Episode 65_Mixdown PROOFED

Wed, Apr 06, 2022 12:25PM • 58:14

SUMMARY KEYWORDS

bees, beekeepers, honeybees, infectious disease, hive, beekeeping, colonies, honey bee, diseases, question, people, research, notes, year, field, biology, parasites, speak, spread, ecology

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, and welcome to another episode of Two Bees in a Podcast. Today, we are joined by Dr. Lewis Bartlett, who's a postdoctoral scholar for the Center of Ecology of Infectious Diseases at the University of Georgia in Athens, Georgia. And he is here to talk with us about evolutionary ecology of infectious diseases, and its application and apiculture. Dr. Bartlett, thank you so much for joining us on Two Bees in a Podcast.

Guest 01:40

Thank you for having me. It's a pleasure to speak to you and your listeners, Jamie, we met a couple of years ago. And it's nice to be able to revisit some of the research topics and the beekeeping stuff that we talked about then, here on this podcast.

Jamie 01:53

You know, I agree. I was looking again at your CV and website, etc. Before you got on. You're really doing some neat things. So Amy and I are really excited to have you on board and be able to join with us and talk to us about the things you do. And Lewis, one of the things that we always do with brand new guests, folks we've had on the first time, is we like to have them share their story of how they found their way to working with bees in the first place. A lot of our listeners just want to know how you, how you came to bees. Have you always been in bees, is it something you discovered in college or graduate school? So how'd you end up where you are? Could you tell us a little bit about yourself in that regard?

Guest 02:28

Yeah, of course I can. So I grew up in the north of England in the United Kingdom, originally in a city called Leeds. That's where my family's from, my family going back multiple generations now. And even as a child, I was always out catching bugs and putting them in jars and trying to see what they were. A lot of that, I think comes from my early childhood. My father took me fishing a lot with him. He's a big freshwater angler. And he used to take me fishing with him a lot. And it was very easy as a young kid to become quite distracted by all the other insects flitting about. And I spent a lot of time running after and catching bees, even as, even as a really young kid. And then throughout high school and approaching applying for college, my strength in the sciences was a reasonably high level. And I still had that long standing interest in, in insects and in bees, watched a lot of nature documentaries growing up, that kind of thing. But I think, really a lot of it came down to about 2008, 2009 was when the media really picked up on these declines of both wild and mostly managed bee populations. And there was all the scare about CCD, colony collapse disorder. And that was making its way into the public science media, but also the wider mainstream media, right as I was applying for college. And I think that was quite formative for me having an idea that this was something that I could learn more about when I was there and potentially work on. And so when I arrived at college, I studied natural sciences at University of Cambridge. I dabbled in physics for a little while the mathematics became far too hard for me. And so I went back to zoology and ecology and evolutionary biology. But throughout my time as an undergrad, I did a lot of work on honey bees just as a system to ply my craft, so to speak, and learn how to be, how to be a scientist. So I worked as a laboratory assistant with Bill Hughes, and that was actually on infectious diseases of honey bees. I didn't realize that's what I'd end up in at the time. But that goes back to me being 18 now when I first started that research, and that's also when I was first taught how to beekeep in a, in a scientific laboratory. I didn't learn beekeeping from a hobbyist perspective, I learnt it as a scientist doing research, although we had a beekeeper, a local beekeeper who managed the research apiaries. It wasn't done by technicians. It was done by contracted in beekeepers whose main moneymaking was selling honey, principally. And so I learned from beekeepers, but it was in this scientific context. And then when I returned to college after the summer work, I set up my own hives on college grounds, just because I'd fallen in love with it, really, continued beekeeping throughout that, and then did some some other work here and there across Britain. After I graduated, I worked in environmental sciences and in animal behavior for a while. I was a behavioral scientist for one of the large zoos in the UK working on captive breeding programs there. I worked for the UN's Environment Programme, and Microsoft research on more computational elements of biology, where I used a lot of the mathematical abilities, kind of, that I developed in my early days as a potential physicist. And then I saw a Ph.D being offered with the University of Exeter, again in Britain, on understanding how a lot of the changes we've seen in beekeeping over the last 10 years might be changing the spread of their infectious diseases, and what that means for their adaptation of those infectious diseases, how those diseases might be changing their fundamental biology in response to all these moves we've had in beekeeping towards things like migration for almond pollination, or the arrival of Varroa during the 1980s and 90s in a lot of Europe and the Americas. And so I started that Ph.D. Halfway through, I moved to University of California, Berkeley, as my advisor took up a new professorship there. And so I moved from the UK to California. So the whole Ph.D, I was coming here to Georgia, to work with Keith Delaplane, who I know was your Ph.D advisor, Jamie, to undertake field work with him as part of a much larger NIH funded, that's National Institutes of Health, here in the United States, NIH funded grant. And then since then, worked at Emory University, and now at UGA, just continuing those themes of understanding how the world that the honey bees experience changes their relationships with the parasites and infectious diseases that get them. So that's the kind of professional spiel, I suppose.

Jamie 07:28

Yeah, I always love listening to our guests talk about how they ended up with bees. I mean, yours is, yours is pretty fascinating. A lot of folks do that. They'll get to the university, they'll see the honey bee story, they'll interact with a faculty member who has that experience, and then the rest is history. So it's really cool how you developed that over time and how you ended up, you know, now at the University of Georgia.

