long without talking about chemical communication with honey bees. It's embarrassing. But listeners, we've got a treat for you today because we're going to solve that problem right now. We're fortunate to be joined by Dr. Victoria Soroker. I call her Vicki, all of her friends do. I've known her for many years now. We've worked on some collaborative efforts through an organization called COLOSS. She's a senior researcher in the Department of Entomology, Nematology, & Chemistry in the Agricultural Research Organization in the Volcani Center. And she's joining us today from Israel. Vicki, thank you for joining us on Two Bees in a Podcast. It's really good to have you on our show.

Guest 02:32
Oh, I'm honored to be in such a nice pod.

Jamie 02:38
Well, thanks. It was good to chat with you a little bit before we got on the air. I always love chatting with you. I always learn so much when I'm around you and you're such a happy, knowledgeable person. So it's always good for me to be around you. You're joining us today to talk about honey bee pheromones. I know we're going to spend some time talking about that. But before we get there, Vicki, could you just introduce yourself to the listeners? How'd you get into bee research? What is it that you do in general? I want our audience to know who you are so that as we go into this, they can appreciate the work you do.

Guest 03:09
So first of all, I was always interested in animal behavior. And that's where I thought my career would be. In animal behavior, I worked with all kinds of big animals, you know, giraffes and lions. Quite accidentally, I had to be a research assistant in the course as a graduate student in a bee course. And I was a bit scared because bees sting. And I didn't want to initially, but the moment I got there and I start reading about them, I absolutely fell in love with them, got fascinated, and I didn't want to do anything else. So along the way, I had to study some other insects as I am a chemical ecologist. But I am very happy that in the last few years I can fully concentrate on bees.

Amy 04:05
That's great.

Jamie 04:06
It's funny, your story is so similar to our previous guest, how they might have been going in another field only loosely related to biology and then took a bee course or read a book about bees and instantly they were hooked. And it's neat because you mentioned other animals that are quite charismatic that people are drawn to, giraffes and other things. So it's neat that you ended up with honey bees.

Amy 04:27

I feel like a lot of people who get into bee research also have a background in zoology, which I've started to notice. So there's definitely a correlation I think between zoologists and biologists and beekeepers.

Guest 04:43
Maybe they should do statistical analysis on that.

Jamie 04:48
So, Amy, I've always thought that people who study ornithology and apiculture would be like amazing. Yeah, yeah. Because then they could be world experts on the birds and the bees.

Amy 05:00
Oh my goodness. Did you just come up with that?

Jamie 05:03
No, I've had that one in my pocket for a while. I've been waiting to use it.

Amy 05:06
All year. So, Vicki, you do research with chemical ecology. Can you tell us what that is? I don't think I know what that is, actually.

Guest 05:17
It's actually a science that studies interaction between organisms. These interactions are mediated by chemical signals. And in the professional world, it's called semiochemicals. This, actually, mode of communication by chemical signals has a very, very long history. I think from the beginning of any creatures, it starts with unicellular organisms, and goes all the way. Today, we are talking about human chemistry. And if you will go over to Google and Google the pheromones, you will see more publications and all kinds of ads about human pheromones. And actually, it's not surprising, because that's how all creatures on earth started communicating by chemicals, by molecules that are all around us. And when they get to us, and we have some kind of receptors, molecules that catch those molecules, and it initiates some changes in us. It can be in the end, this is the change in the behavior. So what we're actually doing in chemical ecology, we are studying the molecules or how these molecules change our behavior, or behavior of other organisms. So that's what chemical ecology is all about. I hope I didn't complicate it too much.

Jamie 06:55
No, Vicki, I think that's actually the best definition I've ever heard of it. Thank you for making it so succinct and clear. I think what you say is spot on. Humans don't think about themselves communicating chemically, as much. And so as a result, it's difficult for humans to take that next step and think about the fact that animals do it. And it's really hard to do anything with bees, honey bees specifically, it's hard to do any research with bees, and fail to consider that they communicate chemically because honey bees use chemical communication. We, of course, call these pheromones and just what you said, a pheromone is something emitted by one individual that's to change the

behavior in another individual. And I think that that's fascinating. Of course, honey bees use so many chemicals. They communicate with pheromones. I mean, this is a very open-ended question, given the amount of chemical communication that honey bees do, but could you give us a good overview of how honey bees use pheromones, how they communicate chemically with one another?

