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SPEAKERS

Jamie, Stump The Chump, Amy, 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.

Amy 00:48
Hello everybody, and welcome to this segment of Two Bees in a Podcast. Today, we are joined by Dr. Kelsey Graham, who's a Research Entomologist with the USDA ARS Pollinating Insects, Biology, Management, & Systematics Research Unit in Logan, Utah. Dr. Kelsey Graham, thank you so much for joining us today.

Guest 01:07
Thanks for having me.

Amy 01:08
So you recently published a paper called "High pesticide exposure and risk to bees in pollinator plantings adjacent to conventionally managed blueberry fields" and that's what we will be talking about today. So I'm excited to be joined by you, and I know that you've been on the podcast in the past, but sometimes our listeners will listen to our podcast out of order. So we'll just go ahead and ask you again to please introduce yourself and tell us about how you got into the honey bee world.

Guest 01:35

Sure. Yeah. So yeah, I've been a research entomologist with the ARS since 2020, and most of my lab's research focuses on crop pollination and integrated pest and pollinator management. This is especially in alfalfa seed production, as well as berry crops. My lab also studies pollination of rare plants and the impact of wildfire management in forests on insect communities. Most of my work these days is not related to honey bees, but a lot of my work during my postdoc at Michigan State University looked at managed pollinators, both honey bees and bumble bees, as well as other bees, and their use in blueberry production.

Jamie 01:36
So Kelsey, it's completely okay that you're not studying honey bees as much, because we still feel like the paper we're going to discuss with you is relevant, and I apologize to you and our listeners. I'm recovering from the illness, which is why my voice sounds so bad. So I'll try to push through this question, and we know, Kelsey, if you fail to understand me -- all right. So you and colleagues recently published this paper, "High pesticide exposure and risk to bees and pollinator plantings adjacent to conventionally managed blueberry fields." We're going to link to this particular paper in our show notes. Could you talk a little bit about the background of this project? What motivated you guys to study this? We'll ask you questions coming up about how the project was designed and what you found. But specifically for this one, we're curious where the idea came from and the motivation for the project.

Guest 03:00
Sure. This was part of my postdoctoral work while I was at Michigan State University under the mentorship of Rufus Isaacs. I had been working in blueberry production for a couple years at this point, kind of thinking a lot about pest control measures, pesticide exposure for bees. And then I was kind of lucky enough that in this production area of Michigan, there had been this history of installing pollinator plantings adjacent to crop fields. So I had been working in these lovely pollinator plantings thinking about pest management, and that kind of just clicked with me in terms of, okay, so we have these pollinator plantings, they're right next to these crops, there's a lot of pest management happening right when these pollinator plantings are peaking in bloom. So they generally peak post crop bloom, so kind of mid-summer, beautiful floral resources, that is also the time of year in blueberries where they are controlling for Spotted Wing Drosophila. And this involves several applications of broad spectrum insecticides during fruit ripening to protect the crop. So that kind of just got me wondering. We have these beautiful plantings. There's close proximity to pest management activities. Are these kind of a safe haven for bees? We kind of hoped that they would be because landscapes that are dominated by crops can be somewhat challenging for especially wild bees during the summer, and these plantings are kind of meant to provide floral resources and nesting resources for bees during this time. But is their proximity to pest management causing potential pesticide exposure as well for bees? So that was kind of the basis of a NIFA postdoctoral fellowship that I was able to secure and kind of led to this research project.

Amy 04:36

Thanks, Kelsey. Yeah, I'm interested to know about the methodology. How do you conduct a research project? What were you looking at in the methodology and all of that good stuff? So can you tell us about what you all did for the project?