Amy 07:47
Yeah, Dr. Bartlett, do you, so you were talking about studying infectious disease biology. Was that specifically with honey bees or in general, and then it kind of landed with honey bees?

Guest 07:59
A combination of both, I suppose. So the department where I did my undergraduate training in zoology and ecology and evolution and conservation biology in these kind of large scale biologies, which was the zoology department at University of Cambridge has an extremely strong infectious disease specialism amongst some of its faculty. So I was taught a lot of the fundamentals of biology using infectious disease examples. And a lot of that came from Professor Derek Smith, who I believe is still there, who is one of, if not the most senior, influenza evolution researchers in the world. He sits on the World Health Organization's panel that decides the flu vaccine strain every six months, for instance. And so a lot of the evolutionary principles and the mathematical population biology principles that we were taught, were taught through this lens of infectious disease biology, because the faculty at Cambridge, even though their teaching zoologists, use infectious diseases as an example. And I really took to that. I have found it absolutely fascinating and also very useful. One of the reasons I enjoy working in Extension, specifically here in the US, is I find the science in and of itself very interesting, but I am most engaged when I know that the questions I am answering can be applied to help people in some way and infectious disease biology very easily does that.

Amy 09:30
Okay, so what is infectious disease biology? What does that mean?

Guest 09:35
Infectious disease biology is any biology, really, that covers pathogens, which are agents that cause an infectious disease. So something like the influenza virus, salmonella, bacteria, anything that causes a disease in another organism. Now, I work specifically on the ecology and evolution of infectious disease and that principally governs the ability, let's say, of infectious diseases to interact with their non-host environment. So that's things that exist for some time out in the world outside of an organism. So something that farms spores, for instance, has an ecological aspect to it, because that spore has to be able to survive the environment that it finds itself in, whether that's in water, saltwater, freshwater, under the sun, in the shade, in the ground, whatever. Bur it also principally governs how infectious diseases spread at the large scale and amongst populations, long-term trends in epidemics at the really macro country level of global scale. So in Britain, for instance, there's a lot of very famous work done in understanding the cyclical nature of measles outbreaks, especially prior to the measles vaccine becoming widely adopted in Britain. That was worked on by Bryan Grenfell, who's now at Princeton, but was a British Welsh, actually, infectious disease ecologist. And I think a lot of people don't necessarily understand that what they might just think is epidemiology or public health, many of the large research groups in that area are trained in ecology, because it's all about understanding how organisms and

infectious disease pathogens are living organisms at the end of the day, spread and move through their environment, how they reproduce, or replicate and all of that is infectious disease ecology. The evolutionary aspect comes in where we understand, A, how the disease's themselves are adapting. So that's why we need a new influenza vaccine every year because influenza is constantly evolving at an extremely rapid rate. Understanding that evolution of the influenza virus is how we predict what is going to be the best vaccination strategy for the coming year, takes a long time to produce the vaccine, so it has to be done in advance. So we do a lot of what is called evolutionary forecasting, trying to guess what infectious diseases are going to do next, try and see when they're going to jump between animals, which is extremely topical at the moment, I've been going to seminars and conferences for the last five years on where the next big virus in people is going to come from and what animal it's going to come from. And so the last couple of years have been really quite intense in my field. I was reassigned to COVID work, actually, for the first few months of the pandemic, simply because the skill set, whether you're working on bees or people, is exactly the same. And so that's really the kinds of biology I do. The final aspect, which is the part that's most applicable to honey bees, that we'll probably talk about in a moment, is we also work on host evolution. So the evolution of either natural or managed populations to defend themselves against infectious diseases. So how organisms adapt, how animals or plants, or the micro organisms even, adapt to protect themselves from viruses and from bacteria and from fungi and from parasites as well. We tend to do a lot of parasite work and also understand things like mosquito lifecycles because they vector infectious diseases. So those interorganism interactions, those spread phenomena of how infectious diseases move, and also their long term evolutionary trajectory is really where my training sits, and that is principally what my Ph.D is in, while branches of my Ph.D were in how that intersects with beekeeping, the majority of my work was either in the laboratory test animals or mathematical derivations of understanding the general rules that govern these evolutionary and ecological principles.

Jamie 13:46
So Lewis, I think this is an incredibly timely topic, because whether or not people are familiar with epidemiology, or infectious disease biology, etc., the last you know, year, year and a half, we've all been absolutely inundated with stuff that's happening, of course, with COVID. And so when we look specifically at honey bees, we see how relevant what you do would make sense for things like COVID, or the flu or things like that, but honey bees also have infectious diseases, right? And there's reason to need to study those, the spread between honey bees, the evolutionary arms race between the host and the organism. So could you, could you introduce us to that world as we kind of hone in specifically on what you do? Could you share a little bit about what infectious disease biology has to do with honey bees?

