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EPISODE 203 TRANSCRIPT

Jamie

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 Norman Carreck of Carreck Consultancy Ltd, Co-editor of Beekeepers Quarterly in the United Kingdom. Norman is a personal friend of mine. I've known him many, many years. We've worked on lots of different groups together in lots of different ways over the years. And Norman, it's so, so, so great to have you again on Two Bees in a Podcast.

Norman Carreck

Hello, and thank you very much for asking me again. I'm sure it was a little while since I've spoken, so various things have changed, so hopefully we can bring you up to date.

Jamie

Well, Norman, we brought you on to speak specifically about Insignia-EU, but it has been a while since you've joined us. I believe it was 2021. You discussed with us local bees in the UK and some of the other things that you were up to at the time. We're bringing you again today to talk about Insignia-EU, which is another project that you're working on. But before we get into all of that, could you reintroduce yourself and talk a little bit again about how you got into bees and beekeeping and how you got where you are today?

Norman Carreck

Yeah, so I became a beekeeper at age 15. My mother was always interested in natural history, and she suggested we should keep some bees. So, we did some beekeeping classes together and I've been keeping them ever since. Then, by one route or another I got into bee research at a place called Rothamsted Experimental Station and so I've been involved in bee research in one way or another for 30 something years anyway.

Amy

So, as Jamie mentioned, we brought you on to talk about Insignia-EU. Can you tell our audience what that is?

Norman Carreck

Okay, yeah, the name is possibly a bit meaningless, but it's a project getting beekeepers to act as citizen scientists and get useful information about their bees. So, it really started out about 10 years ago, a project that came out of the COLOSS association that Jamie has been involved in right from the start. And this, I should say, COLOSS is trying to understand all the reasons why honey bee colony losses around the world may be occurring. And one of those possibilities was the idea that honey bees are often in places where there isn't sufficient food for them. So, some of my colleagues, Jozef Vandersteen in the Netherlands and Robert Brodschneider in Austria, came up with the idea of a citizen science project which they called CSI Pollen. So, citizen science investigation of pollen. The idea was to get beekeepers to put pollen traps on their colonies and collect pollen samples, the idea being everyone was doing exactly the same thing at exactly the same time. So, all over Europe, beekeepers had pollen traps and their colonies collected a pollen sample and we were really interested in the diversity of the pollen.

So, we weren't asking them to identify the individual pollens, but we were asking them to sort out the samples by color. And although the color of pollen doesn't directly relate to the plant species it came from, nonetheless, doing that to get the number of colors gives a good guidance to the diversity of pollen that's available to bees. And we really expected to see that in places like, I don't know, southwest France where you've got thousands of hectares of maize and no other forage for bees, but that would be quite an impoverished landscape for bees. And other places where you've got, you know, semi-natural vegetation, herb-rich meadows and so on that that would have a much greater abundance of plants for bees. And we also expected that that would change over the year.

But interestingly, when the results came back, we found that there is remarkably little variation in the number of pollens that you find in the sample. So, if it's in an urban area, a rural area, different times of the year and these different environments, we found that you get about four common pollen types. They will vary what they are during the year and in the different environments. But nonetheless, the bees seem to understand that they need to get a diversity of pollen and that one isn't sufficient. Even in a place where there isn't much diversity, they're clearly going out and expending a lot of effort in finding more varieties of pollen. So that was an interesting result. And we got to the end of that project, and we were thinking, well, what can we do now? And we thought, well, actually we'd ask the beekeepers to save all their pollen samples. So, in freezers all over Europe, there were pollen samples.

And we then thought, well, couldn't we analyze those for pesticides that might be in the pollen? And for a few minutes we thought that would be a really good idea. But then we thought, well, we don't have any control over how those samples were collected or stored. Some pesticides degrade very rapidly and there's contamination problems and so on. So, we sort of forgot that. But very shortly afterwards, the European Union put out a tender for a research project to look at what pesticides are found in honey bee pollen and ask beekeepers to collect it. So, we thought,

well, we know how to do that. So, we put in a proposal and that was funded, and it became the original Insignia project. We did pilot studies in a few countries and then a bigger study in nine countries across Europe and really demonstrated that beekeepers can be used to collect pollen samples. Our colleague Alice Pinter in Portugal was able to use meta barcoding to identify the pollens that were in the sample. And then our colleagues at the University of Almeria in Spain developed a passive sampler for pesticides, a plastic strip coated with a substance which is really good at picking up pesticides, and that was hung in the hives much the same as the Varroa Apistan strips and so on. And at the end of that project, we had a really good feel for how you can sample for agricultural pesticides and find out what crops the bees were on, the intention being that you can match the two up. And interestingly, we found lots of pesticides and we found that a lot of the most common ones are things that beekeepers put in there deliberately as controls for Varroa. So that's quite interesting.