Guest 07:58
Well, first of all, honey bees produce, I would say, more than 50 compounds, maybe. It's amazing how, I don't know in every day, but every year we learn more and more about those molecules, but the bees have organs from head to toe that produce signals. So I mean, the best signals that we know of are the queen bee signals, and she has several glands in her body, in the mouth, in the toes, in her abdomen, that produce different signals. And those signals affect, tremendously, the whole structure or the activity of the colony. First of all, they do something very amazingly. They regulate the reproduction of other individuals in the colony. The workers that can actually lay eggs would not lay eggs because of the queen signals. But that's not the only thing.Also, the queen pheromones stimulate construction of the wax cells, they stimulate foraging, they stimulate pollen storage, they stimulate caring for brood, and they also inhibit rearing of other queens because when there is a good queen in the colony, they will not rear a new queen. But the moment this queen will be gone, for whatever reason, the workers will activate the behavior that will start building the queen cells, for instance, and the new queen will be born or new queens will be born. We know that swarming is also a result of kind of loss of this control, that when the colony is going to split, it's also regulated by queen signals. Actually, in the colony, other members are sending messages too. First of all, we have the workers. Workers use chemicals to communicate with other workers. They can regulate the development of the other workers because we know that workers develop and change their tasks with age. But if there are too many foragers, the development of the young workers into foragers will be delayed. On the other hand, if there are not enough, and there is, for some reason, for instance, there was some kind of poisoning and they were gone, so the colony would not collapse, the young workers will develop faster to take their place. Also, we know very well and everybody knows that if you're stung by the bee, for instance, you are likely to get stung by other bees. Why? Because you're marked by a pheromone, which is alarm pheromone, which is produced by the bees. Actually, this helps them, if the bee, for instance, the colony is attacked by a bear. Once one bee will come and she will mark him, all the other bees will join him because of the alarm pheromone that bees are emitting. And they will emit it actually, the mission will continue because the gland will be still there on the sting that will be attached to you or to the bear. So as long as you didn't remove it, the information is still streaming and more and more will sting you. The other thing, for instance, bees know how to recognize their nest mates by chemical signals, and they will not allow other nest mates to come in. So this will prevent, normally, will prevent a robbery. So it's a very, very important issue. Also, the brood is communicating with the workers because the broods' signals tell the workers when to cut the brood, when it's developed enough. It also regulates the foraging. It also regulates the development because if there is more brood, there is more need for food. So the whole coordination, everything of the activity of the colony, the life of this super organism, it's all coordinated by, I would say, the orchestra of the pheromones. So I think we also forgot the drones that also produce chemicals, but they are less affecting the whole colony. They're more affecting themselves and the interaction with just feeding but it's also communicated by pheromones. So I think every single member of the colony produce pheromones.

Jamie 12:36
Vicki, let me ask a question quickly about this. Because I've often wondered this question. Maybe I can answer my own question too. But I think about how we perceive information through sight, right? When I'm looking around, and I'm in this room recording a podcast now, and I can see the pictures on the wall, and I can see your image on the computer, etc, and I think with sight, there might be competing interests, right? The picture is in my field of view, the computer is in my field of view, the flowers are in my field of view, but my mind is kind of able to focus on the image that I'm wanting to see most. Now, I think about taking sight away and sitting in a room that's full of crowded people, maybe in an airport, and there's hundreds of people talking around me, how would I be able to focus on a conversation, maybe, that's five meters away? Now, I liken that to being in a honey bee colony where all the members of that colony are producing pheromones. And they're not only producing maybe a pheromone, maybe they're producing multiple pheromones. So how do bees perceive the signal they need to perceive in an environment that's absolutely full of competing messages being put out there from pheromones? It seems such a remarkable thing to have 10,000, 20,000, 40,000 individuals in the nest, all of them cranking out varied pheromones, and then my job is to perceive one of them and act upon what I'm perceiving. Has there been a lot of research kind of on that thought?

Guest 14:20
I think, first of all, I think it's a great question, but I think it looks like a mess, all those pheromones is a mess. But I think that, first of all, I mean, there are people studying and comparing a bee nest, for instance, there are different bee colonies with different bees that have different thresholds of sensitivity to particular pheromones. For instance, in queen pheromone, it's well known there are bees, which have higher sensitivity to queen pheromones. There are bees that have lower sensitivity. So this can regulate the reproduction, for instance. But overall, I would think about it like this. You see, I mean, we know that the bees, they develop in the glands according to their task. So I believe, and I'm not sure because I'm not an expert in that field, so much, I mean, I'm not expert in this field period, that their sensitivity is also changing with that task. So I would say that the bee, which is, for instance, sitting outside, she's guarding bee. And we know, by the way, that they produce, the guard bees produce more of these alarm pheromones. This we know. So I guess if you are a guard bee and you're sitting there, you are listening, I would say listening, but it's not listening, you are smelling better the alarm pheromones because you're ready to take, you're sitting in the entrance, you are ready for that. So you're more alert. But if you are a nurse bee, you're not even exposed to it. So you're not exposed to this signal all the time. On the other hand, for instance, let's say you're very well familiar with Nasonov pheromone, with which bees navigate, they navigate the swarm and they also navigate the bees which are coming in the colony. So when you create a lot of mess, after you can see those bees that are standing with their bottom facing out and fanning. And then you can see very, very young bees, if you, for instance, accidentally shake a comb with very young bees, you will see that they are like ants crawling towards the signal. They're walking one by one. And if you will put a stick, you will see how they're climbing into the colony, following the smell. So it's not all this information flowing at the same time. It's also very much related to the situation.

