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SPEAKERS

Amy, Stump The Chump, Jamie, Guest

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, welcome to another episode of Two Bees in a Podcast. In the first segment, we'll be interviewing Dr. Ralph Buechler, who is a specialist, a bee scientist in Germany whose specialty is the SMR trait in European honey bees as well as breeding honey bee stocks. We will follow that with a Five Minute Management on sting management, how stings work, and then we'll finish with our famous question and answer segment, Stump the Chump. Hello, everyone, and thanks for joining us on another episode of Two Bees in a Podcast. So one of the topics that continually rises to the top amongst our listeners regarding things that they've really been interested in hearing us discuss has all been about queens, queen selection, queen production, and ways that we can use stock to combat some of our notable pests and diseases. So we're fortunate to be joined today by an expert on this topic. It's Dr. Ralph Buechler, who's the head of the Bee Research Institute. That's the LLH Bee Institute sponsored by the State Agriculture Office of HESA in Germany. That's in Kirchhain, Germany, specifically. Ralph, thank you so much for joining us on Two bees in a Podcast.

Guest 02:09

It's my pleasure to join. Thanks for your invitation.

Jamie 02:12

Ralph, one of the things that we like to do every time we have a guest on is we want to introduce our listeners to that guest, but also have that guest tell the listeners how they got involved with bee research in the first place. So how did you find yourself working with honey bees? Has it been one of those things that you've always been involved in doing? Or is it something that came on more as an academic pursuit as you started going to university, etc.?

Guest 02:35
Okay, I have the privilege to come in touch with bees already in my youth. So actually, I started private beekeeping at the age of 16 with some hives and was my fun and at the same time, met very much my biological interests. And then after finishing school, I started to study biology and agriculture at University of Bonn, not thinking about bees when I did so. But then very soon, recognizing that there was a specialized institute for honey bee selection, honey bee breeding, and ecological aspects of beekeeping, so of course, the young student went there very soon and and came in touch with people and joined the research. So step wise, I got a very good introduction in the wider field of bee research, still not realizing that that might get my profession because I plan to go in plant protection field. And when it came then to the, to my final decree, I had to decide about the topic for the graduation and then I got a chance to work on a subject of lethal pesticides effect on honey bees. So in a way, that brought together the main interests and was my first personal activity then in bee research. For you see at that time, at that time, this was not a big issue to think about sublethal effects of pesticides, but it was my professor... who already had this on the screen and looking backwards from nowadays position it was really a wise decision to search what happens if bees are in contact, continuously, with pesticides in low doses and so on, and we could show that there were some physiological effects and some interactions between substances and so on. So that was the starting point. And then further on, I decided to go for my Ph.D studies. And there, this was the first chance to work on honey bee genetics and on aspects of Varroa resistance in European honey bees. So that's how it all started. And then after finishing my studies at the University in Bonn, I could move to the Institute in Kirchhain. So, that was in 1990. And the Kirchhain Bee Institute is a research and training center for beekeepers. So, we run quite a lot of courses and we have our Extension Service for Beekeepers in the central part of Germany. These are the main functions, but behind such activities, we have a team of about 25 people working with bees in the lab and with field research. So we run about 300, 400 hives for our studies and one of the main research aspects are, in fact, improvement of honey bee populations by selection, selection methodology and relevant traits. At the time, when I joined the team in Kirchhain, we started to check also for Varroa resistance. Before were just the classical traits like productivity, gentleness, low swarming tendency, but then, we started to focus more and more on aspects of vitality and resistance of colonies. So nowadays, we are in very close cooperation with PREDA cooperations in Germany. So there's a quite good organization by the German Beekeeper Association. But there are also two specialized PREDA associations, one for the for the Carnica population, and second, for the Buckfast population, it's the mineshaft or the page of Buckfastimker. So these two groups are the ones we cooperate with. And together with the private breeders, we try to develop methods for improvement and selection. So since these days, this is in the focus of my research activity, I took over the director position of the group in 1997, after the retirement of the previous leader, which was Dr. Maurer, maybe some people still know him. So it's now, nearly, or a bit more than 30 years for me working at this institute, and I'm getting older, and I can count the time, which remains for me, but it's nice to see how well this field develop, that there is much more attention nowadays for such breeding activities, and that we can also notice very good improvement of the quality of our bees. And there is nowadays a huge

demand, not only from Germany, but European wide and sometimes even from abroad to get access to this breeding stock. So it's really fun. And still a big challenge is biology standing behind is quite complex and things can be and have to be further improved.