But yes, you do find lots of agricultural pesticides in there and you tend to find more of them in agricultural areas than in semi-natural organic areas, but you still find pesticides everywhere. And so, we got to the end of that project and the European Union liked what we were doing. And so, they then put forward a proposal for a bigger program which became Insignia-EU. The idea was to roll out the sampling in all 27 EU countries. But as well as what we'd done in the first project, they wanted it to be expanded to cover a whole range of other pollutants. So, they were looking for microplastics, for heavy metals, for volatile organic compounds, pH, hydrocarbons and so on, and a whole range of things. So, we again did some pilot studies looking at how we might collect those. We tried different sorts of screens for collecting propolis from hives to analyze for heavy metals, and we came up with a sticky sheet called the Apitrap to collect microplastics and silicone wristbands, the kind of things that are handed out at concerts and things are actually really good at absorbing organic compounds. We found that putting those in the hives, you can collect those VOCs and pHs very successfully. And the whole idea of this was that everything should be non-destructive.

So, it was all things that were being brought into the hive, but we weren't harming any bees or the colony in any way by collecting these samples. In 2023, in all EU 27 countries over the season in a coordinated fashion, there were beekeepers putting these various samplers into their hives, collecting monthly samples, which were then brought back and sent to different laboratories in Portugal, Greece and the Netherlands to analyze the various things. We had a coordinator in each country who was a bee scientist or bee extension specialist who coordinated the things. So, it was a huge logistical effort in doing so. The results have come in but are still being analyzed and written up and so on. But we can say that the project was a great success and has produced a huge amount of information. We've got a lot of information about the pesticides that occur in honey bee colonies. We've been looking for 400 compounds, but we found some 200 or so occurred in beehives. There were 4 compounds that occurred in every country and 14 compounds that occurred in a lot of them. So, a huge body of information being assembled. We got information on the incidence of heavy metals and these other compounds, but I think the

thing that probably struck me most or shocked me, I suppose, was the results for microplastics. And unfortunately, you find microplastics in virtually every sample, and you find them in rural areas as well as urban areas. They can be analyzed and classified by their color and the type of plastic and the type of whether it's a fragment or a film or a fiber. And by far the most common microplastics occurring were polyester fibers, which occur everywhere. And they of course, are from artificial fabric. Clothes, people's clothes, they're everywhere. So, the results are all being modelled and there's a huge amount of work still to do. But we presented the results at the European Parliament at the end of last year and we're hopeful that it will lead to a long-term monitoring program. But obviously we wait and see whether that'll happen.

Jamie

Well, Norman, it sounds like to me you guys have just created a mountain of data. I'm anticipating a lot of manuscripts are coming out of this?

Norman Carreck

Yeah, there's about, I think, 14 referee papers have come out of the project so far and there are lots more in preparation. So, I mean it wasn't primarily intended to be a sort of honey bee research project as such. It's an environmental monitoring one. A lot of huge amounts of information have come out and are really interesting. And there was a lot of sort of logistical work that had to be done on how you do this. For example, how you collect the samples and successfully get them to the lab without degradation. Can you send them through the post? Do you send samples in alcohol or do you dry them, all these kinds of things. So, there was a huge amount of preliminary work that went into the protocol for this.

Amy

That's all I'm really thinking about is the logistics as you're telling us about it. You know, being able to collaborate with that many countries, collecting samples and then processing the data to have again, what Jamie said, just a mountain of data that you have. So, I'm sitting here just in awe. Kudos to you.

Norman Carreck

Yeah. And it helped that, COLOSS, one of the things it did from the outset was to try and understand colony losses in different countries by collecting colony lost data in a standardized way. And so, there was this existing network of beekeepers who got used to sending in their colony loss data each year. So, in each country, there was already this sort of network of, you know, keen, enthusiastic citizen scientists willing to contribute to scientific effort. And of course, it wouldn't be possible without those beekeepers.