Jamie 17:12

I think that's a good explanation.

Amy 17:13
Wow. I feel like I have goosebumps because I'm so happy that we have you on here because I think that it really brings all the episodes that we've had this entire year kind of together, as far as how bees communicate, and their roles, and the different tasks that workers have, and just everything about honey bees. I mean, we already all know that they're fascinating, and this topic just takes it to a whole other level. So, I feel kind of silly for asking this, but how do you conduct research on the different pheromones?

Guest 17:49
It very much depends on what kind of pheromones you want to expose. For instance, many years back, we were looking for a pheromone in Dufour's gland in the queen. So, we extracted, we dissected the Dufour's gland from virgin queens and we prepared the extract. And first of all, we studied what it contains and the gas chromatograph is the instrument that separates the mixture into individual compounds. But then we also took this mixture and we wanted to see if bees are attracted to it. So we took a big petri dish, quite a big one. There is a big one 15 centimeters in diameter, and we put the pheromones on the slide, different concentrations each time, and on the other side we put just the solvent and we put bees inside and we just monitored if they contact the pheromone or their control. So that's how we saw if they're attracted to this pheromone, for instance. We thought that maybe the queens are using this pheromone for marking the eggs. So we took the eggs, just those that were laid by the workers and by drone layers, what you call it, and we tried to spray it. We sprayed it with this pheromone and we wanted to know if the bees will recognize it because we didn't talk about it, that the policing bees workers have worker policing behavior. They don't want other workers to lay eggs so when they discover that the eggs is laid by the worker, they go and eat it. So we thought we can trick them by putting the smell of the queen. It didn't work. But that's how it works. You ask a question. Does this chemical do a certain thing? Then you try it. You can also use dummies that you can put the chemical on some kind of dummy from glass or glass beads. That's used a lot in chemical ecology, and then you put the glass bead with the extract that you're testing and the other bead with something else and put the bees and ask them the question simply, what do you like? Are you attracted to it? Does it repel you?

Amy 20:22
Seems like a lot of work.

Guest 20:24
Yeah. It's fun. But it's all fun, too.

Amy 20:28
It seems like it, definitely. So is there evidence that colonies communicate with one another? I know that we're talking within the colony. But have you done research, or is there evidence that they can communicate with one another?

Jamie 20:42
Yeah, Vicki, this is a question I've always had because we're so focused on how a colony functions and how the bees interact with one another, but I've always wondered if there's any evidence out there that there's pheromonal communication of any sort between colonies?

Guest 21:00
It's a good question. I don't know if anybody's ever done that. I know that they can discriminate nest mates versus aliens, so they can discriminate if somebody's coming from outside. I don't know if they can send, for instance, one colony can say, "I'm sick don't come around me," and I wonder what kind of information they can transfer. I wonder.

Jamie 21:34
Yeah. Well, it sounds to me like a great opportunity for collaboration, maybe Vicki, and also for graduate students.

Guest 21:40
Yeah, I think it's a very interesting question.

Jamie 21:43
Well, I will tell you in my time with bees, Vicki, I've quit putting anything past them. And by that, I mean is every time I think they're not capable of doing something, they always amaze me that they can. I agree, I've never seen evidence that they can communicate with other colonies. But I bet it's possible.

Guest 22:01
Yeah, I bet they probably can do it.

Jamie 22:04
If you're a prospective graduate student out there, maybe Dr. Soroker is looking for a prospective student. Maybe this would be a good topic for you guys. I've got a couple of questions here, actually. But, unfortunately, they're unrelated. But I was curious. I had one question I wanted to ask you, but then one popped in my mind. So I'm going to ask it first. Bees can see, they can sense vibrations, and of course, they can communicate with pheromones. I think about humans, right? We can see, we can touch, we can smell, taste, etc. Would you say for a bee that pheromonal communication is the bees most important sense? I know it's hard to rank senses. But sight, vibration, pheromonal communication, would you argue that maybe that's the most important sense?

Guest 22:50
I definitely would because it's always amazed me. New compounds, all the time, are popping up. The queen has many different messages. We don't even know what she's saying because there's so many. And we don't know if we understand exactly. So I think the vocabulary, the chemical vocabulary of the colony is amazing. As you said, we don't know how they tackle all this information. This will be another, I would say, level So I would say they have so much to say. And I hope we will one day be able to understand what they're saying.