Jamie 03:27
So Ralph, I think that's really an interesting way to end up where you are. I think the thing that stuck to my mind the most is when you said you were going to go into plant protection. And that was a major fork in the road for you. And I will tell you the beekeeping industry has benefited that you didn't go that direction. I personally consider, many people consider, you one of the chief or leading bee breeding scientists on planet Earth. And I know from experience about your program, I've read your papers, and I know you guys have done a great service to beekeepers. And one of the things I wanted to highlight before we kind of move on talking about some of your specific research is that your laboratory, your institute, as it were, has a mandate specifically to work with beekeepers, and I love this idea that you're working with the Buckfast Breeders Association, the Carnica Breeders Association to improve breeding on the ground on behalf of beekeepers, and with beekeepers. And I think that that's a wonderful service that you guys provide in Germany and abroad on behalf of beekeepers. Yeah, there's quite a long tradition in this close cooperation with private beekeepers and probably the background of this is that we have quite a lot of well-educated hobbyists beekeepers, so people who run, maybe 20, 50, 100 hives as their side activity, but spend a lot of time on those things and spend energy to collect as many data as possible and just have fun if they see progress in the, in the traits of their stock. So there's a really high personal investment of people, and they are great. So it's always fun to cooperate with such highly involved people. Maybe this is a bit different between Germany and your country, because in your country, as far as I know, it's a much more professional way of beekeepers work with large numbers. Of course, we also have some of those beekeepers working here, and they play an important role for the breeding programs, and that's also clear, but it's dominated by these small scale beekeepers, but with a lot of experience and very well-educated people.

Amy 11:20
That's really great to hear. I think, you know, when, the beekeepers are invested, that's when the programs really are able to succeed, right? Because you have the collaboration, different experiences, and so it's just, it's a nice, well rounded group to make a successful program for sure. And I was also kind of laughing because I think, you know, not many people think about going into beekeeping as a career or working with bees as a career. And so you have your, you know, typical doctor, accountant, lawyer, etc, etc, etc, for jobs, you know, teacher and so whenever people ask me, what do you do for a living? I tell them I work with bees, and they get so confused. "You work with bees? That's a, that's a full time job?" And I said, "Yeah," and they don't, they don't quite know what to ask next. Of course, they always ask, "Oh, are they really dying, and you know what's really going on with the bees?" But it's always so fun to hear everyone's story, especially being in the bee industry and meeting all the different researchers around the world. We are surrounded by them. But we're still very unique in what we do, I think, in general, so so thank you for telling your story. So, you and your co-authors, you published a paper in September of 2020. So you published the paper on the evaluation of suppressed mite reproduction and how it might reveal for Varroa resistance in, you know, in the European honey bees.

So let's just kind of start from the beginning. Can you explain to us what suppressed mite reproduction is? What is SMR?

Jamie 12:51
So suppressed mite reproduction describes the fenomen that mites who are ready to reproduce, which successfully introduce work uproot cells, not in any case, in all cases have success in reproduction. So we are used to find about 80-85% of the mites successfully reproducing, but in some cases, this rate can be much lower. So you'll find brood samples where it's just 50%, or even less of the mites, which successfully reproduce and successful reproduction means that at the moment where there is a natural emergence of the adult worker, it's not only the mother mite, which is still present in the cell, but there's female offspring, which develop to the adult stage and which got also mated inside the cells. So, this is what we understand under successful reproduction. And what we can observe that is that in some cases, female mothers completely failed to reproduce. But there are also cases where you have delayed egg laying, so that some offspring is developing, but until the moment of cell emergence, is not yet major. And you also find cases where you get adult female offspring, but there is no male present in the cells. So there is no chance for the daughters to get mated inside the cell. And then afterwards, they will not be able to successfully reproduced by the cells. So in this sense, they also, they also lost and this is how we understand and describe SMR, an increased rate of nonreproductive mites inside the worker group. So I've got a lot of questions about this, Ralph, but I'm going to try to temper my enthusiasm about this, this topic. So what are some things that could lead to this suppressed rate of mite reproduction, because you've told us a few things that might happen, that Varroa might fail to reproduce all together, she might delay her egg laying, there might be female offspring in the cells, but no males, what, what are some things that can lead to this? There are quite a number of relevant factors. So first of all, we can observe that it depends on the season. So if there was a longer period without any brood in the heights, as we have it in winter time, or as it may also occur in the course of swarming period or whatever, then you can notice that, at the moment where the first mites can introduce brood again, they usually don't have a full success in reproduction. So it's something about the physiological status of the mites and this changes as the brood seasonality changes. Then, secondly, we have very clear proof that specific behaviors of the northern bees affect the final rate of successful reproduction. So this, for example, this so-called Varroa sensitive hygiene behavior, and this is that nurse bees detect infested cells and selectively open such cells and may remove the brood together with the, with the mites, and there is at least a good indication that there is a higher reaction on cells where beside the mother, you also have offspring mites present, which ends up then in a higher removal of successfully reproducing mites. And this ends then with a higher percentage of remaining infested cells, where you find mites without reproduction. But there's also this so-called uncapping and recapping behavior of bees, so it's obviously related to the previously described VSH behavior. But here, bees open the cells, and afterwards, close them again without removing the brood. And we see nowadays that also this uncapping and recapping behavior affects the situation of the mites inside the cell. It's still under research to better understand what is going on there. So we know at least in the very early stages of the brood, it may happen that mites at the moment where the cell is open, leaves the cell, but we also find the case that, that mites, at that moment, introduce a cell and so they may come into touch with with the larvae or pupae at a stage where they don't get a chance to normally reproduce