Jamie

Yeah, I've done some pesticide residue studies before and it's just a lot of work and a lot of coordination. And like you said, thanks to those beekeepers who are participating. But, you know, also pesticide analysis is not cheap. So, it sounds like the funding that you have to pull off this must be pretty significant from the EU.

Norman Carreck

It was about €4,000,000 or something, which sounds a lot of money, but when you divide it up among the countries and the number of samples and so on, it wasn't a huge amount of money. As you say, these things are expensive. The cost of analysis does come down, and the lab at Almeria is set up for the job because it's already the EU reference laboratory for pesticide residues in foods. So, you know, they're very familiar. The other lab, the Bernanke Institute in Greece, likewise was already set up for pesticide analysis. So, that's good. But some of the other techniques had to be developed from scratch. So, the Apistrips, these plastic strips for putting in the hives were specifically designed for this, we did in the preliminary studies looking at whether you could get pesticides from pollen from bee bread, from dead bees and so on. These strips proved to be the best for the non-polar pesticides. We also looked at honey for the water-soluble pesticides, things like glyphosate and so on and that can be picked up on the Apistrip. So, we collected honey samples as well for those others to try and get as complete a picture as possible.

Jamie

Well, Norman, I really am grateful for all the work you guys are doing with this Insignia-EU project. It's going to be one of those things that generates a lot of data. A lot of the stuff that you're talking about are things that we've dabbled into my lab as well. So, you guys will be creating a lot of referee manuscripts and more importantly, you'll be taking care of beekeepers and giving us information we need to protect honey bees. So that's great. Well, I want to use this moment to pivot to another set of projects that you're working on. You have been involved with beekeepers working in the Isles of Scilly, just off the southwest coast of England. These islands are small, but there's evidence that the bees there are Varroa free. It's a great microcosm for studying and conserving honey bees on the island. Could you elaborate and tell us what you guys are doing on these islands?

Norman Carreck

Yes. So, I think last time we spoke, I talked about the native bees of Britain and Ireland and trying to find out whether, you know, the original dark European honey bee still existed. And so, I've been working with some beekeepers in the southwest of England. They call themselves the B4 Project, which is bringing back black bees. So, they've been working in Cornwall, which is the extreme southwest of England, and Devon, which is the county next door. But just off the southwest of Cornwall there is these little group of volcanic islands that stick up out of the sea. So, these are called the Isles of Scilly. And there are 5 inhabited islands and depending on the

time of day and the tide, a vast number of other little uninhabited islands. And they, I should explain, they belong to something called the Dutchie of Cornwall. So, this is a very old established dukedom which has been held for hundreds of years by the heir to the throne of the United Kingdom. So, for 50 years or so, the Duke of Cornwall was the man who's now King Charles, the Duke of Cornwall is now Prince William. And the Dutchie of Cornwall actually owns these islands. One of them, the island of Tresco, has been leased by a private family for 200 years or so, but the rest of the islands belong to the Dutchie. Historically, they were used for growing flowers such as daffodils and so on, but more recently they've become a tourist island, and the economy is quite tight, small farms and so on. There are a few beekeepers on there. And so, the B4 people became quite interested to see whether there were native bees on the Scilly Isles and the beekeepers on Scilly expressed an interest. Some preliminary work was done a few years ago to look at the genetics of samples of those bees.

So, I should say there's only known to be about 45 honey bee colonies on the island, but it was known that there were a few wild colonies living in walls and trees and barns and things like that. So, some preliminary samples were collected a few years ago and were analyzed and showed that on two of the islands there are fairly pure black bees, Apis mellifera mellifera. On one of the islands, unfortunately, a beekeeper over the years has introduced Buckfast bees, which are totally different. And then the other two islands turned out to be a bit of a mixture. As you said in your introduction, it was believed that these islands were Varroa free. So, 2023, I was invited over there to look at this and see where we could go, whether there was a sustainable population of bees on the island that would mean we didn't need to bring in bees from elsewhere. And so that raised lots of interesting questions.

