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SPEAKERS

Guest, Serra Sowers, Jamie, Amy

Jamie 00:10

Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere. In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast. Hello, everyone, and welcome to another segment on Two Bees in a Podcast. We are talking about Varroa, as Varroa always seems to be a very popular topic among beekeepers. Amy, you and I live in Florida. So, here in Florida, I know in the greater US, but also all around the world, beekeepers struggle trying to manage Varroa. It's funny because we know a lot about Varroa but everyday research scientists around the world are uncovering more and more about Varroa biology. And today, we actually have a guest with us who uncovered or is illuminating one aspect of Varroa biology that I hadn't thought much about in the past. It's a manuscript he and his colleagues wrote, and the manuscripts entitled "Raised seasonal temperatures reinforce autumn Varroa destructor infestations in honey bee colonies." We're going to talk all about that with our guest today, Dr. Szymon Smolinski, who's a research scientist in the Department of Fisheries Resources in the National Marine Fisheries Research Institute in Poland. Szymon, thank you so much for joining us on Two Bees in a Podcast.

Guest 01:53

Hello, everyone, and thank you very much for this invitation. I'm glad to talk to you today on this podcast.

Jamie 02:00

Well great. So, you and I and Amy were talking a little bit before we started recording the segment. And as all of our listeners just heard, you're working in a Department of Fisheries Resources. So could you tell us a little bit about yourself and how your background ultimately led you to conduct this research project on Varroa destructor population impacts from temperature?

Guest 02:27
So I work for the National Marine Fisheries Research Institute, as you mentioned already. We are located in Gdynia. And that's one of the really wonderful young cities in Poland located on the Baltic Sea, on the coasts of the Baltic Sea. And actually, most of my scientific career is related to the sea. I completed my PhD in oceanology. So that's something that may be a bit unexpected here in this podcast, but I entered the field of honey bee ecology completely accidentally. I'm from a different world, if I may say so. But I hope you're tolerant of newbies. What I do regularly is research the effects of environmental conditions on fish. I studied different aspects or different environmental effects on, for example, fish grove recruitment, spatial distribution, diversity, and so on. And I'm also interested in freshwater fish but it's a really interesting change for me. It's a change of subject and a real pleasure to talk about this Varroa related study. I did, in this research, I did some specific tasks, especially analytical tasks, but actually, it was an initiative of my coauthor, Professor Adam Glazaczow from the Adam Mickiewicz University in Poznan and Dr. Alexandra Langowska from the University of Life Sciences in Poznan. They are entomologists working professionally every day on the aspects of insect biology, including colony bees, but they are also dedicated beekeepers having a lot of fun in their apiaries. At least, that's what I noticed working with them. And in this study, we were together trying to take advantage of everyone's knowledge and to tie some ideas to research environmental effects on the Varroa dynamics. So as I said it was, let's say, an accident to be here.

Amy 05:02
I think that's so funny. I love when people from different departments are able to collaborate and work together on a common project. Even though you're not a beekeeper, you have the expertise to contribute to the study. And I always think that's really fun to hear about. So I love interdisciplinary collaboration. So I'm very happy that you all were able to work together to do this publication. So your research examined the effects of temperature on autumn abundance of Varroa. So you actually looked at 1991 to 2020 in Central Europe. And as I was reading your abstract, I was thinking how did you go about even looking at this information? And what specifically were you looking for while you were doing your, I assumed it was a literature review that you were doing?

Guest 05:52
So I agree, Amy, with you that there is an advantage in interdisciplinary works. And as I mentioned, I mainly focus on fish. But some things in ecology are really universal across subdisciplines. And for some time, I am very interested in the identification of the optimal environmental signals that affect different biological processes. It may sound a little bit scary, but let me give you an example from the terrestrial ecosystem and maybe that will be easier. So suppose that, for some reason, we want to predict the biomass of some plant in a certain area, for example, clover, as it is considered one of the valuable sources of oil and for the honey bee, right? Now, I will simplify some things. Let's assume that only temperature affects the growth of this plant. And we want to specify the temperature variable that would be helpful to predict the biomass of this plant somewhere, let's say around our apiary. In a very simple way, we can try to characterize the relationships between this plant biomass and local temperature conditions, using, for example, mean annual temperature. But we can very shortly realize that probably the spring temperature conditions are much more important than average temperature

from the whole year because in a given geographical location, the intensive growth of this plant occurs exactly in spring. So now, what we do very often in ecology is that we investigate these kinds of relationships between organisms and environmental conditions using apiary assumed periods for the environmental variables. And of course, it's not fully wrong. I mean, it's often based on expert knowledge, previous studies, and so on. But the idea in our research was to change this perspective, and with given data, try to identify when is the most important period during which temperature affects biological processes in question, in this case, Varroa loads. So, thanks to the available statistical methods and information theories, we can systematically do that. So, in fact, in our research, we are looking for specific periods of the year when the temperature has the highest influence on the autumn Varroa abundance in western honey bee colonies. And we have certain assumptions we assumed, for example, that these temperature effects can be more indirect and that we can observe effects with considerable time lags. For example, even temperature early in the year may have some lag consequences for the shape of the mite population in late autumn. And we analyze data collected over almost three, I believe, almost three decades by Adam in his apiary, and then contrasted the abundances of mites to the air temperature conditions experienced by the colonies over this time.