Guest 14:28
Yeah, very gladly. So honeybees are afflicted by a litany of parasites, and in my field, we tend to use parasites to mean both pests, so large scale things, including small hive beetles of Varroa mites, or even tracheal mites, and pathogens, which are the much smaller things, things like viruses and bacteria, microsporidia like Nosema, and in my field, we tend to just group them all as parasites because there's some generalities we can make. They all make their living by parasitizing another organism. They somehow exploit another animal or plant or creature to make their their existence viable. And in honey bees, there's no shortage of things that are looking to make their living, so to speak, either in the honey bees themselves, or in the honey bee hive in the colony, either consuming

the honey bees resources or somehow negatively impacting them. And so we know that the bees themselves are constantly working quite hard to protect, not only themselves as adults, but their developing larva from infectious diseases, trying to minimize things like European foulbrood outbreaks, or high Nosema levels, trying to prevent small hive beetles from running rampant in the colony, things like that. And all of that comes under this idea of ecology and evolution of infectious disease, and the bees, whether or not we know it, are always hyper vigilant about these things. And they pay a price in that vigilance now in the last few decades. And I'm not quite old enough to have first hand memory of this, but speaking to the wealth of older, more experienced beekeepers, both back home and here in the US and anywhere else I've traveled, it's not always been the case that we've had to be quite so aware of the parasites that are in our honey bees, because a lot of them are new arrivals. And if you go back 50 years, the bees were defending themselves very happily and doing such a good job of it, that beekeepers didn't really even have to be aware of what was trying to infect or infest their honey bees because the honey bees were perfectly capable of looking after themselves. And it's only really more recently, with the arrival of some of these new diseases, new parasites, that beekeepers have had to become doctors, or veterinarians, rather, for their bees, as well as just their caretakers, because the bees, are in some respects, losing certain battles that previously they were winning, because they've got new enemies that they haven't yet adapted to. They don't have the history of knowing of having evolved, how to protect themselves from those new threats. And so that's really where my interest grows from and what a lot of my work focuses on as well is understanding which are the principal things increasing honey bee mortality or reducing productivity or just making beekeeping harder to get into, and what we might do about that, and what we might need to keep our eyes on the horizon about as well.

Amy 17:38
So Lewis, you know, I feel like there's so many questions I have to ask you, and I think it's so cool that you have the infectious disease background. I feel like any beekeeper who has ever spoken to that has been beekeeping since, you know, at least 2006, they're probably asking you all these questions, right? About the different infections and, and, you know, what do they do? Do you have an Extension appointment? Are you split between Extension and research, and, you know, what does that look like as far as just your day to day, you know, working with beekeepers versus doing research?

Guest 18:13
So my appointment is a full research appointment. I don't have any mandated extension duties. That comes from me being housed in the ecology department, which is not an extension department unlike entomology or forestry, or even plant pathology, where these are departments who have a remit to undertake extension. That's not the case for some of the other colleges that I've ever been housed in. In fact, I've never been in an Extension department. It's worth saying that the concept of agricultural extension, as it exists here in the US and perhaps in other places, was entirely novel to me when I arrived in the Americas. We don't have an equivalent in Britain after all. So that was very exciting for me when I first got here and started understanding it because I love it. It's one of my favorite parts of my job. So while I'm not required to undertake any Extension work, I very much do. I'm speaking to a beekeeping club tomorrow evening, for example, up in New Jersey, no doubt fielding exactly those questions that you asked about, all these different ways that infectious diseases harm our honey bees. And I think it's very important for me, even selfishly, from a research perspective, to be out speaking with beekeepers, boots on the ground beekeepers, to be aware of what they're struggling with, if

they've noticed something new or what they perceive as the challenges or what they're unsure about in terms of treatment regimes, what's feasible in terms of testing, both cost wise and labor, and to really make sure that I'm not losing sight of what the industry I claim to support looks like. But I also am quite gregarious, I like speaking to people, I like talking about my work. So it's very easy for me to engage with all of that. And if I were to have my way, I'd like to secure, when I do secure a faculty appointment, an Extension component. I think it's incredibly rewarding and worthwhile, but also important to make sure that the public money, ultimately, that funds our research in these state universities and elsewhere is directly, sorry, is directly brought back to the beekeepers.

Amy 20:30
Yeah. So, after speaking to beekeepers, you know, and doing kind of your needs assessment on the ground, what, what is some of your research focused on, specifically to honey bees?

Guest 20:43
So there's a few different branches to it. I do some general work that is very much from my kind of ecology and infectious disease background. So some of my more recent work, for instance, looked at the concern that some beekeepers feel, at all levels really, about crowding their honey bees in their apiaries, that question of, well, "We know that squashing animals together means that is easier for diseases to spread. So how worried do I have to be about packing my colonies into an apiary? You know, if I start putting tens, 50, or 100 colonies in a very productive yard, particularly if, you know, you're surrounded by a mass blooming tree or crop, do I need to worry that that's going to lead to large disease outbreaks compared to if I've got smaller apiaries that are maybe better spaced, and the bees might easily able to identify their home?" And so I did a lot of fundamental epidemiology from a mathematical perspective, because rather than potentially waste, you know, hundreds of thousands of funding on doing field trials of that, it's very typical in my field to do the theory, the mathematical modeling, first, to establish what we might expect, and then potentially go out and test it. And so I did a bunch of epidemiology, as we'd call it there in collaboration with Carly Rozins, who's now back up in Canada. She comes from an agricultural background, fantastic mathematical biologist, as she worked on a disease for a long time called Marek's disease in chickens and looked at how packing of chickens in different densities in barns, etc. influenced the spread of viral diseases in that system, and so she was very good with this kind of thing. And me and her worked together to do a lot of fundamental epidemiology in the honey bees. And what we actually found was that, because honey bees are so numerous, and so densely packed, even in their individual colonies, what to our eye might look like a very sparse traditional apiary, with few colonies quite widely spaced, there's still hundreds of thousands of bees in that small vicinity. And that if an infectious disease gets into one of those colonies, it's basically going to get to every bee, regardless of beekeeper decision making there, regardless of whether or not the beekeeper's, you know, equalizing brood between colonies, whether they're packing the colonies in, bees, not naturally, but traditionally, within beekeeping, the bees are at such high densities, that they're always going to be giving diseases to each other. They don't live solitary lives by any stretch of the imagination. And so beekeepers, from an infectious, purely infectious disease point of view, at least, maybe need not worry too much about how densely they pack their colonies into their productive apiaries, as long as they're being, you know, reasonably careful about disinfecting equipment and such. Because the bees are getting all the diseases in the apiary, regardless of how many of them are there. We're never going to be able to bring be density down far enough that we prevent infectious disease transmission. And in some ways, it was a relief to be able to tell beekeepers,