Guest 04:49
Yeah. So, this work, again, it was focused in these pollinator plantings that were already mature and established on blueberry farms in southwest Michigan. We worked on 12 farms and eight of these were conventionally managed, so they used synthetic pesticides and just typical pest management protocols. Half of them had mature pollinator planting, so four of them. There was kind of this other four that were kind of matched, so they didn't have pollinator plantings, but they were managed by the same growers, so had very similar kind of pest management protocols in place. And then we also had four farms that did not have any pesticide use, and these served as controls. So to kind of measure pesticides on the farm and what bees might be being exposed to, we sampled flower heads, both from in the pollinator plantings themselves, as well as outside the pollinator planting. So kind of on those matched farms that didn't have pollinator plantings, we also collected kind of weedy flowers that were in the field margins, kind of where you'd expect to find a pollinator planting. We also collected weedy flowering plants from within the crop field, so in between the blueberry rows, and then all that residue analysis was done at Scott McArt's lab at Cornell. We also took soil samples from those same locations on the farm, as exposure through soil is especially relevant for ground nesting bees, again, that are active throughout the summer in this area. And then we also placed commercial bumble bees, so that's Bombus impatiens with a common name of bumble bee. We placed colonies in the field margins of each farm. These kind of were our proxy wild bees. And we had them kind of go out and forage, and then when they came back to the colony, we would grab them and take pollen off of their legs and then analyze that pollen for pesticide residues. And again, we kind of use them as our surrogate for wild bees in the area and out foraging, what kind of exposure might they be coming into contact with, especially because, even though we can collect residues from directly on the farm, both in the pollinator planting and elsewhere, we know that bees forage much more widely. So we wanted to really capture kind of what a more realistic exposure for a bee might look like through pollen, and then we calculated risk quotients for these samples. This provides an estimate of risk that sort of incorporates toxicity of the pesticides and this is really because some pesticides you might detect at really high concentrations, but they might carry very little risk in terms of bee health outcomes. So the ones that you get in the highest concentrations might not be the most relevant for bee health, whereas you might see another pesticide at really low concentrations, but it might be very high risk. So this kind of risk quotient allows you to get a better assessment of how does the exposure profile that you are detecting in the samples actually translate more towards risk for the bees in terms of their health?

Jamie 07:50
So Kelsey, I'm kind of chuckling because I have the shortest scripted question to ask you, but I've done residue analyses and similar studies to what you're talking about. So I know the short question is going to have a mound of data and answers behind it. So the short question is, what were your findings? What did you find? And I'm laughing because I know you found so much because of all these analyses you did. So I'll just sit back and let you take it from here.

Guest 08:20
Sure, yeah, I'll try not to go too long. But yes, we do. We did find a lot. That's what these big kind of exposure studies -- you always find so much, and you could go down so many different rabbit holes. But I'll try to keep to the main findings. And I guess the main finding really was that pollinator plantings, we did not really see them as safe havens for pesticide exposure. Pesticide exposure in the pollinator planting was very similar to what we were seeing in the weedy plants outside of the pollinator planting. So yeah, so on conventional farms, pesticide residues very similar in the pollinator planting to samples from the unenhanced field margins. So just those weedy flowers, as well as the weedy flowers that we were collecting inside the crop rows. So again, that was a bit surprising. The sprayers are kind of going along the rows, so you might expect that a lot more kind of off target pesticide deposition might happen in those crop rows compared to in the field margin. But really, we saw very similar residue profiles and risks both in the field margin in the pollinator planting, as well as in the field. And unfortunately, risk, as we calculated it, was pretty high. We were getting some of these kind of more toxic pesticides, again, that are used for control of Spotted Wing Drosophila. We are seeing some of them at very high concentrations in these floral resources. I guess the bright spot is that soil samples had much lower risk. So we would hope that that means that for ground nesting bees during the development, hopefully, their exposure profile is somewhat less, or at least that one exposure route is hopefully not as relevant as maybe pollen might be. So I guess the insecticide that pulled out as most important in terms of driving risk was phosmet, and again, this is used for Spotted Wing Drosophila control. We know that it's a high risk pesticide. It's broad spectrum. It's used during fruit ripening. It's pretty critical for protecting yields for blueberry growers. But yeah, it's an organophosphate known to be hazardous to bees, but unfortunately, our data provide evidence that this, as well as some other high risk insecticides, are drifting onto non-target plants that are attractive to bees. So that is where you're going and collecting floral resources.

Jamie 08:26
Quick interjection -- of all the compounds that you found, was phosmet the only one that exceeded the risk quotient of concern?