Jamie 09:44
Yeah, when I was looking at the research project, I think it's really great that you have the nearly three decades of data. I love this idea that you're able to monitor Varroa populations throughout the year, temperature throughout the year, trying to correlate the two and use temperature to predict when those Varroa populations are high in autumn colonies. So let's talk about some of your results. So what turned out to be the ideal temperature range for the survival of honey bees or the temperature range that supported the greatest Varroa abundance in fall? And how have temperatures in spring and autumn changed over the years that you were doing this research?

Guest 10:30
Right, actually, this is quite a tricky question because our study wasn't designed to provide exactly this kind of information. And first of all, we have to distinguish the temperature that exists within the hive and ambient temperature. In our research, we were investigating the ambient air temperature. And we actually conducted some kind of correlational analysis of long-term observations, while a more experimental approach would be needed here if we want to specify the optimal temperature. And, of course, air temperature can affect, for example, the level of activity of peace or pollen availability, intensity of robbing between hives, et cetera. So here we have a different mechanism, which makes the answer to this question a little bit more difficult, because the optimal air temperature conditions are context dependent here, but what we know from the literature and available experimental studies is that Varroa mites preferred temperature between 26 and 33 degrees Celsius, if I remember correctly, which are, of course, significantly lower than the normal temperature in the room nest of approximately 34.5 to 35 degrees Celsius. So going back to our research, we identified two critical periods of the year when the temperature can have a strong influence on the Varroa abundance. The first most optimal signal was identified from March to May, just after the first cleansing flights. This is a spring season at our latitudes, and the second period was October, just before the last autumn flights of peace. Over these three decades, we observed significant interannual changes in autumn Varroa abundance like changes from year to year, which were closely correlated with the changes of temperature in these specific

periods of the year. And we observed also a slight positive trend over the years both in mites abundance, spring temperature, and autumn temperature, but this trend was statistically significant only in autumn. So there are not too many changes over the years. Only slight increase. And we know that this relationship between Varroa load and temperature in the specific moments of the year are positive. So we should expect that due to their climatic alterations and temperature increases in many areas of the globe, we can expect that this can cause also an increase in Varroa infestation in the future.

Amy 14:10
All of what you said is so interesting. I'm just thinking about the time of year as far as when Varroa is impacted. And it's always kind of funny because Varroa loads always go up when our bees are declining, and that's when the weather starts getting colder. So there are, I'm sure, so many factors that go into this. But you were mentioning it and you all found significant effects of bee abundance, capped brood abundance, and the number of colonies merged on mite infestation. So can you discuss a little bit more about what this means?

Guest 14:47
Okay, so, in our research, we identified two mentioned periods in which temperatures are critical for the Varroa abundance in autumn. It was the period from March to May and October. And then the next question that appeared was how these temperatures affect the dynamism of the Varroa population. Is it because of the increased bee reproduction in these specific periods or is it because of the extended brood-rearing period? And what we found was that Varroa abundance is positively correlated with all these three variables that you mentioned. So, bee abundance, bee brood abundance, and also number of colonies merge during the summer beekeeping activities. And now, this is something that we should expect, that's something actually very natural and very often observed in this kind of host-parasite systems, relationships. Something that is good for hosts is very often is also good for pests. And this can provide some kind of negative feedback loops causing, actually, negative effects. So, that is one thing that we should keep in mind when talking about Varroa mites and the management of this pest. Yeah, but in our study, we also had additional information on the first spring cleansing flights and last autumn flights of bees. So we were able to test, also, this second hypothesis, and we found actually no statistically significant relationships between the days of the first or last flights, nor the extent of the active period over the year on Varroa abundance. So according to our results, these temperature effects were potentially related to increased peak reproduction in the specific periods of the year and not with the extended period of activity or, for example, earlier spring onset.

Jamie 17:49
So this is really great research. And just like you and Amy both have said, it's a great example of how someone with your expertise, as well as someone with other expertise were able to come together and answer a question that we really haven't had answered well in the bee world, and it's great to see your data on Varroa population, especially abundance in fall related to ambient temperature throughout the year. I really think it's neat that you saw two temperature time points from March to May, as well as October influencing Varroa abundance. So given all of that information, given your research, given what you found, what do you believe are some take-home messages that you would like beekeepers or our listeners to know?