"Look, here's one thing you actually don't need to worry about. Don't worry about this one. Do whatever you think's best from a point of view of foraging or management. You're not going to have worse disease outbreaks just because you've doubled the number of colonies in your apiary. And we didn't really need to do much testing for that, it kind of just emerged from the mathematics that with any amount of laboratory measurement of how easily infectious diseases spread between bees, it wasn't a concern for the beekeepers and so that was a useful thing to be able to tell them, although, perhaps a bit frustrating, because we know that beekeepers are struggling with these diseases and that was clearly something that they couldn't change to fix the matter, either. But I also think it reflects a newer understanding of how honey bee disease works, that bees are very different to us as mammals or to birds or other things where our immunology tends to focus on either keeping diseases out or getting rid of them when they arrive. Whereas, as our scientific methods for screening honey bees have gotten more and more precise, you tend to find that a lot of the more modern studies find just about every virus or just about every bacteria, every infectious disease in almost every bee that's sampled. And it's less about whether or not the bees encounter those diseases. And I think much, much more about how healthy those bees are to be able to control those infections and stay healthy. So it highlights this shift in understanding in my field, I think, that you're never going to get rid of infectious diseases in honey bees, you're never going to keep them sterile or protect them from encountering viruses and bacteria and parasites out in the wild. But you can give them everything they need to keep those infections in check, control how much virus is replicating in their hemolymph, control how severe their bacterial infections get by virtue of good food, minimal pesticide exposure, good breeding, and in that way, keep the bees healthy, not by keeping them away from infectious diseases, but keeping them strong in the face of infectious diseases. And that's a large move in emphasis for me more recently, is understanding then, well what about our wider beekeeping culture? What about what we feed our bees, where they go, what they do, what pesticides they're exposed to, what genetics they have, determines their ability to fight off these ubiquitous diseases. And I've done some more recent work on that, comparing honey bees from different beekeeping treatments, whether they're feral bees from the Okefenokee Swamp, which is a large swamp for international, not nearby listeners, smack bang between where I am in Georgia and where Amy and jealous -- Amy and Jamie are in Florida. You know, we looked at bees there, compared them to bees maintained up here in Athens by, kind of, hobby beekeepers, compared to them to these big industrial beekeepers' bees that are shipped over to California for almond pollination and looked at how good they were at keeping their viral infections in check. And this was work that was published just at the start of this year. And we found that there are major differences based on where your bees come from, even if you keep them in the same place for a year, essentially, as to how badly they're faring in trying to control their infectious disease. And it's not necessarily that the wild bees are doing best. The wild bees had some of the worst viral infections for certain viruses. And actually the bees, across the board that seemed to show the strongest ability to control the infectious diseases were the ones managed by more hobbyist, traditionalist beekeepers who were keeping their bees in one place, who are in these suburban or small farmland environments where they have a lot of forage, they're not being moved around, but they do have someone looking out for them. And understanding what the drivers of that are, whether it's nutrition, whether it's pesticides, whether it's genetic heterogeneity, it's probably a combination of all three is really where I'm moving now in a lot of regards, like what is it about bee biology and the lives bees lead that determines their health? And what does that matter for their infectious diseases, rather than this idea of well, we just need to make sure our bees don't get sick, because that's not really possible.

Jamie 28:54
So Lewis, this is all really fascinating. So there's so many questions that are pouring in my head that I want to ask, but I just want, I want to kind of take a 1000 meter approach, right, you're hovering, you're hovering above the bee industry, you've got this background and infectious disease ecology, and I think again, in the era of COVID, where we think about spread, transmission, survivorship when you get these things, what are some broad concerns that you have for the beekeeping industry given your background? I'm about to ask you a second question, like what encourages you regarding the industry, but surely, you're looking at the beekeeping industry from a different lens than I'm able to look through given your background. So what are some, some of the bigger concerns you have for the industry, as well as some things that encourage you when you look at the industry as a whole?