Guest 10:08
No. We had some others, but phosmet definitely pulled out as most important. Yeah, I think imidacloprid also kind of pulled out. But phosmet, for sure, was the one that became our primary focus, just because we detected it in such high concentrations. That one definitely, definitely caught our attention the most. Again, we're seeing it -- I think the critical point is that we're seeing phosmet in the field margins, which is not what you would want to see. So that does mean that off-target deposition and drift is occurring, and that this can have impacts for bees. So any kind of drift reduction technologies that can be implemented would be really critical.

Amy 11:20
That's really interesting. So I got a couple of questions for you. I guess the first one is, I know that you did this with bumble bees. Has the project been done with honey bee colonies? And the second part of

that question would be, do you believe that the results with the risk and the pesticide exposures, do you think those would be the same between, I mean, I guess even bumble bees and honey bees and other native bees? Ground nesting bees, things like that.

Guest 11:43
Yeah. That's a great question. I've done sort of similar exposure work during blueberry bloom, which is when you would have both honey bees and bumble bees and other wild bees, sort of active and foraging on the farm because growers will bring in commercial hives. And there's definitely some differences between how honey bees and bumble bees forage, and therefore, what their exposure profiles will end up looking like. So I would expect that would be similar during the summer. They're going to be foraging at slightly different flowers, and that means their exposure might be slightly different. But I will say that a lot of the flowers that we were collecting and doing residue analysis on, these are flowers that are pretty commonly visited by both bumble bees and honey bees, as well as other native bees. So yeah. So I would expect kind of a lot of the risk to be somewhat similar, especially as this high risk insecticide phosmet was detected at such high levels. If honey bees are going to these flowers, I would expect the risk to be pretty high for them as well. But again, there's obviously always going to be some differences between bees and how they forage, and therefore, what their exposure profiles look like. Similarly, for wild bees, they're often more specialized in what flowers they're going to, and, often, their foraging radiuses are smaller. So that's also going to change sort of their risk profiles. But if they are on these blueberry farms nesting or foraging in these pollinator plantings, I would expect, again, their risk to be pretty high. But I guess kind of the interesting thing about when we're thinking about honey bees versus wild bees in this scenario is just that honey bees are moved out of the farm after bloom, so they're somewhat protected from, hopefully, these higher risk exposures. So, once crop bloom is done, the honey bee colonies are moved out. But of course, wild bees that are in and around that farm, they don't get moved so they're going to still be there and still kind of having these higher risk exposures that happen after bloom. But I will say I worked with one beekeeper that, because some of these pollinator plantings are really big and beautiful and have all these lovely floral resources, beekeepers were sometimes moving their colonies back onto the blueberry farms to take advantage of these pollinator plantings. So honey bees are often there, and therefore, their risk could also be somewhat high.

Jamie 13:56
So I think the million dollar question is, given everything that you've found, what are some recommendations you'd actually have both for growers and for beekeepers? Those are two different target audiences. What would you tell your growers with all of this in mind? What would you tell your beekeepers with all of this in mind?

Guest 14:11
I think for growers, it's just remembering that bees are still there even after bloom. I think often they're very tuned into the fact that they need bees during bloom, and then often after bloom, their focus will shift a bit more towards pest control. But of course, wild bees are still there, and they're still visiting weedy flowers or other resources on the farm. So yeah, steps should be taken to reduce off-target