Guest 18:39
Yes, so honestly, when I started this research, I did a deep literature review on the Varroa population dynamics. And I found surprisingly scarce information on the climatic effects. I think that the common problem in many areas of ecology is the lack of long-term biological observations. That's why I was so impressed that Adam and my co-author collected his detailed observations on colonies and Varroa over three decades. He predicted that this kind of data will be valuable in the future. So I think that the take-home message would be to all of your listeners that are beekeepers to collect this kind of information, collect the data, ideally in close collaboration with scientists, entomologists, and experts, because this kind of data can help us understand really complex biological processes and I think that citizen science is becoming more and more important nowadays. And I think that this kind of active engagement of hobbyist beekeepers can help us.

Amy 20:15
Okay, so after this discussion, I'm just thinking about the future research that probably needs to be done. So what sort of future recommendations do you have for research that needs to be done in this area?

Guest 20:29
There are definitely more factors than only the temperature we were investigating. So, for example, factors like precipitation, humidity, wind, solar radiation, and so on, and so on. So I think that these aspects need to be better studied. We need more and more studies on this, which would integrate multiple factors, but also information from different regions. Since the dynamics of Varroa, for example, in Florida is very different, I believe, than what we observed in Central Europe. What is the temperature in Florida right now?

Jamie 21:19
So, right now, let me look at my watch. I've gotta convert it to Celsius, I'm sorry. We're somewhere in the neighborhood of about 18 or 20 degrees Celsius.

Guest 21:31
Okay, so now try to imagine that we have minus 7 Celsius.

Amy 21:36
We don't like to imagine that. That's too cold for us.

Jamie 21:39
That's why we live in Florida.

Amy 21:41
Exactly.

Guest 21:43

Yes. So again, I completely agree with the frequent opinion of researchers that we need more studies. We need more studies on these aspects, definitely, especially from different biomes, different climatic regions.

Jamie 22:07
Well Szymon, that's so great for you to join us and talk about your research. It's been really a great discussion. It's really opened my eyes to a new area of Varroa research. So just thank you so much for joining us on this podcast.

Guest 22:20
Okay, thank you very much for inviting me. And it's been a real pleasure talking to you. And I wish you the best with your podcast.

Jamie 22:30
Everyone that was Dr. Szymon Smolinski, who's a research scientist and the Department of Fisheries Resources in the National Marine Fisheries Research Institute in Poland talking with us today about raised seasonal temperatures that reinforce autumn Varroa destructor infestation in honey bee colonies. We'll make sure and link his paper, he and his colleagues' paper, in our show notes so that you can go and have a look yourself. Thank you for listening to this segment of Two Bees in a Podcast.

Amy 23:14
Welcome back to the question and answer segment. Jamie, the first question is really interesting, because I feel like we've answered questions that say that bees beard. We just say that the bees beard, gets really hot outside, but the questioner is asking why do the bees beard at the front of the colony? What is the reason for this? And what are they doing?

Jamie 23:34
So great questions. First, let's talk about bees bearding. So June, July, August and sometimes September, every year, I get questions, especially from brand new beekeepers saying, "I've got this huge cluster of bees on the face of my hive. It happens at nighttime. Are they trying to swarm? What should I do?" And the reason I point out that it's June, July, August, and September is basically, it's the hot months that I start getting this question. So what is happening? What's happening is something we call a beard. Bee colonies are bearding. And what it looks like is if you consider the face of that hive as a face, the entrance of that hive is at the very bottom. The beard is when bees will cluster from that entrance downward. It's like the face of the hive has a beard of bees hanging off the bottom of it in the front. So what's happening? Well, number one, you normally only see these beards in the hot months. So that's an important clue. Number two, it happens in the evening. It's not usually something you see regularly in the morning or early afternoon. It's usually an evening phenomenon, usually kind of four or five, 6pm and onward. So the best explanation that we have for bearding is usually you see bearding when it's hot and when colonies are at peak population. Remember, they've just come out of their major nectar flow in spring, they're superduper full of bees. So what you've got, probably, is a scenario where the bees are out foraging and working during the day, hence no beard, and in the evening, they are not wanting to go into the hive and raise the nest temperature making it difficult to rear brood since it's so

hot, and instead spend the evening on the face of the hive in this big cluster as a beard. So the explanation I usually see given in the books is it's probably the foraging and older bees getting out of the hive in late afternoon, evening, number one, when they have nothing to do, but number two, to avoid overheating the hive, making it difficult to rear brood. It's absolutely 100% normal to see. You shouldn't panic at all when you see it. It's just one of those neat biological phenomenon that bees do. And they certainly know why they're doing it. And our best guess is to help with temperature regulation in the summer.