Guest 29:44
I think it really depends which beekeeping industry we're talking about. Obviously, for the last six years, I've worked in the United States where beekeeping does look significantly different than it did where I grew up in North England. So I'll speak principally on what I see here in the US. And I think some of my biggest concerns come down to lack of genetic diversity amongst the bee stock here in the US, and how that might limit the ability of colonies to maintain high genetic diversity within the colony, which we know is very, very useful for them in preventing these outbreaks, but also maintain differences between populations. And one thing that we are taught in infectious disease biology from extremely early on, is that genetically diverse populations limit the ability of an infectious disease to spread, because a disease very able to infect one individual might not be as good at infecting a genetically different individual. This is something that was really well demonstrated by rice growing research in China. They did phenomenal trials in the late 90s, early 2000s, that have since been repeated in a variety of animals, showing that the more genetically diverse your population, the more limited infectious diseases become, they're less able to specialize, they're less able to spread. And I think in the US, we suffer a lot from having a very narrow sample, a very shallow sample of the worldwide honey bee gene pool. And so that's something that concerns me, and I'm sure that's not new news to a lot of bee keepers, I think people are really starting to caught on to that. Some of the other things that concern me is the evolution we're seeing, potentially, in some of these infectious bee diseases. It may well be that some of the patterns we see relating the migratory bees to higher disease levels isn't actually to do with the bees themselves. And it's to do with specific strains that have started adapting to become more deadly, potentially, you know, and this, again, we're all hyper aware of with COVID is, well, what's the virus going to do next? And we've already seen this, to some extent, with things like deformed wing virus, where deformed wing virus has changed its biology to become much more deadly. And whether or not we're going to start seeing that in other pathogens as well, and that kind of evolutionary forecasting is very difficult to do. But it does worry me that there is a selection landscape these diseases are experiencing. And in some places that may well make them much more dangerous than they were previously. On sticking on that selection point, I think we're all concerned about increasing resistance in Varroa to certain treatment options that we have and that we might start running out of them. And again, that touches on a lot of my background where I've worked on arthropod resistance evolution for almost 10 years now, looking at the ability of insects, or arthropods, mites and such, to evolve to be resistant to certain things, and they're very good at it and any crop grower would be able to tell you that. And so those evolutionary aspects are even less well understood than the ecological ones. The other major concern of mine, from an ecological perspective, is something that the conservation biologists are very aware of. And that's what our bees are doing insofar as deriving pathogens spread

in other bees, wild bees, for example, which don't have a beekeeper to look after them, and maybe even less well able to defend themselves than the honey bees to a lot of these diseases. We know that wild bees capture viruses from our managed bees, and what that's doing to their populations is likely not good. And I'm worried that that will only become an increasingly severe problem. And I actually have some upcoming work this year on that, which I won't talk about now because it's quite nuanced. And I, I will no doubt speak on it on a bunch of the beekeeping circuits later this year or next, but I am concerned about what our beekeeping disease dynamics are doing to wild pollinators as well. Those are the things I've been looking at.

Jamie 34:18
Some things that encourage you? That's, that's all kind of scary, Lewis. I'm wondering if there's--

Guest 34:22
Some of it does really encouraged me, apologies, yeah. I always talk about being--

Jamie 34:27
I know. Give us some good news, man.

Guest 34:27
Yeah, of course, I'll give you some good news. I always talk about this. I get so used to it. Being an infectious disease biologist is always doom and gloom, unfortunately. It really is a constant feeling of being a horsemen of the apocalypse, so to speak, you know, plague was one of them, right, I believe. So I think there's plenty beekeepers are good at doing. I found the results where we should and these are results have been recapitulated by Margarita Lopez-Uribe, up at Penn State as well. Showing that managed bees are healthier than wild, than feral bees. I find that really encouraging. It means that beekeepers are doing loads of stuff to make their bees better. They're doing a good job. Beekeepers are helping their honey bees. And we just need to understand what more we can do and how to do it. And I find that really encouraging. I think Tom Seeley, for instance, has done a phenomenal job advocating for understanding how to direct the breeding of our bees, and that will start intersecting with ideas about genetic diversity. I think there's a lot of exciting work to be done there that just requires some, some fine tuning from scientists who are evolutionary biologists, for example, and I find that all very compelling. I really don't worry too much about the negative impacts of the migratory bees, because the environments they find themselves in, these massive monoculture farms, and the places where spillover to native bees happen, you know, there's very, very few wild bees in the almond orchards of California really, and even if there are a few, these aren't areas of major conservation concern, right? You're not taking all these caravans of bees and putting them in the middle of Yellowstone, for example. And so I think while I have some worries about what's going on in kind of suburbia, or more diffuse farmland here in the southeast, for instance, is not necessarily the same as what's going on out west where we have a lot of embattled bee populations as well. And so I find that not as concerning and I think there's easy things to be done to reduce risk there. I also think there's just a lot of exciting work coming up on how to use honey bee nutrition, and especially self medication to help the bees help themselves fight these diseases. Many people who listen, I suppose, and yourselves included, are likely very aware of all of Marla Spivak's work, phenomenal work describing social medication in honey bees and how they use propolis to defend themselves and all the plant compounds that the honey bees used to treat themselves. And we're finding new compounds all the time, there was