Jamie 23:31
That's fascinating. Well, let me ask a question that kind of goes a slightly different route. One of the things that's interesting to me about chemical communication is, number one, I think you're right, we're just kind of at the tip of the iceberg and we're going to find out so much more about this in the future. But we've got a lot of beekeepers who listen to this podcast and a lot of them may wonder how can chemical ecology help them make colonies healthier? How can it help them in the management of bees? I've seen, Vicki, quite a few people try. I've seen for example, people study Varroa chemicals and maybe using them as lures. I've seen people's look at small hive beetle pheromones. I've seen people try to understand how honey bees communicate and maybe think a product downstream. But the only thing I can really think of that people have been somewhat successful with by taking advantage of chemical ecology are some of these little pheromone strips, these QMP pheromone strips that you can use in colonies that are queenless or you can use in some of your cage studies when you're trying to convince bees that they have a queen. I guess one of the struggles that I have and maybe our listeners will have is how can chemical ecology provide tools to beekeepers to use in their management strategies?

Guest 24:57
So first of all, when I look to the Internet recently, I saw there's a lot of products for attracting/trapping swarm. This is the most, I think, popular thing that people -- even AliExpress is selling those. I never tried but now that I saw that how many there are out there, I might buy one and try. Because it sounds to me good because, often, as a beekeeper you have the swarm that is on the tree and they you're thinking, "Oh, how will I get there with my box and shake it? Maybe I can just put this lure in the empty box and then it will come there." They say it works but I mean this is a very simple thing. People use a bee scent for pollination for some time. I was thinking also of, like you said, it's very important to put something in the box to prevent worker reproduction if you can have the queen lure because, for instance, you don't have a queen now and you know you can get one in a week so you don't want your bees to become drone layers. Once they become drone layers, it's gone. But if you can keep them for a week or something it may help you to inhibit. I was thinking about swarm management, it's a very important issue swarm management. I don't know if people really developed it this way.

Jamie 26:37
We use it in the past as we've used QMP drone congregation areas. So for our listeners, QMP is queen mandibular pheromone. You can purchase that, and anyway, we've used it to identify a drone congregation area. So there's been ways, like what you mentioned, that people have used it. One of the things, Vicki, that I think it'd be interesting for our listeners to hear you comment on, so in those regards, I can see pheromones being useful. I know people maybe even you have tried looking at some of the bee pests pheromones, Varroa pheromones or small hive beetles and others. But one of the things that goes into my mind is oftentimes Varroa, small hive beetles, they might cue into the same signals that honey bees produce. So to augment those signals to use against Varroa and beetles might have a downstream impact on colonies because bees are using potentially the same chemicals as well. So I think that's why it's been a little difficult for people to develop strategies to control bee pests using chemicals. What do you think about that field?

Guest 27:40
I think you're absolutely right. I think you're absolutely right. But what you can do, like this work that was recently published by all of APO lab, they found the chemicals and some of it by Singh was also found before by Nazee. They found chemicals, which are produced by the Varroa infected brood, and you can use these chemicals. I mean, they're not exactly pheromones. I mean, maybe they are pheromones initially. They are pheromones that we believe induce the uncapping and removal of the sick brood or of the Varroa. So we can use these chemicals. We use them as a bioassay to see if we have the right kind of bees, if we have our resistant bees, you know, Varroa sensitive hygiene. So this can be used and they are developing, I think, they went on developing it market. They published it as a patent. And so you can actually use it as a test. So if you are a queen breeder, and you want to know if you're succeeding in this venue towards Varroa sensitive hygiene, you can use it as a very sensitive test, you put the chemical and that can be used. So it's kind of a practical approach. It would not repel Varroa, it would not do anything for Varroa. Directly, Varroa is not affected, but you can use it for this, I would say, your efforts in breeding the resistant bee. If this can be the same for viruses and any resistance that if you detect we know that also bees are able to detect shockproof so maybe, by the way, another issue, if we know how to detect the scent, we can use it for sensors. If you, for instance, we are all about this the future beekeeping. For instance, if I can imagine about the times when the person would not need to check his colonies. We'll have all the sensors sitting in the colony and he's sitting in his office. This especially it's good for the amateur beekeepers that don't have hundreds of colonies, and he's sitting in his office and he sees his computer is blinking red, he clicks the button, and he said, your colony is having Nosema, you need to do this and this. Or your colony has Varroa, you need to do this and this. And he doesn't have to check it regularly. So I think it's a good tool if you can, by chemical signals, identify diseases, for instance.

Jamie 30:41
Yeah, I think that's neat. I hadn't even considered that as an option. But I think, Vicki, that that's a really good way to think about it.

Guest 30:47
So this is the future. The other thing, for instance, if you're talking about not really phermones, but the bees have some chemicals that repel them. So people thinking about using them in agriculture when they apply pesticides to reduce the attractivity of bees for certain periods. I think it can work for a very short time. Because I think when you are hungry, I always think about us humans. When we are hungry, I would say, we become less choosy. So I think it won't work in the situation, there is not many possibilities for bees to go to foraging, so they will go there anyhow, and they willl get harmed. So these are tricky, but I agree with you. I think the pheromones are really underused. I think they should be explored much more.