deposition. Our study did show that this is happening, and I should say, it is on the pesticide label language as well that drift onto flowering plants needs to be minimized for these insecticides that are really risky for bees. But again, growers have a lot on their plates. I totally understand, but they really should be doing things like mowing really low right before you put on a spray like phosmet. Getting rid of those clovers, those dandelions, any of those weedy flowering plants that are going to be really attractive to bees because drift off-target deposition is going to happen. So we want to really kind of reduce any chances of those exposures happening by reducing the floral resources that are right there by the crop. So yeah, I think just thinking about those things, thinking a little bit more about integrated pest management whenever you can. I know that pests like Spotted Wing Drosophila have kind of thrown a lot of the integrated pest management options out the window because this is just a terrible pest, but there's slowly being new options for control being integrated into pest management programs for this pest. So, yeah, just thinking about integrated pest management, thinking about ways to reduce exposure for bees. Yeah, I think that's kind of the most critical thing for growers. For beekeepers, , as I said, we did have some beekeepers bringing their hives back onto blueberry farms to take advantage of these pollinator plantings. And I think given this study, I would think about that a little bit more. So obviously, beekeepers also have a lot on their plate. They're trying to find the best landscapes to put their hives so that they can have floral resources. But obviously, you need to be thinking also about what risks are in these landscapes. And you can't control where your bees are going to forage. You have to think pretty widely. The beescape resource out of Penn State, I think, can be a great option for beekeepers to try to kind of critically evaluate landscapes and try to figure out which resources are available, and do those resources come with some added risk based on proximity to especially crops. So unfortunately, it's just thinking about more things, and I know that both growers and beekeepers, that's not what they want to hear. But yeah, I mean, obviously, pesticide exposure can pose a serious risk for bees, so it's something that needs to be considered.

Amy 16:48
Kelsey, I'm going to go back to the methodology real quick, because I realized that I know nothing about bumble bees. Everything that we do is with honey bees. And so I guess, I don't know. I've just been thinking about the collection of pollen. Do bumble bees collect pollen similarly to honey bees? And are there traps at entrances that you use to collect that pollen? What does that process look like?

Guest 17:08
Yes. So it's very similar. They pack it on their legs, similar to honey bees. There have been some pollen traps that have been piloted. They do not work super well for the common Eastern bumble bee, because they have huge size differences in workers. So, you'd have to set the trap basically for the biggest of the workers. And then, of course, the little workers can just sneak right through, and none of the pollen would fall off. They're also very rotund, very round, so they can, as they're crawling through the trap, their little legs kind of cross behind them and kind of perfectly protects the pollen on their legs, and it tends to not get knocked off. So unfortunately, that means that we just sit at the entrance to the colony, and we kind of shut the door and then wait for the bumble bee worker to come back with pollen, grab her, put her in a queen marking tube for honey bees, and then just grab the pollen off of her legs and then release her and let her go back into the colony. So it is very time intensive, so it takes a lot of

effort to get these samples. So unfortunately, we had to -- we went, I think, three or four times to every farm and spent hours each time at that farm collecting pollen, and then we still didn't have enough to have separate samples for each day. We had to combine all of that pollen across the season to get one sort of composite pesticide residue analysis sample. So yeah, a lot of work for that one sample that you end up getting. And so there's obviously those caveats that this is across the season exposure profile that we're getting, instead of getting this kind of snapshot of how exposure might change over time, like you'd be able to get with honey bees. Yeah, a lot of work for one sample, which can be a little rough.

Amy 18:53
Thanks for sharing that. I was just like, as you're talking, I'm thinking, like, how in the world did that work? So, awesome. Well, good. Thank you so much. All right, so as we end this episode, is there anything else that you would like to share with our audience?

Guest 19:07
Yeah, I think the main one is just that I hope this study doesn't dissuade people from installing pollinator plantings. They can be really wonderful in terms of providing floral resources in agricultural landscapes that can otherwise be somewhat challenging for wild bees, especially after that pulse of a crop bloom. So I just think we need to think a little bit more about where we install them and maybe kind of increase that distance between the crop and the pollinator planting. Again, there's a lot of challenges with that. You have to find space on a farm or near a farm, to both put it in and then also protect them from drift. So I realize that's a challenge, but I hope we can kind of work towards that, and I also hope that this is kind of a call to action that we really do need to think a lot more about reducing drift on farms, because these can have pretty big impacts for bees.

Amy 19:59
Very cool. Well, thank you so much, Kelsey, for being on our podcast today.

Guest 20:04
Yeah, thanks for having me. This is great.

Amy 20:17
So Jamie, this was kind of a fun take on risk and pesticide exposure, not to honey bees, but to bumble bees, and just kind of taking a look at that whole process. What were your thoughts on the episode today?