So, while I was there, I was able to go through about 1/3 of the colonies and I didn't find any signs of Varroa or foulbrood or deformed wing virus, which was encouraging, but obviously it doesn't actually prove those things are not present. And we were also interested in the question of whether the bee populations on each island were totally independent or whether bees could move between the islands. They're quite close together. They're sufficiently far from the mainland of Cornwall that bees can't fly between them. But the islands themselves, some of them are quite close and between two of the islands, on certain days of the year, at very low tide, it's possible to walk across between them. So, it seemed quite likely there'll be a movement of bees between them. And so a chap called Stephen Fleming, who's the editor of the magazine BeeCraft, who's a geographer by training, became quite interested in, you know, could the bees, the bees move between them and Jamie will certainly, I know you've done some work on drone congregation areas and drone lures, and if you put out a queen lure in the air, you can get drones to come and form a drone comet. That suggested a means of seeing honey bee drones were moving between the islands. So, in the first year they went into beekeepers' colonies, marked some drones with a different colored paint for each island and then looked to see whether those turned up in colonies subsequently. And it was a bit late in the year, so none of the colored drones turned up.

But again, that doesn't prove anything. So, in 2023, when I was over there, what we did was set up a queen lure in places that were likely drone congregation areas, and Stephen and his colleagues very quickly found some good drone congregation areas. What we did then was put up the lure, catch drones in a net, mark those drones and release them. So, different color for each island again. And we found that we were catching the same marked drones again. As you know, in science, in biology, in marked recapture experiments, there are formulae that you can use based on the number of individuals you capture and the number of marked individuals you recapture, you can estimate the population that it's drawn from.

On one occasion on a lovely sunny day, we estimated that there were about 2000 drones in the congregation area we were studying, and I'd looked at the managed colonies on that island and there were very few drones in them. So, that suggests that there's a lot more drones out there than were in the small number of managed colonies we were looking at. But we didn't in that year actually obtain evidence that the drones were moving between islands. But again, it didn't prove they didn't. And then when Stephen and his colleagues went back last summer, unfortunately, I wasn't able to go. They decided they would go to a couple of the uninhabited islands and see if there were any honey bees there when there were no known colonies. And they went to one of the islands, put up the lure, rapidly got drones, marked them, and then they found that those colored drones turned up in colonies on two of the neighboring islands. On another experiment, they went to another island, which is a bit further away from the other islands. They put up the lure, waited, and then drones appeared and they were marked drones from another island. So, it really does prove that the drones are able to move between the islands. We'd already heard sort of anecdotal evidence that swarms move between the islands. But it does show that effectively there is mixing of the population. So that sort of bodes well for the future. And the beekeepers managed to persuade our national bee unit that it's interesting to find out whether these islands are really Varroa free.

So, we now have a Sentinel apiary on each island from which regular samples will be sent to our national bee unit to see whether we can demonstrate in a while that these islands are indeed Varroa free. And if the islands are Varroa free, then I think we can exchange material between the islands to try and select from the best bees that are on the islands and have a sustainable bee population there without the need to bring in other bee imports. And of course, these islands, although they're connected by ferries and planes to the mainland of England, also have ships visiting, cruise liners and so on. The islands are, of course, vulnerable to the import of things like small hive beetles and Tropilaelaps mites and Asian Hornets and so on. So, there's a whole load of interest in the biosecurity of these islands. They already have problems with certain invasive plant species that were brought there as ornamentals, you know, 100 years ago and are now taking over. They have problems with rats on the islands and things like that. So, the bee question is really being brought into the sort of wider biosecurity of the Scilly Isles, and these islands, because they're so small and you can potentially map all of the bee colonies, it enables you to study how island populations work. And therefore, it is a microcosm for studying how bee

populations of conservation interest in much bigger islands such as Malta, Sicily and so on in the Mediterranean and the Balearic Islands, which all have interesting honey bee populations that need conserving, and we can really use the islands to work out how to conserve honey bees elsewhere.

Amy

So Norman, I'm just watching the bees in my mind with drone congregation areas moving from island to island. While we're on the topic of movement of bees, I also know that you're part of a project for the Irish government, with colleagues and you were looking at the effects of banning imports of bees. You've mentioned this earlier with some of the stuff with the Isles of Scilly and you've been looking at disease implications of imports. I think Jamie and I have talked to our audience about the Irish honey bee, but maybe you could tell the audience a little bit about the Irish honey bee, what this looks like and what your project was working with the Irish government.