work that came out in Britain, in my homeland, actually from the region I'm from, we have Heather Moreland in the north of England. And it turns out, heather, calluna vulgaris, has a compound in its nectar that is antibiotic, it's very good at killing certain bacteria, and the bees are aware of this. And if they get a sniff that certain pathogens are in the colony, they'll go and harvest a bunch of this nectar to treat themselves with it. And they think as that research area grows, we're going to end up discovering a huge toolbox of quite exciting natural ways for the bees to help themselves. And in some regions of the world where there is greater plant diversity still apparent, the bees are probably already doing that. And it may well be that we're seeing a lot less severe disease outbreaks in places with more intact nature, because the bees have a kind of apothecary's garden on which to forage. And I think that will begin to solve a lot of our problems as we either develop some of those compounds into treatments, or understand that so long as our bees are given a variety of plants on which to forage, they'll be able to, to keep themselves healthy. And so I've just found it very encouraging that there's, in my opinion, very clear pathways to improvements in honey bee health. They're biologically very exciting, but also, to my mind, quite achievable. Lewis, I agree, I really think we're kind of on the tip of the iceberg. And one of the things that I always tell people when they asked me about the future in the industry, I say, "Man, I'm so encouraged." There are so many smart students and postdocs, you know, like yourself, who are doing amazing work that I really feel are going to solve these big problems that the industry is facing. I mean, I think by the time I retire, we'll have really addressed a lot of these big, big issues. And certainly, we'll know a lot more about them. So Lewis, thank you so much for joining us and sharing a bit of your insight on this issue that I would gather most beekeepers don't think about it from the infectious disease perspective. So thanks again. It's been a pleasure. Thank you for having me. It's always a bittersweet joy to talk about all the things that try and kill our honey bees. This is the field I signed up to walk through.

Jamie 39:20
Lewis, it's funny you say that. I always tell people that it's really depressing to be a bee scientist at a beekeeper meeting because beekeepers always want you to come in and talk about what's killing bees, right? So we never get assigned the fun parts of the lectures. You know, how to make a nuc and things like that, it's always, what's killing your bees and how can we stop it?

Guest 39:37
Right, yeah. The beekeepers always get to teach each other the fun parts. We need to stand up and be, like I said, heralds of the apocalypse, it feels like at times.

Jamie 39:46
Well, well said, Lewis. Well, everyone that was Dr. Lewis Bartlett. He's a postdoctoral scholar in the Center for Ecology of Infectious Diseases at the University of Georgia, joining us on Two Bees in a Podcast. So thanks for joining us on this segment.

39:59
For more information about this podcast, check out our website at www.UFhoneybee.com.

Amy 40:24
Alright, we've got Five Minute Management. Five Minute Management. And today, Jamie, we are talking about hive configurations. I'm going to let you lead this conversation because there are so many

different ways that we can go with this. And I'm just going to go ahead and start the timer if you're ready.

Jamie 40:39
Yeah, so this is one of those topics that makes me incredibly nervous, because there's so much that goes into it. And just to help myself a little bit, I will tell all of our listeners that I actually wrote a document about this for the American Bee Journal some years ago. We're gonna make sure and link it in the show notes so that you'll be able to find this document and read more about the topic. Alright. So there's a handful of things that you have to think about when you think about hive configuration. Before I get there, though, it's important for you to hear me say, whatever configuration that is the one that works best for you is the one that you should do. Don't let anyone talk you into a hive style if you're uncomfortable with it, or out of a hive style if you're very comfortable with it. The reason I say this is if you go to beekeeper meetings, you're going to see people argue adamantly one way or the other. "You gotta do this. No, you've got to do that". And so I'm just going to tell you what's possible, and then leave it to you to decide what you'd like to do. So the very first thing I want to talk about is the type of hive. And we can't overlook the fact that Langstroth hives, traditional Langstroth hive are the -- is the most popular hive style in the US, and modifications thereof, for that matter, around the world. I'm not telling you you have to use this type of hive, I'm just telling you, it's probably the most popular configuration, and as a result, you're going to find the most equipment resources related to managing this hive style. Of course, there are other hive styles. Warre hives, top box hives, long hives, lots of other hive styles. So you've got to decide what hive style, what type of hive you want to use. But remember, most beekeepers are going to make the decision to use a Langstroth style hive. It's just a square or cube box in which frames go. Alright, the second choice you have to make is hive configuration. The best way to think about this is what is going to be your standard brood nest. A lot of beekeepers use single deep Langstroth boxes, a lot of beekeepers, especially in the northern US and other parts around the world use double deeps, some beekeepers prefer to use shallows or medium supers because they're easy to lift. But you need to figure out what is going to be your brood chamber, again, a double deep, a single deep, or something else, and then what will be your super style that you use above that. Most beekeepers use medium supers or shallow supers because honey supers get very heavy. Alright, from there you have to decide what construction material will be used to make your hives. Obviously, the most standard construction material is wood. But there are also Styrofoam hives, there are plastic hives and variations thereof. Wooden hives are most popular, they're usually the easiest buy and can often be the cheapest. So you have to figure out what construction material you're going to use. The next decision you have to make with regard to configuration is the number of frames that you want in those boxes. Historically, Langstroth style hives have been 10 frame hives. These days there are eight frame hives, usually they're made for the purpose of being lighter. So a lot of people like to manage those styles of hives. So the number of frames will be an important consideration for you because it will dictate the size of the boxes that you use to compose your hive. And then there's some basic things like the type of foundation. You know, I personally prefer pure beeswax foundation. Despite the fact that that just came out of my mouth, I use the hard plastic foundation because it's just more convenient. It's easy to pop those types of foundations right into the frame. They're usually coated with a thin layer of wax, but there's so many styles of foundation, but without question, the most popular, at least today in the US, is that hard plastic foundation with a thin coating of beeswax on top of it. Then you have to decide whether or not you're going to use a queen excluder. I use them, not everyone does. A lot of people will swear that they're honey excluders. There's absolutely no evidence to support that at all. So