Amy 31:46
Well, I'm really excited to see what happens in the future, especially with some of the technology that may be coming out. Vicki, I think that you're my new honey bee hero. I think that the research that you're doing is really great. And I think you're so knowledgeable about honey bee pheromones and

hopefully, we can meet one day so we can sit down and have some coffee or tea and just talk about pheromones because I have a lot of questions so that I can pick your brain. I know that you've been in the industry and you've been doing research for quite a bit with honey bees. And so I'm wondering what other projects you have on honey bee health that you would like to highlight and tell our listeners about.

Guest 32:24
So first of all, I am a member of COLOSS for 12 years now. So I'm participating in three task groups. In COLOSS, I am monitoring the colony losses in Israel and they're interested to see what the connection is between what beekeepers do and the results in the beekeeping. So kind of trying to learn from deep that I think it's a very great Bee Informed Partnership that you have in United States, so I'm trying to do some of that. I am studying Varroa in my lab. We work a lot on the Varroa interaction with the bees. So we are trying to understand how the Varroa is sensing the bees in attempt to disrupt the ability of the Varroa sensing the bee so we are studying its chemosensory system. We look for, really, the proteins in their forelegs. And that involved in a chemosensing, we are doing all kinds of behavioral assays that's to try to see how we can confuse the Varroa. That's the other thing, and the third thing that I'm doing is breeding for Varroa sensitive hygiene. And in doing that, I am also trying to see if we establish some kind of program in which we screen the colonies for their ability to remove infected brood. And in the United States you use liquid nitrogen. We use pin test, like in European countries, and then we also test how does it affect the Varroa infestation and how does it affect the virus infestation of the colonies? This is the other thing. And now we are looking also at something to try to see as we see less Varroa and less viruses. So we want to see what are the mechanisms in the bee that helps the bee to fight it. And I also try to establish integrated pest management in Israel towards Varroa. So to try to introduce these methods like oxalic acid, queen caging, those methods that will reduce this total dependence on the synthetic chemicals, which work for some time, and then they stop working because of the resistance. And so this is, I think, more or less what I'm doing.

Jamie 35:19
Well, Vicki, you've got a really active program. You and I met principally through the COLOSS stuff that we worked on together for years, and I always enjoy seeing you at those meetings. And like I said, it was really neat to have you on today to talk about chemical ecology and pheromonal communication in honey bees. I really look forward to seeing how we learn more about this just from a science perspective, but also how there might be some practical applications that come out of this that can benefit beekeepers. So thank you so much for joining us on this segment of Two Bees in a Podcast.

Guest 35:51
Thank you very much for inviting me. And I was very happy to be in your pod.

Amy 35:59
You're welcome any time.

Jamie 36:00
Going to be three bees in a podcast this time, right? That was Dr. Victoria Soroker who's a senior researcher from the Department of Entomology and Nematology and Chemistry for the Agricultural

Research Organization in Volcani Center. She's joining us from Israel. Again, Vicki, thank you so much. And I'm sure you listeners really appreciate learning about all of these ways that bees communicate. Amy, I tell you, every time I think about bees and hear more people talk about what they do, I'm amazed at what bees are capable of doing. So I think our listeners really can appreciate that, and thank you for listening to this segment.

Honey Bee 36:44
Have questions or comments? Don't forget to like and follow us on Facebook, Instagram, and Twitter @UF Honey Bee Lab.

Jamie 36:58
Welcome back, everyone. In this segment, Amy and I are going to spend a little bit of time talking about ways that you can help us improve our podcast. Now, it's November of 2020. It's at the end of our first season. I know that you might be finding this podcast well in the future. But I just wanted you, as our listeners, to know that there's multiple ways that you can help us out. One of those ways will occur at the end of every year when we do some year end surveys about our podcast. So Amy, let's spend a little bit of time talking about the way that all these people who've put up with us for a year at this point can help us improve Two Bees in a Podcast. What's that first way that you and I've been talking about?

Amy 37:34
Well, like you mentioned with the surveys, so I guess if everyone wants to continue hearing us into the future, the survey is going to be the best way for everyone to let us know whether they want to keep listening to us or not. Probably post it on our social media pages, our listservs. And, again, we would just love your honest feedback. If there's something that needs to change, if you want a different bee in the pod, maybe we can make that happen. I can't promise that one. Going through and letting us know, one, I think what you've learned, and two, if you feel like there any changes, I know that a lot of people throughout the year are doing that anyway. But with where we are, it's really important to go through and just let us know what you're up to.