afterwards. So we have a kind of desynchronization between the brood development and the mite development due to this uncapping and recapping behavior, but there may be further aspects like change of humidity or CO2 content or whatever inside the cells. We don't know exactly. But there's something going on with this, with this recapping behavior. Well, I want to ask a quick follow-up question to one of the things that you just said. If there is a cohort of mites that's not reproducing at all, or well, due to these reasons that you state, and you have a VSH line of bees, right, that's kind of taking away the mites that are reproducing and leaving behind only those mites that aren't, over time would that select for low reproduction in a Varroa population? If you're taking out the highly reproductive mites, but leaving behind only the nonreproductive or the low reproducing mites, would that produce a Varroa population that then doesn't grow traditionally, like what we would expect a Varroa population to grow? As far as I know the literature and ongoing research, we have no indication at all that we have a kind of genetic selection within the mite population due to such a behavior, but what we clearly get is change of the, of the average reproductivity of the population due to this ongoing behavior of the bees. And I think this is what what happens here. So it's a good protection mechanism for the bees, which develops these activities.

Amy 20:12
I have so many questions on a lot of the behaviors that you were just talking about, specifically with the decapping and recapping of the cells. You know, how, how long does this take? You know, how long did they leave it uncapped before they recap it? How, how were you able to observe this? And then, you know, how does it affect the pupa? There's so many questions that I have. So you can feel free to answer one or all three, or none of those questions. But you know, what does that look like, the decapping and recapping process? I don't know why, but that was like one of the behaviors that I really was intrigued by when you had mentioned that.

Jamie 20:47
Yeah, so first, the duration of the uncapped period can be quite different. So sometimes, it's just that some bees start to open the cell, partly open the cap, and other bees immediately follow, which close it again. And we did some research on observation hives, where we continuously filmed what is going on. And the student who did this found one cell 17 times opened and closed again within this 12 days period of normally sealed brood. Remarkable.

Guest 21:28
So it's a very dynamic process. On the other side, you find cells which can remain open for several hours, or even several days. And this is then one thing which beekeepers can easily notice when they work on the hives and take out brood combs. Check for cells where you, which are open, but not with their larvae before normal cell capping process, but with, with pupae, with white eyes, or sometimes even with elder stages with colored eyes. So you can easily find those cells. And this may be a good indication of colonies which have been high activity with this uncapping and recapping process. And I remember quite well a beekeeper who contacted me about 25 years ago already from Britain. And he said, "Well, this is very strange." And he sent me pictures. "I have some colonies, which have most of the brood open, even in the pupa stage. So this may be very extreme situation." But it's interesting to

recognize that pupae can well develop without a sub cap. So what we assume is the cap is definitely needed at the moment where the larvae stops feeding, stretches and goes in for propation. So at the moment where the, the larvae spins the cocoon, it needs to have the cap to stay inside the cell. But once it's it's within the cocoon, it could live well without the cap.

Jamie 21:40
That's crazy. That's neat. It is crazy. And, yeah, we don't know why. Bees keep brood, usually kept until the moment of the emergence of the major bee. But it's from the biological point of view, it's not urgently needed, at least.