you've got to decide whether or not you want to use a queen excluder. From there, you've got to determine what type of bottom board, whether you want it to be a solid bottom board or a screen bottom board, there's pros and cons of both. And then when we think about bottom boards, we need to think about the other side of the hive and think about lids. Are you going to use a telescoping lid that's very beautiful, aesthetic piece of equipment? Are you going to use the more standard migratory lids and have the holes in the middle of them that can accommodate a feeder jar? So again, the type of hive, what the basic brood nest will be, the construction material, the number of frame, the type of foundation, whether or not you'll use excluders, what type of bottom board and a lid. And I'm just going to tell you what I do, which is neither right nor wrong. I'll just tell you what I do, from top to bottom. I use telescoping lids with inner covers. I use a single medium super to provide food for the bees year round. I use metal bound queen excluders, my brood box is a 10 frame Langstroth deep, and I use screened bottom boards, and that's just my personal configuration. As I shared with you, there are many. All of them are right, whatever works best for you is okay. There you go.

Amy 46:15
Alright, Jamie. No, you didn't make it, but that's okay. You were doing such a good job, I felt bad. I didn't want to interrupt you. So I just let you keep going. Alright, that was our Five Minute Management. We will have other Five Minute Managements later touching base on all of the other specifics about hive configurations later. Thanks so much.

Stump The Chump 46:42
It's everybody's favorite game show, Stump the Chump.

Amy 46:54
Okay, it's that question and answer time. I'm super excited for the three questions that we have today, Jamie. I think they're super fun and very practical.

Jamie 47:01
Good. I cannot wait to hear them and stumble over my answer, I'm sure.

Amy 47:06
All right. So this first question, it's really funny, because I've actually gotten a lot of calls lately with rooftop bars contacting me, asking me how to get rid of their bees. And I'm like, "Well, do you have sugary substances on your tables and your glasses and everything else?" And they said, "Well, yes, we do." And I'm like, "Well, you can get rid of that and maybe you won't have bees." The first question we have someone says, since oftentimes you see bees in or around soda cans, would flat Sprite be an acceptable substitute for simple syrup?

Jamie 47:39
I'm chuckling because there's a lot behind an answer I could give you but for purposes of anonymity, I've got to disguise this, my answer with a group of folks I've talked with about this. So the short answer to that question is no, I would not feed bees flat versions of any soda, including Sprite there. It's not just sugar and water that are in those liquids. There are other things in there that you know, we just don't know about the impacts on bees. Furthermore, I don't think it's cost effective, right? And I think the research is sufficient to show that sugar water, you know, granulated sugar that's dissolved in water as

well as corn syrup, both of those are good substitutes for carbohydrates for bees, you know, they can replace honey for an energy resource, and I wouldn't start dipping down into things such as flat Sprite or sodas. But the chuckle early on is there's a place -- that's all I'll tell you -- of which I'm aware that has had bee problems in the past. And this place has tried to distract bees from these areas where they're problematic by putting out kiddie pools of the syrup that's used in the soda fountains to make Sprite.

Amy 48:54
What, ew!

Jamie 48:54
So, yeah, so it's funny because they use these kiddie pools that are well placed that will distract bees to those kiddie pools to go for the sugary substance away from areas they don't want the bees to occur. But this is not something I would necessarily recommend for beekeepers. And I certainly wouldn't consider feeding it to bees. I just stick with the stuff that I know is okay, and that's granulated sugar dissolved in water or corn syrup. But it's a, it's a funny question. And it wouldn't have to be Sprite, it could be any number of sodas, right? Usually, in late summer is when schools will start complaining about bees showing up at their trash cans. Because the reason they do this is because bees simply don't have any other forage available in the environment. That's why they start showing up at soda cans certain times of the year or trash cans at certain times of the year because that's the sugar available to them. They'd much prefer to go to flowers, but will absolutely visit other sticky substances. We hear these discussions from zoos and restaurants and other places that people frequent that have to protect the public from bees.

Amy 49:58
That's so funny. I almost feel like it'd be a really fun middle school or high school project.

Jamie 50:03
Yeah, maybe a good science fair project out there. So if you're young folk listen into this, maybe we've just worn you, won you a scholarship to some university because you'll develop some amazing science fair project built around this topic.

Amy 50:14
Exactly. Okay, so the second question is about bananas. And you know, we've had another episode where we had the Q&A part where we talked about bananas. But this person is asking if guard bees can tell the faint difference between one queen and another even hours after the forager has left the hive? Can they not tell the difference between the smell of bananas that I had with breakfast and the alarm pheromone?