Jamie 38:14
Yeah, I think that that's a very important point, Amy. So the way, listeners, that we're trying to sales pitch this idea to you is at the end of every calendar year, somewhere around November of December every year, we'll be sending out our annual survey, which will have some very specific questions. You follow a link, you answer those questions, and it'll just help us find ways to improve it. For example, Amy, this year we've been in our very first year, our inaugural year, we've been sticking to this kind of two segment then a Q&A segment format, where in the first two segments, we might interview someone, or it might be we interview someone in the first segment, then you and I talk about something else in the second segment, and then we have the Q&A. But is that the way that you, our listeners, want to do this? We don't want to just put together a program that is entertaining, we want to put together a program that is transformational. We want you to hear us, listen to our guests, and take action on what we say. Now, there will be times we're interviewing people who are just giving you knowledge for the sake of giving you knowledge. But we really want you to be able to take something out of our podcast to help you be better beekeepers, keep your colonies healthy. And we can only

make it what can help you if you tell us what you need to help you. So do we need to talk more about management? Do we need to talk less about the heavy hitting science topics? There's certain people that you need us to interview. Amy, I think you'll agree for us, we want to see behavioral change, right? We want some evidence that what we're talking about, what we're saying actually changes the behavior of some of our listeners. I know we've gotten some email feedback throughout this first year, where people say, "Hey, I caught this episode on this and now I'm going to purchase and use these queens that you guys talked about. Hey, you guys mentioned this management strategy, and I've been implementing it. It's working." That's exactly what we need to hear.

Amy 40:09
Definitely. And with our previous podcast episodes, if you've been listening from the very beginning, we did a lot of segments about extension and what that actually means. And so the Two Bees in a Podcast is just one activity that we do under the extension umbrella at the University of Florida. And so, if this isn't working, or if there's a different way that we need to move forward with that, then we will try to do that as best as possible. Another thing, Jamie, that I was just thinking about was the way that we promote our content. So I know that a lot of people right now are following our Facebook, Instagram, and Twitter accounts, and so that's how they're finding us. And some people don't know that we have our podcast episodes actually sitting on our website. So people have asked us, where are the additional resources? And where are these notes that we're always talking about when we have guest speakers? And so did you all know that we have it on our website? And if it's not working for you on our website, what suggestions do you have for us to where if you had a question, how would you be able to go through all the question and answers that we've been doing? So even just formatting. I think we've had a lot of people message us and email us and let us know what they'd like to see. And so the more input we have, the more feedback we have from you all, the better the content will be, and the more available the content will be to you.

Jamie 41:25
I mean, I think you hit the nail on the head. Through a lot of the podcast platforms such as Apple Podcasts and others, it's very difficult to link show notes and some other things. So really, our website is probably the best place to listen to our podcasts. Because in that place, you've got the podcast, you've also got show notes, you've also got links to what we talked about, etc. But, is that the the best way for you guys to receive that information? We really just need your feedback. So Amy is putting together, at the end of every calendar year, again, this annual survey that we'll be doing. It's just the way Amy mentioned, through our social media accounts. And so you guys can follow us on Twitter, Instagram, and Facebook @ UF honey bee lab, @ UF honey bee lab. We just need you to tell us, "Hey, I'd love to hear this person, I need you to cover this topic. This topic is so important to beekeepers where I live." And we need to think outside the box. And we not only need to think outside the box, but we want to make sure that we're thinking outside of, in our case, Florida, in our case, outside the United States, because there's people literally from dozens and dozens and dozens and dozens of countries all around the world listening to us. So what's relevant to you in your area, who's a great speaker somewhere we could do a great interview with in your area, what are some research topics you've heard kind of bubbling up in your circles of influence that you'd like to have, quote, the expert, talk about on our podcast? Let us know all of this stuff through our social media accounts. A really good

third way, Amy, that people can reach us is through the podcast platform themselves. For example, I listen to us through Apple.

Amy 43:04
You listen to us?

Jamie 43:05
Yeah, well, occassionally. My kids really like the intro to that Q&A section. So I play it every once in a while, but I'll do that through the Apple Podcast. And there, I can see the number of people who've rated us and left comments. Just rating us and dropping some feedback there, we check that. So through our annual surveys, through direct feedback on our social media accounts, through direct feedback and ratings on the podcast platforms themselves, and of course, you've always got the opportunity to email us directly. You can call us, as we bump into you at meetings, or we speak at your conferences, what have you, you can tell us directly. These are all really good ways to provide your feedback.

Amy 43:44
I think my favorite emails are the people who have feedback on our podcast. Every time they email us, they're like, "Hey, we listened to Two Bees in a Podcast. You guys are really funny." And I'm like, "Thanks. We think so too."

Jamie 43:56
Tell your beekeeper friends and colleagues about us. Spread the news to your local bee club. The more people we have listening and the more people we have providing input, the longer we can do this, the more we can provide these services for you. Is there a different structure to the podcast that you'd like to see? Would you like us to throw in different segments here and there or review of equipment etc.? Just let us know what we can do to make Two Bees in a Podcast better for you.