Amy 23:34
Interesting.

Guest 23:35
And what you should know at the moment where we have a more systematic research for the uncapping and recapping activity, we usually go with seal brood combs, and then we open cell by cell and at the moment where we take off the cap, we do this very carefully so that we can keep the whole structure but just open from one side and lay the cap then upside down. So in that moment, you look from the inner side on the capping, and there, you usually have the cocoon left from the pupae because it's like a silky net on the wax. But at the moment where bees open the cell before and recap it, of course, they cut the cocoon and afterwards, close the hole with, simply with wax. So you'll find this pure wax then, in those areas and that's how, how you can easily follow afterwards if the cell was at least one time open before, and you can also distinguish at the moment how big the hole was and find cells which have just a small point besides cells, which were completely opened by the bees.

Amy 25:05
Alright, so how do you select for SMR in your bee populations?

Jamie 25:12
How do we select? To be honest, I have to say, so far there is not high intensity in selection for SMR. And the main reason is that it's really time consuming, notorious activity. So the way how you measure SMR is that you get appropriate brood sample. That means you have to find pupae, which are just a few days before natural emergence and these elder pupae, you open them cell by cell, and you check if there is a female mite inside. And if you find such a mother mite, then under the microscope, you carefully check, do you find any offspring, and in which sex and which stage is the offspring? And then afterwards, you relate the age of the pupae, which you can notice by the color marks of the eyes and the wing paths and so on. So you can precisely determine the age of the pupae, and you compare it with the composition, age of the offspring, which you find. And then by this comparison, you can say, well, this is a normal full setting of spring, as you can expect it related to the age of the pupae, so everything looks normal. And you can expect that if such a cell would normally emerge two or three days later, then there will be at least one mother developed to the adult stage. And then you have also seen the male, which then probably have mated the young female, or you say, well, related to the age

of the pupae, the offspring, which I find, is still too young. There is no chance left to get mature until emergence, or you even miss a male or you miss offspring at all. And this is how you decide then cell by cell if you have a normal or disturbed reproduction. But to get a reliable estimate for such a brood sample, you should at least check 35 single infested cells in the right stage. And depending, of course, on the, on the average brood infestation rate, that often means you open 300, 500, sometimes 1000 cells, which takes you easily 2 ,3, 4 hours. Then you have the result for a single brood sample of one colony. So if you start a selection program, you deal with hundreds of colonies. And realizing that the reproductive activity depends also on seasonal effects on similar things, you would like to repeat your sampling two or three times within the season. So at the end, it's enormous workload. And this is why, so far, a trait which is mainly checked for in research programs, so we do it at the Institute since several years in quite a large extent, and right now with national funding, we got a selection program in cooperation with Carnica and Buckfast Breeding running where we both each year about 500 colonies which are tested then by the beekeepers with our support and with some experts in the game who helped them, but it's really a costly thing. And we do this at the moment for mainly with research interest to see how quickly we can increase the SMR level and we hope to find the genetic standing behind. So the the far goal, of course, is to identify genetic markers which can be used in selection programs. So there is hope to get this as a more effective selection procedure. But for now, it's really time consuming. Biologically, highly interesting and highly relevant for resistance of colonies, but difficult to be established as a routine testing within selection programs. Ralph, this is a perfect segue into my next question. So it is very labor intensive. I mean, listening to you describe having to open at least 35 cells that contain a single foundress mite, that might take hundreds or even thousands of cells to look through and hours per colony, how ultimately, then, do you envision beekeepers being able to use this trait to the benefit of Varroa control in the future? In other words, where do you see all of this heading on behalf of beekeepers?

Guest 30:20
I mean, the strong positive aspect is that we know by now quite a number of resistant populations of Apis mellifera in more or less all parts of the world, and also in Europe. And what we see with most of those resistant populations is that there is a change in the average reproductive success of the mites. So SMR is present in those resistant populations. And this is why it's a clear selection go at the end to find productive, gentle, easy to manage colonies, which have a high level of SMR. However, at the moment, my impression is that we will end up with high SMR bees, but probably we do not directly select for SMR in the way as I described before with sampling the brood and investing so much time in this. But we may achieve this by selection for, for example, good fruit hygiene, which can be done with frozen fruit or in Europe, usually it's done with pin tests. So this is much easier to handle. And our research shows that there is quite some good correlation between those traits. So it may be much more effective than to go with, with the pin test or, or similar tests. We are developing right now test, which can easily check for this recapping behavior. So this may be more effective ways than to test in the field. And of course, it would be a huge success if genetic markers for this SMR trait can be developed. Several groups are working on this worldwide. And I think there's quite a good chance that we get something in our hands to do so in near future.