Norman Carreck

Yeah, so that this is very much related to what I was mentioning earlier. And in Great Britain, there have been imports of various strains of honey bees for several hundred years, particularly Italian bees and Carniola bees and so on. So, we know that in many parts of England there's a huge mixing of the bees, but there's been this great interest in, are there native bees still surviving? And for a long time when I started beekeeping I was told there were no native bees.

And in particular for that, I think we have to think of brother Adam, the famous bee breeder down in Devon, who categorically stated that all the native honey bees died out at the beginning of the 20th century due to something called the Isle of Wight disease. And I think everyone believed that. But then in the 1950s and ‘60s, there were a few people that thought, well, now maybe some of these native bees survived. There was a professional entomologist called Beowulf Cooper who began looking at bees that he found in remote places in England, and he was using wing morphometry to look at what subspecies they might be.

And he became convinced that there were still plenty of pockets of native and what he called near native bees existing in various places. But I'm not sure anyone really believed him. It seemed obvious that the island of Ireland, which is off the West Coast of Great Britain, being more remote, was more likely to have some of these native bees. And morphometric studies suggested that this that was the case, and there were groups of beekeepers, particularly at the Galti Valley, which is sort of in the middle of Ireland, who found these black bees and selected them and passed them on to their neighbors and so on.

But it was really the introduction of molecular techniques that made it much easier to look at the genetics of these things. And in recent years, there have been various studies that have shown that Ireland actually contains the largest population of dark European honey bees, Apis mellifera

mellifera, anywhere in its original range, which was right over northwestern Europe. You know, France, the Netherlands, Belgium, Germany and so on. Ireland has the biggest population of these dark bees anywhere until you get to the Ural Mountains in western Russia, where they're living in the forests. There are still these surviving populations. But sadly, over much of its range in France and the Netherlands and Germany, it's been replaced by other bees. Beekeepers in Ireland, I think, become very proud of the fact that they've got these dark bees which seem well-adapted to the Irish conditions, which can be quite harsh. It's very windy, it's very wet, it's not particularly cold, but beekeeping in Ireland can be, shall we say, problematic. And so, over the last few years they've been concerned about continuing imports of other bees into Ireland. And there was evidence that although these imports are quite small in number, they're quite damaging in the native bees become introgressed with Italian bees, Carniolan bees, Buckfast bees and so on.

Growing interest led to something called the Native Irish Honey Bee Society promoting dark bees and they managed to get a senator, a member of the Irish Parliament, interested in this. And with the help of some lawyers acting for nothing, they put together this Native Irish Honey Bee Bill which will have the effect of banning imports into the island. And so, this went through the first stages of the parliamentary procedure. But of course, as Ireland is a country in the European Union, the European Union is about free trade between the nations and, therefore, you have to have a really good reason for restricting trade in any way. Banning imports of bees would be a restriction on trade.

So, the Irish government itself, the civil servants were very concerned that, you know, they could only do this if they had really good evidence. So, the progress of this parliamentary bill sort of stopped and the government put out a tender asking for evidence. So, a group of us, led by Professor Grace McCormack, who's at the University of Galway in the West of Ireland, we agreed to answer lots of queries on behalf of the government. So, it was a team with her colleagues at the University of Plymouth in England, the University of Edinburgh in Scotland and colleagues in Greece and Switzerland. We had to look at all the available literature and answer a series of questions. So, we were asked, is there evidence that there are native bees in Ireland? This was an opportunity to bring together various unpublished studies, published studies, and that demonstrates that yes, indeed there are still lots of dark bees in Ireland. Then the question is there something distinctive about the Irish bees? And again, there was already evidence that although genetically the Irish bees are closely related to dark European honey bees from mainland Europe, from France and elsewhere, there actually seemed to be some unique genotypes in Ireland. And the further work has suggested that these Irish bees actually differ from the mainland European populations in a number of ways. They are slightly smaller, they're slightly hairier, they have slightly shorter legs, and they have slightly shorter proboscis than the mainland version. So yes, they are unique and these possibly or probably are adaptations to the particular climate of Ireland. So, they're locally adapted bees.