Jamie 20:27
Yeah, it's good. And so we've talked about pesticide impacts on bees and risk a lot in the podcast. But, to summarize, if you know a level that damages bees, and you know a level of the compound present in the matrix to which the bee will be exposed, so pollen or nectar or wax or whatever, then you can use that exposure information and that toxicity information to calculate risk, which is what Kelsey and her colleagues were doing. And with that, you can run every pesticide residue you find through this risk calculation, and they found that imidacloprid and phosmet, specifically phosmet, that she kept

hammering on, were compounds that exceeded the risk quotient. So what that would do in a typical regulatory setting is, once that's found kind of in a tier one setting, that means that additional tests would be done on the risk that compound poses to bees in the field, and depending on the information that comes from that, that would inform the pesticide label and how the product can or can't be used. So Kelsey and her colleagues found that these two compounds, but specifically phosmet, exceeded the risk quotient. In other words, there's reason to believe that it could pose a reasonable risk to bees in the field. And now, what are the risk mitigation strategies? Right? That's why we have risk calculations, because once you identify risk, you have to develop mitigation strategies. And their suggestion out of this was, be careful about drift, because this stuff's not being sprayed on these wildflower plantings. It's being sprayed on the target crop: blueberries, in this case. But it's making its way to the wildflower plantings that are supposed to be safe havens for pollinators. So what's the best way to reduce this problem? Well, keep the compound from drifting over to the wildflower plantings. So this is how the system is supposed to work. Identify compounds that pose a risk in the setting and then develop mitigation strategies. So it's really nice to see that Kelsey and her colleagues were able to fill in the blanks with some important information that informed this particular system, this blueberry treatment system and wildflower plantings around it.

Stump The Chump 22:45
It's everybody's favorite game show, Stump the Chump.

Amy 22:54
Welcome back, everybody, to the question and answer segment today. Jamie, the first question that we have, this questioner was talking about how they do a dish soap and alcohol wash to check for mites. They always save the bees in paper towels and then count them, either right away or they wait the next day so that they can get an accurate percentage. They'll be able to count the bees and the mites. To their surprise, when they open up the paper towels the next day, all but three of the half cup of bees that they tested flew away. It's kind of funny. As I'm reading this, I'm like, cracking up.

Jamie 23:26
I mean, I'm sorry.

Amy 23:29
That was a nice surprise. I thought you were dead, and here you are. So they're wondering, okay, so what's going on here?

Jamie 23:36
What's going on is simple. In your wash, you failed to kill the bees. So, let me back up and talk about this a little bit. Well, the questioner mentions two types of washes, dish soap and alcohol wash. Alcohol washes kill bees, period. So the only way that they are surviving an alcohol wash is if you are significantly watering down the amount of alcohol that you are using. So my guess is this didn't happen with your alcohol wash bees. My guess is, instead, it happened with your dish soap bees. And in that context, I'm guessing you used way too low of a concentration of soap, because dish soap water

should also kill bees. They are far more likely to survive that than they are an alcohol wash, but even then, only survive the dish soap wash if there is a very low concentration of soap in the water that you make the dish soap water out of to wash the bees. So I don't think it had anything to do with you allowing the bees to stay warm during the recovery process. I just feel like it was probably too watered down of a killing agent, either dish soap water or alcohol wash, but most likely the dish soap water that allowed them to survive the wash and fly away the next day. So I'm also surprised to hear this. So, to me, it can only be explained by a significant watering down of whatever liquid you used to wash the bees.

Amy 25:04
Well, the first question I think I had was whether you think they were just taking like a bubble bath or not in the dish soap. And the second question is whether we would consider this like a survivor stock. I'm not sure.

Jamie 25:14
I was thinking, whatever those bees are, you need to keep them. They sound amazing, though. In all seriousness, it's probably too watered down of a wash.

Amy 25:22
All right, so for the second question that we have, this person's always read that it takes about 16 days from egg-laying until a queen will emerge. Is this understood to be a pretty consistent length of time? Does this change at all? What is the timeline and is this true for all queens?