Jamie 50:37
So the motivation behind this question for you listeners for whom this may be new is that bananas have a chemical component that's similar to a chemical component, or the same chemical component for that matter, that's present in alarm pheromone? Now alarm pheromone is not solely one compound. So the listener who's asking this question is making a good point. Alarm pheromone is actually a composition of a few compounds, whereas this ingredient of bananas is only one of those compounds. So there's been a long held belief that if you eat bananas, or have banana residues on you when you

work bees that you might be subjecting yourself to an increase in the number of stings. I don't believe that that's the case. I've eaten bananas plenty of times before going into an apiary and have not, at least in my opinion, have experienced any elevation in the number of stings. Bees just like to sting me regardless of what I eat. But for sure, bees will be able to tell the difference between a banana and the composition of honey bee alarm pheromone. They're actually really good at detecting odors. In fact, they're even better smellers as it were than our dogs. So it's an interesting question. It's, it's, it's full of biology and chemical ecology. And I thank you, listener, for, for asking that question.

Amy 51:50
Alright, so the last question, this person says that they keep on hearing that taking good notes and documenting your hive inspections is very helpful and important. This person has been taking notes furiously for years now. And now they're at a loss to what's important to record, how to use it, and what is just busywork. I feel like that's, you know, that was like me in middle school and high school, just taking notes, and then looking back and being like, wait, what did I actually need to know? Yeah, I mean, and you know, if you're going year after year keeping bees, you can kind of see, you know, what went well, and what didn't go well. And maybe there's a, there's a cycle that's happening, you know, annually with your, with your colonies, and what's blooming around you.

Jamie 52:16
Well, I do love this question, because it's one of those things, it's a recommendation that we're saying, basically. Do what I say and not what I do. I'm terrible with taking notes with bees. When I first started keeping bees 30 some odd years ago, I actually took quite detailed notes. And these days, I take no notes at all. I know that everybody and everyone's management style is very different. And so I would argue to each his or her own here. But with that said, I believe once you start approaching 8, 10 or so hives or more, that it's going to be really difficult to remember who was queenless at your last inspection, which ones were struggling and might need some feed, which ones you saw some funky brood that you might need to address, which ones might have high Varroa loads. And so once you start accumulating a number of colonies, it's very difficult to know who needs to be addressed and what was going on the last time you saw them. So I would always argue notes aren't really necessary for folks who keep one to five hives, maybe up to 10 hives, but after that, it's just hard to keep track with what's going on in the hives. And I've seen notes being taken every style possible. One of our previous guests we had on Two Bees in a Podcast even mentioned living in the stone age where a colored stone is what's placed on top of the hive to keep notes. For example, here at the lab, we've had different people manage hives differently, but we have a brick, right, that has six sides, the four longer sides and the two end sides and all sides are painted different. And so if yellow is facing up, it may mean that you've got to come back and inspect because something's happening. If red's facing up, maybe the queen's dead. If black's facing up, the colonies on its way, you need to address it. If green side is facing up, maybe the hive was good the last time you inspected it. That's, that is a very simple way to tell you what was going on the last time you saw it. Now that's, that's from one perspective. The listener saying, "Hey, I've been taking notes forever and can't figure out what to do with them." Well, that's, that's kind of what I do. But, but on the other extreme, there's these really great softwares that are being made available today with QR codes and readers and all of that stuff. You can take very detailed notes on colonies while you're out in the field. And all of this can be fed into spreadsheets, and if you're running large operations, especially satellite or commercial operations, it would be incredibly helpful, especially if you have an employee or multiple employees who you have to send out into the field to do such and such

to colony so and so. So I would argue for the vast majority of beekeepers, you know, who are hobbyists from that ten colonies are fewer, it's probably not that important to keep notes. Maybe you just want to know what you have to do next time. And maybe a simple multicolored brick can tell you that. But if you're a sideline beekeeper, commercial beekeeper, notes would be indispensable because, you know, it's, it's hard to be intimately connected to any one colony. So you have to know what was going on with any colony in any apiary just because you won't remember it from inspection to inspection. I know I kind of rambled a bit. But that's, that's kind of my general take on notes. Amy, you're always keeping me straight. That's a perfect example of why notes are even good on a small scale, right? So you can say, well, last year, my colonies produced two supers of honey apiece, this year, they produce four supers, what's the difference? Well, it rained a lot or it didn't rain a lot, or I moved the bees or I requeened everybody or I didn't. So you could start spotting those long-term trends, even when you have a few colonies if you keep notes. So very good point, Amy, you got me. You stumped this chump.

Amy 56:12
I don't know if you know this, actually. But there were a couple of people cleaning out the freezer a couple of weeks ago, and they found this super that had pencil, you know, notes written on the super and it was from, like, 1989. It was kind of cool to see. I remember that because that's the year I was born. But, you know, there were just notes back to 30, 32 years ago. It's kind of cool.

Jamie 56:34
Well, it's funny because we would call that an old super, right? That's an old super.

Amy 56:38
Thank you.

Jamie 56:38
But you're, of course, super young. So we would call a person young in that regard, but the super old.

Amy 56:45
All right, well, thank you everyone for your questions. Those are really fun today. Thanks for the laugh. We hope to see more questions. Make sure to email us at our honey bee email, or contact us on our social media pages. We're on Facebook, Instagram and Twitter. 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 57:33
For more information and additional resources for today's episode, don't forget to visit the UF/IFAS Honey Bee Research Extension Laboratory's website ufhoneybee.com Do you have questions you want answered on air? If so, email them to honeybee@ifas.ufl.edu or message us on Twitter, Instagram or Facebook @UFhoneybeelab. While there don't forget to follow us. Thank you for listening to Two Bees in a Podcast!