Jamie 31:55
Ralph, given your decades of work with honey bees and your expertise and all the experience that you have, you know, are you, are you optimistic for the industry? Do you see things heading in a good direction? Are you encouraged by the way things are heading? You know, do you, do you feel that our defeat of Varroa is imminent? Or is, are there some things that discourage you when you look, look out on the health of bees and beekeeping? I'm absolutely sure the long-term future of beekeeping is going with resistant bees. So it's extremely important. And there is, it's absolutely in our hands to develop such bees. So the biology is on our side. And in fact, Jamie, if we would not always interact with our chemical treatments, and with all our management tricks, let me say, then the nature would very soon develop such resistant bees, and we see them in so many places around the world right now. So it's much more about the way how we manage our bees and how we deal with, with all this Varroa side. And there is the question, how quickly the beekeeping industry can be turned around that we reduce chemical treatment, that we come to more threshold based treatments, which we need to have if we want to give the more resistant colonies a better chance of reproduction. What happens at the moment in our industry here is that the beekeepers routinely treat two or three times a year with highly effective drugs, and doing so, they do not even recognize the differences in susceptibility or resistance to mites. We have colonies, which do very well without treatment even over several seasons and still produce a lot of honey. So they are there. But the point is they are not well-identified, and they are not clearly preferred in the selection programs. And our breeders are doing a very good job, and we are very well-organized with our breeding programs. So we see that there is such a strong improvement. And the more tricky question is how can we convince beekeepers that they can stepwise change their routine in colony management and treatment? That is how I see it then, and we discuss it intensively with our beekeeper organizations. And we are looking for ways out of this viral of treatment and more intensive freedom and more intensive treatment. So it's a manmade problem. It's not the nature and it's not the biology of bees, which brought us to this point. It's simply the way how we keep our bees. Ralph, I think that was beautifully said, and it was spoken from someone who clearly has a lot of experience with this. This is one of those issues that I feel like our beekeepers here in the States face as well. Obviously, you know, a lot of our, especially, commercial industry relies heavily on chemical treatments for Varroa even though we've got populations of Varroa, the SH bees, the Russian honey bees, things like that, that are clearly resistant to Varroa in some capacity. So it's really encouraging to hear kind of your concluding statement. In fact, I typed it down. You are, you are sure the future of beekeeping will go with resistant bees. And I'm really excited about that. There's only one thing you said this entire interview that makes me nervous. And that was right at the beginning when you said you're able to count down the days until you're not working any longer. So I think that makes me, in the beekeeping world, very nervous if you're not going to be out there as ambassador for the program. Jamie, you're a bit younger than me but not so far away. And you will see when you retire, even better people will follow up. Okay.

Guest 36:43
We won't stop with those activities.

Jamie 36:45

Well Ralph, I just want to thank you so much for joining us on Two Bees in a Podcast. You've really spoken a lot of truth to our industry. Our listeners are going to benefit tremendously from the encouragement they received, listening about the research that you and your colleagues have done on this particular trait. So thank you for joining us. Yeah, and thank you very much for your interest and an interesting discussion. Absolutely.

Guest 37:10
And all the best.

Jamie 37:12
Thank you. Everyone, that was Dr. Ralph Buechler, who's the head of the Bee Research Institute, the LLH Bee Institute, that is the, that's the State Agriculture Office of HESA in Kirchhain, Germany, talking to us about suppressed mite reproduction and European honey bees. Thank you again for joining us on this segment of Two Bees in a Podcast.

37:32
Have questions or comments? Don't forget to like and follow us on Facebook, Instagram and Twitter @UFhoneybeelab.

Amy 37:52
All right, for the next three Five Minute Managements -- Five Minute Management -- we are going to focus on stings. So, Jamie, today we're going to talk about how stings work. You've got five minutes, and I'm going to start the timer right now.