Jamie 25:39
Okie dokie. Oftentimes, Amy, when I get emailed a question for our Q&A or when I get emailed a question, because I also answer questions for the American Bee Journal, people will ask a question like this, or they'll say, "Jamie, or is this just a case of biology is messy?" A lot of our listeners and a lot of the readers from my writing know that I have this saying that biology is messy. This is absolutely a case of biology is messy. Much of what you read in the honey bee biology books represents what I would call average behavior, or average timeline, or average information associated with the bees or the colonies. So on average, it takes about 16 days from egg to adult queen emergence. But this can vary significantly. I use that word, I guess, a little lightly, maybe a day and a half. So it could be 14 and a half days. Maybe it's, 17 and a half days. So it would be, on average, around 16. But certainly, queens can develop a little bit earlier and a little bit later, and it all has to do with temperature, diet, how well the individuals were tended while they were developing, things like that. So yeah, 16 is average, but it can certainly happen before or after that. Absolutely, well within the range of normal. And it all falls under that biology is messy.

Amy 27:01
Yeah, we're working with the science illustrator right now, working with the development of each cast in the honey bee. And every single time I ask someone, okay, does this look right? Is this where it gets capped? "Well, maybe we should partially cap this day, maybe." And I'm like, "Oh my gosh, what are

we gonna do?" So there you go. Biology is messy. So Jamie, the third question was from a beekeeper who had rendered some wax, and I think there were three different hives that they had. When they rendered the wax, they turned them into these little wax blocks, and each wax block was a different color. So the colors kind of range from bright yellow, orange, one of them is like green-ish. What would cause this?

Jamie 27:44
Well, I mean, there's a lot of things, potentially, that could alter the color of beeswax. So let me just start by saying, when bees secrete scales of wax using their wax glands onto their wax plates, that wax, as scales, is almost white looking. It's not quite perfect white. It's kind of a creamy white. And when they fashion that into pure beeswax comb, it takes almost a creamy, light yellow appearance. So pure beeswax in volume is kind of a creamy, whitish yellow appearance. Wax gets stained and adulterated over time for lots of reasons. Bees get dirty feet. Wax is used to store honey, wax is used to store pollen. Wax is the matrix in which bees raise their brood. Along with brood rearing comes silk and other stuff that gets trapped in the wax. Wax may be adulterated by propolis or debris, so when you ultimately melt that wax, it can be different colors based on the adulterants that it's in it. So usually, a lot of things like beeswax candles and beeswax cakes, things like that that are pure beeswax tend to be that yellowish, whitish, kind of creamy-ish color, and that wax is usually from the cappings of honey cells, the newest wax that's had the least amount of time to be adulterated. But when you start melting brood comb or older combs for rendering and use and other things, that can range in all sorts of colors based on the amount of adulterants or debris or things in it. A lot of things can contribute to the staining of beeswax. And I suspect, in the particular context of this particular questioner, that's what would have contributed to the different colors of wax that they saw coming from their own hives.

Amy 29:46
There's nothing more beautiful than fresh, beautiful wax, right? Just like that clean wax that you see in the colony. It's just a beautiful thing.

Jamie 29:55
I love the color, I love the smell. Brings back so many just thoughts about me keeping bees when I was a kid. It's great.

Amy 30:04
Alright. Well, listeners, those were the questions for today. Jamie, we had a listener stop by the office today just to say hello from a different state, and I think she had mentioned something like, "Oh, I've been meaning to send questions to you all soon." And we're like, "Send questions!" So don't be shy. Make sure you send us questions. We try our best to go through and sort through the questions and answer them on air, but it is helpful for us, and I'm sure if you have the question, someone else probably has that question too. So be sure to send us an email, or you can reach out to us on one of our social media pages. Thanks for listening to today's episode. This episode was edited and produced by our podcast coordinator Mitra Hamzavi. Thanks, Mitra.

Jamie 30:56
Visit the UF/IFAS Honey Bee Research and Extension Laboratory's website, UFhoneybee.com, for additional information and resources for today's episode. Email any questions that you want answered on air to honeybee@ifas.ufl.edu. You can also submit questions to us on X, Instagram, or Facebook @UFhoneybeelab. Don't forget to follow us while you're visiting our social media sites. Thank you for listening to Two Bees in a Podcast.