Then, we had to look at the risks of continuing to import bees, and there's good evidence that these bees coming in have caused, if you like, genetic pollution to the population and introgression, which mixes up the genotype. And then we were asked to look at what would be the implications of a ban. Would there be huge economic losses if you banned imports? Would there be effects on pollination of crops and so on. Actually, it turns out the number of queens coming in is quite small and, therefore, the economic impact would be negligible. And clearly there's huge support from the beekeepers in Ireland. We then had to look at how conservation measures for honey bees operate elsewhere. So, there are a number of places in Europe where there's legal protection for bees, but there are other ways of doing things through voluntary bee reserves and conservation areas and so on.

So, the conclusions are, yes, unfortunately the small number of queen imports that happen do have a disproportionately large adverse effect on the native bee population. But evidence that these imported bees are in some objective way better than the native bee is really hard to find. And it really builds up quite a sort of coherent view that these imports have been harmful and that a ban would have negligible effect on the Irish economy, would improve the conservation of bees. So, the bill went through the upper parliament of Ireland, but it now has to go through the lower house. I don't know what will happen, but I think other countries around the world, particularly Europe, are sort of looking to see what happens in Ireland. And certainly, beekeepers in England are very concerned about the number of imports into the United Kingdom. It's much greater. So, we await the results with interest, I think.

Jamie

Norman, that's obviously a fascinating topic to me about these wild Irish bees. We study wild populations in South Africa. So, I really have a growing interest in where wild populations of honey bees may exist, whether they need protection, how to protect them. Honestly, you've talked about Insignia, the bees on the Isles of Scilly, and now the bees in Ireland. Each of these we could bring you back just to talk about as a separate podcast episode, but I guess we have to wind down. I just want to ask you, is there anything else you'd like to share with our listeners?

Norman Carreck

Well, just I suppose for your audience to say that those of us on this side of the Atlantic, I think, are very concerned that the reports we hear out of the United States of the very heavy colony losses that you seem to be experiencing at the moment. It's difficult to get detailed information of exactly what's happening, but it certainly sort of takes you back 20 years ago to the CCD story and so on. And it was that that led to the COLOSS organization we've been talking about and the attempts to understand global colony losses. I'm very much waiting for more information to the United States to see, hopefully, that those losses are not quite as extensive as being reported, but to try and understand what's going on there and what can be learnt from the research that's been carried out over the last 20 years into colony losses.

Jamie

I know, Norman, it's like it's really concerning to me. So, for the benefit of all the listeners, we happen to be recording this episode at the end of February in 2025. There's been new reports of elevated losses of bee colonies in the US. I think I saw a report about 1.1 million. So, Norman, you're right, everything you said is correct. First of all, I can't believe it's been almost 20 years since this concept of CCD was born. And you're absolutely right too, bee losses have led to an explosion of bee research, bee organizations, bee scientists, and bee funding. And hey man, just like you, we're also waiting to see what some of this information is going to show, get a handle of what the loss rates are and the contributors to those losses. I think it illustrates that I think about the projects that you share, and I think about you asking about the losses we're experiencing here. It just really illustrates that there's no shortage of issues that we face in the honey bee world and that we're all going to have to be working on, well beyond even me and you and Amy, having jobs. There's going to be people coming after us needing to address very similar issues well into the future of honey bees and beekeeping. So, yeah, thanks for asking about that.

I just want to thank you also in general for joining us on this podcast. It's been very enlightening and you're really collaborating on a lot of different projects that are very interesting, Norman. So, thank you so much for joining us.

Norman Carreck

Well, thank you very much for inviting me. It's always good to talk to you.

Amy

Jamie, I was really listening to Norman, just thinking, first of all, the amount of work that they've all done, you know, to look at these bees and to have native bees. There's just so much to talk about in that episode. You and I don't have that experience as far as having a native Irish bee, being in Ireland, like we don't have a native US bee. What are your thoughts on the episode?

Jamie

Yeah, there are so many things to unpack, but I'll save it all for another day. You're right. I mean, there's three big topics he discussed, right? This Insignia-EU, the bees on the Isles of Scilly and the native Irish bee. And I'll do it backwards since you asked about the Irish bee first. You're right. Here in the US, we don't have a living native honey bee. Apparently, honey bees were in North America at one point. There's a fossil record of at least one species. We don't have a living native honey bee, so we just don't have those same questions that he and other colleagues of his are asking, like they are about the Irish honey bee.