Jamie 38:09
All right, how stings work? I feel like an expert on this topic because I've been on the the pointy end of stings many, many many, many times in my life. All right. Ultimately, honey bees and for that matter, other critters, sting in an effort to defend themselves or their nests. So honey bees, we all know, have a stinger. When they sting you and push it into you and try to fly away, that stinger is ripped out of their body and it allows you to see very closely the anatomical structure of a sting. So I'm going to to make it over simplified. There's lots of pieces in a sting as it were, but I'm going to say it's composed of kind of three primary parts. One of those is the shaft, the pointy end that goes into you. A second of those is a muscular bulb that pumps the venom into you, and then, of course, the third part of that sting would be the venom and the associated venom glands that produce that venom and the sack that holds the venom. So when a bee stings you, she is pushing into you a shaft that is basically three long, skinny pieces of exoskeleton that together fold and make basically something similar to a needle, like the type of needle that you have when you go get a shot at your doctor. On the top of that is a muscular bulb that beats a lot like a heart. So if you've ever been stung in your arm and the bee flies away and you look closely at that sting, you'll see something pulsing and that is the muscular bulb. And what it's doing is above it, and very difficult to see once the bee is pulled that thing from its body, above it is a venom sack. It's, again, very difficult to see. It's very thin, but it's full of venom. And as that muscular bulb pumps, it is pumping the venom from the venom sac, through the muscular bulb, through the shaft and

into your body. It's actually a really remarkable structure. The shaft itself towards the very end has these small barbs, if any of you are fishermen or fisherwomen out there, you'll know that if you look at the the end of a fish hook, it's usually barbed on the tip and that is so that it doesn't easily come out of the fish's mouth. We're on the same premise here with the stinger. It's got multiple barbs on either side of that shaft. So when the honey bee worker sticks that sting into you and flies away, those barbs hold into your skin, and as that bee flies away, it pulls the sting out of her body. Now, incidentally, queens can also sting but their shaft has barbs as well, but the barbs are much smaller, so she cannot get it stuck in your skin. So when that bee flies away, that bulb is pumping, it drives that shaft further and further and further into your body. And then it tries its best to empty all the venom into you. So this leads to an important question, why do honey bee workers die when they sting you? Why is it necessary that that be the case, given that wasps and yellow jackets and ants and hornets and all of these things can just sting, sting, sting, sting, sting? Well, honey bee colonies are composed of thousands and thousands and thousands of workers. So you could almost argue that any one worker is kind of expendable. I hate to say it that way, but that's kind of what it is from a more biological perspective. Number two, leaving that sting in the victim ensures that the maximum amount of venom will go into that, venom, yeah, that victim. If the bee just stung you and stung you and stung you and flew away, once it flew away, it's taking the rest of its venom with it. But if it stings you and deposits that sting in you, then the victim, you know, me, you, a bear, a skunk, whatever, has to get that sting out, or all of the venom is going to be delivered into our body. And we humans have some dexterity, so we can pick stings out of us on a lot of different spots on our body. But bears and other things can't reach to their back and pull out stings. So these things are designed in a way to maximize impact on the victim, get away from me, get away from my nest. One last thing is that the venom is not meant to kill us. It's just meant to push us away. Get away from us. Leave us alone. We don't want you here. But it's the venom that you feel and not the shaft going into you.

Amy 42:52
Wow, you did that with three seconds left. I'm impressed.

Jamie 42:55
It was, I was lucky, Amy. That's a lucky coincidence.

Amy 42:58
That was pure luck.

Jamie 43:00
A lucky coincidence.

Amy 43:01
All right. I have one yes or no question. Is it true? Is there a difference between pulling the stinger out and wiping it with a credit card? Or, you know, they say swiping it over? Is there a difference in the amount of venom that goes into your body?

Jamie 43:15
There's not, Amy, and it's funny that you asked that question, you know, I can't do yeses or nos. There's not -- and the reason this is an important discussion, because it has -- we've all said, forever, that you shouldn't pinch, right, or remove stings that way because when you squeeze that bulb or venom sack, you're just doing its job for it, you're squeezing the venom into your body. But there was actually a research project where they looked at the impact of a sting when the sting was pinched and removed, versus scraped out, which conventional wisdom says to scrape out those stings to minimize the amount of venom that goes into your body. It -- the research showed that it didn't matter. The most important thing is to get that stinger out as quickly as possible, because that's what minimizes the amount of venom that goes into you, not whether you pinch it or scrape it or anything like that.

Amy 44:07
Alright, that works. Okay, we went a little bit over five minutes, but I'm assuming that if you've listened to our podcast for the past year and a half, you've listened to way more time. So that said, thank you for listening to our Five Minute Management. The next two Five Minute Managements will also be related to stings.