Amy 44:22
On that note, why don't you all go ahead and go and rate us and follow us and let us know what your thoughts are?

Jamie 44:28
Thank you for listening to Two Bees in a Podcast. We look forward to coming back with new content in the new year and continuing this well into the future as long as you find this a helpful tool that makes it where you can keep your bee colonies stronger and healthier and more productive.

Stump The Chump 44:45
It's everybody's favorite game show, Stump The Chump.

Amy 44:58
It's that question and answer time, and today our theme is going to be honey. Are you excited, Jamie?

Jamie 45:04
I'm always excited about honey.

Amy 45:06
Okay. So the first question that our listener had was how do you differentiate between uncapped honey not ready for harvest and uncapped honey that is ready? I always thought that anything that was uncapped was not ready. What are your thoughts?

Jamie 45:21
Oh goodness, there's a few things to think about here. Number one, honey bees, of course, collect nectar and convert it to honey. Nectar is about 80%, I'm rounding everything off here, so don't hold it against me if you read a paper, but honey is about 80% water and about 20% sugar. And they need to reverse that. Right? It needs to be about 80% or so sugar and about 20% or so water. And so what we tell people is that honey is ripened. And so now I'm going to give you the the actual range. Honey is, quote, ripe when it's between 15.5 and 18.5% water. That's the range that you need it to be. Above 18.5% moisture and it's prone to fermentation. Below 15.5% moisture and it's prone to granulation. So both of them quickly, honey is a supersaturated sugar solution. Try saying that five times fast. That means it's a liquid when it really should be a solid, right? And so if honey is dry below 15.5% moisture, those sugars are prone to come out of solution and crystallize, and so that's what happens to your honey when it turns solid. It's basically all the sugars are coming out. When it's too wet, yeast can ferment it. When it's over 18.5% moisture yeast can ferment it. The good news about granulation: it's reversible. Fermentation is not. So that sweet spot, pardon the pun, is you want to be between 15.5 and 18.5% moisture.

Amy 47:03
How do you know that?

Jamie 47:04
I was gonna say, this is an overgeneralization. It's an overgeneralization. But generally speaking, bees will cap over the honey when it is within that moisture range. Now, they will cap, some bees will cap honey that's too wet, some bees will cap honey that's too dry. But generally speaking, the first indicator that it's okay to harvest and extract is that it's capped. The general rule of thumb is you shouldn't be removing frames that are under 80% capped because there's too much, quote, wet honey, which can cause that entire batch to be prone to fermentation. The problem is, though, think about it this way. Think about you're in the middle of a honey flow, and you've got three supers on your colony. The bottommost super is full and it's fully capped. So you put on a second super. That second super, they've been working on it, and it's mostly capped so you put on a third super. And then the honey flow starts slowing down while that third super is on so the bees put nectar in it and they start the conversion process. But the nectar starts trickling in while that super is on. So there's not enough incoming energy to fully ripen that honey and therefore cap it over. So your bottom two supers are capped. You've got no questions there at all. You take those off and extract it. But now there's no honey flow. It's over. Your uppermost super now is full of uncapped honey, what are you supposed to do? So when bees run out of incoming energy, they often will not have the energy to cap over that honey. Right? And so there are

times where bees simply don't have the capacity anymore to cap honey that's nearing being ripe enough. And so a lot of beekeepers will take those supers off because they're like, look, there's no incoming resources, we've got this honey, they're not going to be able to cap it, so we're going to just extract it anyway. So how can you know? You can know, number one, because bees will cap it, that's the right range. Number two, if you're serious about honey production, you should consider buying a refractometer. It's a little handheld device. You can smear honey on one glass end of it and you look in the other end, the eyepiece, and it will tell you what percent solids are in that or what percent of solids is in that sample. And you want it to be between 15.5 and 18.5. Refractometers are relatively cheap these days. When I was a kid growing up, they were expensive or difficult to find. Now, they're sold by most equipment providers, and you can make sure your honey is in that range. So that's kind of where you want to be if you've got a super that's just uncapped, it's fully uncapped, but it's absolutely full of stuff that they brought in near the end of the nectar flow, you can tell test it with a refractometer and see if it's within the right range.

Amy 50:03
So what happens if it's not?

Jamie 50:05
Alright, so the second question is what happens when it's not within the right range, and you feel pretty confident that there's going to be no incoming resources for them to finish capping it in the first place? In other words, you're stuck between a rock and a hard place. Well, a lot of beekeepers, commercial beekeepers especially, will take off those supers of honey that are uncapped, again, they might call it wet honey. And they'll attempt to dry it. And the way that they'll do that is they'll stack the supers crisscross, so they're not stacking them up immediately flush on one another, like you would see them on an actual hive, but they stack them crisscross. And when they're stacked crisscross, it permits airflow between those supers. They'll stack them crisscross in a smallish room, they'll run a heater and a dehumidifier and a fan. So the fan circulates the heat, the dehumidifier pulls off the moisture. And they will do this for days or weeks, checking it regularly with a refractometer to make sure that the percent of moisture is going down in that honey over time. Sometimes, what they'll do is they'll just extract a mess load of capped honey, and then kind of stir in some of this slightly wetter honey that won't cause that capped extracting honey to ferment. So there's a handful of ways to try to deal with it. Again, diluting it with ripe honey, or trying to dry it while it's still in the combs. It's difficult to draw honey once it's extracted. There are machines that you can use to do it. They tend to be expensive. So it's often better addressed before you extract it in the first place.