But honestly, Amy, I can't really understate the importance of that research because Apis mellifera is native across Europe. But it's really hard to know when you're working with a honey bee colony that's not in a managed box. It's really hard to know in Europe if it's wild or if it's just

a second or third generation feral colony that came out of a managed colony some time ago. Because like Norman said, there's this general belief around Europe that when Varroa and other issues arrived in Europe, a lot of the wild population died off. And so now it's really hard to prove that a colony you're working with outside of a box is truly wild or just feral or unmanaged. In Ireland, they're trying to get to the bottom of this with their Irish bees. I think it's a fascinating story.

Obviously, you know that I like studying wild honey bees. One of our PhD students does that in South Africa. I could go on for days. And that's neat, then, when they pivot to the Isles of Scilly, maybe not a wild bee, maybe honey bees were or were not native there. I don't know if Norman clarified that point, but honey bees are there now, nevertheless. And so, you've got all of these free-living honey bee colonies, and they're using these islands to answer questions about the free-living colonies. And then we pivot up to the first discussion we had about Insignia, I think specifically about pesticides and nutrition, like what they're doing in the Insignia-EU project. Beekeepers, bee scientists, others, make so many comments that we often don't know. You know, pesticides are killing all of our bees, nutrition is killing all of our bees or lack thereof. And really, a lot of those statements are made without data. So, one of the things I appreciate about the Insignia project, like let's just look, let's just collect samples from colonies across Europe and see what the pesticide loads are. Let's look at the pollen that they are bringing in and look and see if the diversity is there. I've been involved in similar projects here in the US and that's what we need. We need long-term monitoring of these resources so we can understand better what's happening to our colonies.

Amy

I totally agree. And you know, the nutrition stuff and the pesticide stuff, that stuff takes so much time, right? I mean, collecting the data, but processing it takes a lot of time. As you mentioned in the episode, the funding as well.

Jamie

Amy, that is such a big deal. And for example, in the pesticide work we've done, we've used a residue lab before that cost, you know, nearly $400.00 a sample just to screen for about 200 compounds. Well, if you want to know what's in adult bees, immature bees, wax, pollen and nectar, you know, that's five different matrices right there. You multiply that by $400.00 a sample, we're talking $2000 just to know what's going on in one colony. So, it's great to hear that the EU is putting up this money. Norman mentioned $4 million isn't a lot. It's not a lot in the research world, just like what he said. When you split it up amongst colleagues from multiple countries and sampling multiple beekeepers' colonies and doing these residue studies, oh, and by the way, pollen and by the way, trying to coordinate this, the money goes very quickly. But it's this type of information we need to truly understand what's happening to our bees.

Stump the Chump

It's everybody's favorite game show, Stump the Chump.

Amy

Welcome back, everybody, to the question-and-answer segment. Jamie, this first question has to do with red light. The listener has read how red-light therapy has health benefits in humans. So, the question is, can honey bees benefit from red light therapy?

Jamie

I'm not aware of any research on this topic so it's one of those big, royal we don't knows. I will say that honey bees are exposed to red light in multiple capacities. I'll give 3 examples. One, I know when commercial beekeepers move their colonies at night time, they will often use forklifts and front-end loaders, etc. that have red lights rather than regular lights under the premise that bees don't see red. So, they are less attracted to the red lights on your machines than they would be on your regular white lights. So, I've helped commercial beekeepers load colonies at night time when I was young and that's how I got the experience. They were red lighting everything to minimize bee attraction to the lights at night.

The second way that I've seen honey bees get exposed to red light with regularity, again, is under that premise that bees don't see red is when you do research with observation hives, you want their behavior to be as normal as possible. So rather than observing bee behavior under regular white light and observation hives, it is far more common to observe bee behavior under red light in observation hives.