Stump The Chump 44:33
It's everybody's favorite game show, Stump the Chump.

Amy 44:45
Welcome back. It's a question and answer time. Jamie, I've got three questions and I don't know why, but every time I read a question, I turn it into something really funny in my mind, like I don't know how, but I'll -- we'll go through the questions.

Jamie 44:57
Yeah, I was looking at today's questions, and I'm curious what funny in your mind is happening with these.

Amy 45:05
Well, the first question, this person's asking, you know, do you know if there's anyone out there doing research into drone fertility and sperm load? I guess, I guess the question, the answer would be like, okay, yes.

Jamie 45:16
Yeah, that's going to be the easiest question that I'm going to answer today. And the answer is, yes. There's, there's actually a lot of folks looking into drone fertility and sperm load counts. And so we actually have a graduate student in our lab, Brynn Johnson, who's working on some projects here related to Varroa, etc. And we gave her some of the questions that we get from listeners to help look up some of the answers to these, and she found a very specific paper by Stirrup et al. in 2013, called When Every Sperm Counts: Factors Affecting Male Fertility in the Honey Bee Apis mellifera. And there are lots and lots of papers like this. So rather, Amy, than me kind of going through and creating a

reference list of papers and, you know, mentioning everything they found related to this topic, what I figured I would do, be beneficial to do for our listeners, is to just tell them how they can find this type of information. So Google is a very powerful search engine. And they have a search engine specific for academic papers. It's called Google Scholar. If you Google search Google Scholar, you'll basically get a different Google page into which you can put into a search box, you can put whatever topic you want. So it's really easy for us to find a whole lot of papers related to sperm load, sperm fertility, sperm counts, related to all kinds of things that drones might encounter, nutritional stress, temperature stress, pesticide stress, things like that. So anytime you folks out there interested in finding scholarly papers about a very specific topic, I highly recommend using Google Scholar. You know, what did we do before Google? I mean, I feel bad for the people who were doing research and how to go and actually find encyclopedias, right? Yeah, Amy, when I was a graduate student, and I lived overseas, the Internet was was in existence there, so I'm not that old, but it was just gaining popularity, and it was not nearly as much information on the Internet. And so we had to do it the old fashioned way, we had to go to the library and look up stuff by subjects and index and find books and with regard to journals, we just had to know which journals the bee papers likely were published in and search those journals for new topics. It was very difficult. These days, it's incredible how quickly we can find information related to scholarly work.

Amy 47:28
Yep, absolutely. Okay. So for the second question, are food resources gathered from robbing reflected by the field force through the waggle dance? And to kind of follow up on that, this is where I think it's kind of funny. How close to the hive can the waggle dance indicate food? I mean, would a worker bee just be like, yo, there's food right under the hive, just go down, you know?

Jamie 47:48
Yeah. So both of these are interesting questions. The very first one, I was unsure of, again, some of these questions that that we're unsure of we give to Brynn to see if she could find some papers related to it. And she wasn't able to find any manuscripts related to bees dancing to alert foragers to rob. So just because there weren't any papers related to or papers, at least that she found, doesn't mean that they don't do it. So my sneaky suspicion is that there are multiple cues bees use to trigger in old colonies for robbing purposes. I believe it's also possible, maybe, maybe not likely, and again, if we haven't seen papers, that doesn't mean something one way or the other, but I would say it's possible that there could still be some dance involved. And so what's important to focus on in this particular question is the questioner asked specifically about the waggle dance. And so the waggle dance, that figure eight dance, is not one that would be used to suggest that robbing should happen in nearby colonies, because waggles are used to communicate a food resource that's greater than 100 meters from the nest, usually. And so that kind of speaks to the second question. The second question was, how close to the hive can a waggle dance indicate food, and it's about 100 meters. And so that's about 328 feet for those of you keeping track, and how we measure things versus how the rest of the world measures things. Instead, bees use a round dance to communicate food resources that are close to the nest, and that's within about 15 meters or about 50 feet. So if there's a food source close to the nest, they do this circular dance, spread scent around from the food source that they collected, etc. And bees

will just kind of go out and within 50 feet, look for that food resource. Between 50 feet and this 328 feet distance or 15 meters and 100 meters, they'll start transitioning from the circle or round dance to the waggle dance and it's basically a circle dance that begins to open up until when you're about 100 meters away. It's, it's officially this waggle dance. So they wouldn't use -- ifdances are involved in alerting foragers to rob, they wouldn't use the waggle dance to do that. And more often than not, because they're robbing one another within very close to the hive. But still, the jury is out at the moment on whether or not they use dances at all to communicate robbing.