Amy 51:48
Okay. Have you ever tried fermented honey? Is that mead? Great. Information on the honey judge program is on our website. So check it out. I think those are all the questions. I guess the last thing I have, Jamie, is I've tried to send honey in the mail. And did you know you're not supposed to? Well, you're not supposed to send liquids through the USPS, the US Postal Service. And so they asked me if it was a solid or liquid. And I wasn't sure how to respond because it was like kind of in the middle. And so I'm like, is it a solid? Or is it a liquid? I'm not sure.

Jamie 51:51
That's an interesting question. And I'm going to try not to chase too many rabbits here, Amy. But one of the things that you might not be surprised to find out is, when I travel around the world and speak about honey bees and beekeeping, it's very common for beekeepers who want to run up to me and give me a jar of their honey. I've never calculated it. But I would argue that well over 50% of the jars of honey that are given to me by beekeepers, well over 50% of them are fermented. And I think it's because beekeepers have not learned to recognize what the taste of fermented honey is or the smell is. And I don't know what advantage I have, except that I've just tasted honeys from all around the world, and I've tasted really fermented honeys and ones that are really dry. That's one of the benefits, incidentally, Amy of the program like what we run, the university, the UF IFAS Honey Judge Program. I know there's other honey judge programs around the world, the Welch honey judge, etc. But one of the benefits of going through honey judge training is learning how to spot fermented honey. And so in my case, I can just taste a hint of ethanol. It's funny, I need to throw out a disclaimer, I'm not a drinker, right? But I've worked over ethanol a lot. We pickle bees for research purposes a lot, right? You'll collect bees and ethanol for later dissections or analyses. So I've worked over ethanol washes a lot. So I've smelled a lot of it. And it's that smell of ethanol and that slight taste of ethanol that you can get in fermented honey. Another dead giveaway is how watery the honey is in the jar. When someone gives me a jar of honey, and then walk away, the first thing I do is start tilting the jar to see how freely it moves in the jar. And I can tell by its viscosity if it's going to be prone to fermentation. If it's really moving around well in that jar, kind of sloshing around as it were, I can suspect it's going to be fermented. When you smell it, it can smell that hint of ethanol. When you taste it, you can taste that hint of alcohol. It can be really subtle in a lot of jars, which is why I think a lot of people don't even know that their honey is fermented in the first place. But I strongly encourage beekeepers who are interested in producing a premium honey product to be careful when they harvest, to be careful when they extract, to learn how to taste and smell fermented honey, and to buy and use a refractometer to make sure that they are producing a premium product. And, in my opinion, to harken back on something I just said is why honey judge programs are so important. A lot of people think that we're just teaching people how to judge honey. But people who go through honey judge programs usually come out the other end producing better products. They're able to sell for a lot more and that rarely, if ever, have issues associated with fermentation.

Amy 55:05
Well, we always refer to it as liquid honey. So, it's a liquid. But the solid form, I guess, would be that granulated form when it comes out of solution. Honey is such an amazing product, right? It's pretty cool.

Jamie 55:30
It's amazing. And one of the things that I think that this Q&A segment really brings up is our bees work hard to produce a premium product. I think it is our responsibility to ensure that level of care and attention that bees put into it continues all the way to the consumer. So they put it in the combs, we put it in the jar, they do their half. So it would behoove us to do our half and make sure that we are representing the hard work of everything involved by putting together a premium product so that the

consumer at the end of the day can benefit from the bees care, our care, and just the miraculous product that is honey. It's an amazing product. So we don't want to give people a reason not to like it.

Amy 56:21
Exactly. All right. Well, thank you for that Q&A segment. Hey, everyone, thanks for listening. Today, we'd like to give an extra special thank you to our podcast coordinator Lauren Goldstein and to our audio engineer James Weaver. Without their hard work, Two Bees in a Podcast would not be possible.

Jamie 56:47
For more information and additional resources for today's episode, don't forget to visit the UF/IFAS Honey Bee Research Extension Laboratory's website ufhoneybee.com Do you have questions you want answered on air? If so, email them to honeybee@ifas.ufl.edu or message us on Twitter, Instagram or Facebook @UFhoneybeelab. While there don't forget to follow us. Thank you for listening to Two Bees in a Podcast!