Amy 26:10
Yeah, it's just spill over, right? Show up late to the home, you got to hang out outside of the rest of the people. Not enough space in the hallways. Alright, so the second question we have, this is actually a pretty good question. Well, they're all really good questions. But the second question we have is if the beekeeper moves a queen around, will it spread her pheromones faster?

Jamie 26:32
Well, that question is missing a little bit of detail. I would have asked what do you mean by moving a queen around? Do you mean, putting her in this box and then putting her in that box?

Amy 26:43
I took it as, like, if you have a queen in a cage, and you're about to introduce her and you want to release her pheromones, I mean, you don't want to shake the cage, but if you move her around methodically around all of the bees, is that going to spread her pheromones? All right, so for the third question we have, so this person has a nuc that doesn't have a queen in it and they're about 70% full of bees. So all five frames and the nuc have drawn out comb. They're wondering if they replace two frames from another hive, so basically, that has capped brood, eggs, larva, all of that good stuff, how many days would it takes for the bees to look at those frames and decide which cells are going to be queen cells or whether they're going to decide if they're going to start bringing a queen in the first place?

Jamie 26:58
See, yet again, that's a different interpretation of the question. So what I would say is I understand the impetus behind this question. You want be used to be able to recognize the queen as quickly as possible. But I would say that we would be nowhere as good at doing that as the bees are good at doing that. And so what happens is how a queen's pheromone is spread in the first place is the bees that are immediately interacting with the queen are licking her, feeding her, exchanging food, which includes some of her pheromones, and then they turn around and pass this to sister workers who turn around and pass it to sister workers who turn around and pass it to sister workers. Within a couple of hours, the entire nest is aware that there's a queen in that nest. So I don't think we can do very much to help beyond what the workers are remarkably good at doing themselves. So I don't think it's necessary for us to take the step of doing that ourselves because the bees are so stinking good at it in the first place. So I would say, to answer the question most directly, can we move the queen around and distribute her pheromones, we likely can. But I can't ever think of a scenario that it would be necessary or that it would outpace what the bees are able to do themselves. They're just remarkably good at

spreading awareness of the queen around the nest, so much so that when you remove the queen, within just a few hours they know that she's not there and they're beginning to make preparations to replace her. I love that last question because it's how many days will it take for the bees? And the answer is it will only take hours for the bees, not days. Let's unpack it from the top down. You've got this nucleus colony or nuc that's queenless. Right? And the beekeeper is going through it, sees that it's 70% full of bees, in other words, it's got a reasonable population, the beekeeper didn't mention about why they would need to move in two frames of brood from another colony. But I'm assuming based on that question, that the nuc is also broodless, so it's queenless and it does not have the ability to make its own queen because there's no brood, especially young larvae from which to choose to make the queen. So if this is the case, moving in two frames of brood from another colony would actually be advisable. You'd want to make sure that those two frames contain eggs and the youngest of larvae because that's what you want to provide this queenless nuc so that they can, very quickly, start going to the youngest available female larvae and pushing them towards royalty, so to speak. And they can do this within hours. I mean, if your nuc is already queenless, they already know that, they're already in, "I want to make a queen mode." So when you move over two frames of brood within hours, six to 12 hours, they're already going around and starting to take some of those youngest female larvae and enlarge their cells to make queen cells to accommodate all the food that they're going to give those young larvae to push them towards becoming a queen. So it happens very quickly, less than a day.

Amy 30:36
Yeah, I mean, it's just amazing how fast bees work and just how smart they are. They're so smart.

Jamie 30:43
Amy, it goes back to the question right before this one, right? Moving the pheromones around the nest, well, in the absence of the queen, that feedback loop breaks down very quickly. And the bees are like, "Oh my gosh, we don't have a queen, we need to do something about it." And they just know. They just know to go to the youngest available larvae. They just know whether it's a female larva versus a drone larva, they just know the age that they need to pick to push them in the right direction, and it's just remarkable what honey bees are capable of doing.

Amy 31:13
It really is. Alright, so if you all have other questions, feel free to send us an email, send us a message on social media, and give us a call.

Serra Sowers 31:24
Thank you for listening to Two Bees in a Podcast. For more information and resources on today's episode, check out the Honey Bee Research Lab website at UFhoneybee.com. If you have questions you want answered on air, email them to us at honeybee@IFAS.ufl.edu or message us on social media at UFhoneybeelab on Instagram, Facebook and Twitter. This episode was hosted by Jamie Ellis and Amy Vu. This podcast is produced and edited by Amy Vu and Serra Sowers. Thanks for listening and see you next week.