Amy 50:17
That is so cool. I just learned something new. I had no idea they did this circle. It's like half, half an eight.

Jamie 50:22
Yeah, it's, it's funny. I mean, because it's like, if you watch it, it's, it's basically a bee saying there's something really close, and it's really good, go find it kind of thing. Whereas, you know, by the time they get to the waggle dance, there's distance, there's direction. There's a lot more communicated in that. And it's, I think it would be a really cool topic on why bees don't use the waggle dance throughout the distances. It's, it's, it's only accurate, you know, at 100 meters or further. And I don't know why that's the case. I'm sure there are folks who've looked at it. Maybe it's even in the literature, but it's a very interesting topic.

Amy 51:00
That's very cool. Alright, so the third question we have, why does the queen take 16 days to develop, while the workers take 21 days and the drones take 24 days?

Jamie 51:12
Yeah, so this question actually came in over email, and I answered it. And I know a colleague of mine answered it as well. And then some of the implications behind the question, I began to rethink as well. So let me, let me just give you my standard answer to this. And this is what I've read years before. And as with anything else, you know, it's subject to change based on the information that's found in research moving forward. But as the questioner noted, queens take 16 days to mature, workers take 21, drones take 24. What I have read, and what I continue to teach folks, is that queens develop so quickly, because they are fed so much more food, and a higher quality food than our workers and drones. So queens get all the food they can eat, and then some, whereas workers and drones are kind of provisionally fed, and then not everything that they could eat, right? Workers could eat a lot more and have been a queen. So just that sheer volume of food that queen larvae get while they're developing, pushes them through their development quickly. The reason drones take a little bit longer than workers probably has only to do with body size, right? They're bigger than workers, it takes an extra three days of development maturation in order to be the size that they are. And in fact, they are larva, larvae longer tham our workers. They have to eat more food to become these larger body drones than do workers. So then an important question is, you know, biologically, why would this be useful at all? Well, it makes a lot of sense for queens to develop quickly, because very often when colonies need queens, they need

them now. Right? And so there, there's probably been a selective benefit over time to speeding up the development of queens. It probably just goes hand in hand with the quality and volume of diet that they get while they're developing.

Amy 53:07
That makes a lot of sense. You know, I'm so glad that you're the one answering these questions because I think if someone asked me that, I would probably just be like, because they do. And that's why it was funny when I was reading the question. I'm like, there must be more to that.

Jamie 53:21
Well, Amy, the funny thing is about all of this to me is when I was a young bee scientist, I knew every answer on the planet and can answer things on the moment. Of course, I'm saying that tongue in cheek. Now that I'm older, I realized how little I actually know. And more often than not, I doubt my answers. It's easy to answer questions in an audience when there's, you know, 20 people in the room. But when you've got listeners from all around the world and also answer the questions for the American Bee Journal, when you have readers from all around the world in that particular case, you know, everybody out there listening to you answer a question or are reading your answer to a question, they all have this collective knowledge that you can't possibly have. So a lot of times, right, people will point out, "Well, Jamie, you said this, but I found this paper that said this," and then I have to go back and correct myself, which by the way, I'm more than willing to do. It's just that I've actually gotten more tentative over time answering questions with the more I know, rather than less tentative, which is what you would think should happen as you develop in your career.

Amy 54:24
So you basically just make things up at --

Jamie 54:27
Well, basically, what I, what I do is I only answer the things that I, I know conclusively or that I have read that others know. There's so many things out there I don't know and that I'm not even sure is known, and so that's why we have to have folks, you know, like Brynn, help us out when we're, we're trying to find out answers to some of these questions that are just a little off the standard beaten path for me.

Amy 54:51
Yep, that's great. Listeners, you know, don't forget to keep asking us your questions. Facebook, Instagram, Twitter, send us an email, give us a phone call, leave a voicemail if you want to. We'll try to get to your question as soon as we can. But thank you so much for joining us on this segment of Two Bees in a Podcast. Hi, everyone, thanks for listening today. We'd like to give an extra special thank you to our podcast coordinator, Megan Winfrey, and to our audio engineer, James Weaver. Without their hard work, Two Bees in a Podcast would not be possible.

Jamie 55:31

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