And then the third way that I know that bees are exposed to red light is a lot of folks have heard scientists like myself and others, other beekeepers say bees cannot see red. We all know this quickly. I've said this now multiple times. Bees can't see the color red. It's too far into the red spectrum for them. They don't see that. Humans see further into the red spectrum than bees. Bees see further into the ultraviolet spectrum than humans, so they can see UV light. We can see red. We both win in one case and lose in the other. And bees translate red as black. And under this guise, there have been people who have created lids of hives that are transparent and red. So, they were making them out of this plastic red material with the idea is that, oh well, bees will translate that as black. They won't know that light is coming in from the outside. And beetles, small hive beetles don't like light, so they'll run away from this light. The problem with that is, is that first of all, it's letting a lot of light into colonies, even if it's going through a red tinted piece of plastic. But also, a lot of insects don't see the color red, and so working against beetles would make it also work against bees. And so, it's a tricky thing. I'm not saying it doesn't work to push out beetles, but if it does or doesn't, it wouldn't be due to that mechanism. Nevertheless, my point is that honey bees do have some interaction with red light, but I've never seen any research on using it for a therapy purpose in honey bee colonies.

Amy

That makes sense. All right. The second question that we have is, since drone eggs are laid in different sized cells than worker eggs, are the egg sizes different as well?

Jamie

No, they are not. I am looking at a research paper from Henderson from 1992 and in the summary, I'm going to read the sentence. There was no statistical difference between sexes, that's adults, and eggs destined to produce drones during the swarm season were not necessarily larger. In other words, Henderson found no difference between eggs destined to become workers and eggs destined to become drones.

Amy

There you go. They're the same size. All right, the third question that we have, so this person says my thoughts on bees, quote, unquote, hearing one another, would their hairs or even their antenna essentially be the structures capturing the vibrations within the air? How do bees hear? They don't have ears, right? We've already talked about this in a past episode.

Jamie

Yes, I actually really, really love this question. And I didn't know the answer, so I had to look it up. One of the problems with looking up the answer is the truth is with every question that I am asked, I only answer it from the one or two papers I find quickly or from my background knowledge working with bees. I'm going to do the same here with this question. And of course, this article that I'm going to cite is, gosh, it's 30 something years old at this point and science may have matured, but there's two questions in here really. Can bees hear and what structure do they use to hear if they can? Well, obviously bees use vibrations. We know they use vibrations. They emit audible sounds that we can hear. Workers will do this. Queens will do it with piping, etc. Now, Amy, you're right, bees don't have ears, so they wouldn't be picking it up the same way that we do. But they seem to be doing this clearly on purpose. So, they are using vibrations in some capacity to communicate.

Well, the question then is, if they are using these vibrations, what organs might they be using to pick up this information? There's a really neat paper I found called Hearing in Honeybees. It was published in the Journal of Comparative Physiology back in 1993, and the authors are Dreller and Kirchner. Hearing in Honeybees: localization of the auditory sense organs. So, this paper is designed to answer this question, and I just want to read the whole abstract because it's quite fascinating. So, this is the abstract directly from this article.

Airborne sound signals emitted by dancing honey bees contain information about the locations of food sources. Honey bees can perceive these near field sounds and rely on them to decode the messages of the dance language. The dance sound is characterized by rhythmical air particle

movement of high velocity amplitudes, clearly not something I study myself. The aim of the present study was to identify the sensory structures used to detect these near field sound signals. In an operant conditioning experiment, bees were trained to respond to sound. Ablation experiments with these trained bees revealed that neither mechanosensory hairs on the antenna or head, nor bristle fields at the joints of the antenna were the hearing organs in bees, but rather the Johnston's organ, which is an organ in the pedestal of the antenna. In other words, a special organ in the antenna. It was used to detect near field sound in honey bees. So, I'm not arguing that they don't receive some vibratory information from their hairs. But this paper, these authors suggest that it was the Johnston's organ in the antenna of the honey bee that they used to quote, hear the near field sound signals that would be emitted, for example, by dancing honey bees. So, there you have it.

Amy

Jamie, the only thing I can think of when you read that was science, am I right?

Jamie

Hey, listen, I love science. And Amy, I said this earlier. One of the problems I have with answering questions, obviously I don't know everything. I don't even know a small minuscule fraction of everything. And my answers are only as good as the number of papers I find. So, here's one paper, and there could be 50 more since then that will flip the science on their head. And so, the beauty of having listeners all around the world is that if I'm wrong, you guys can send me updated papers and say, Jamie, that was a bad answer. You should see this new science paper that shows this and that and the other. But it looks like they can perceive sound with the Johnston’s organ.

Amy

We love our feedback from our listeners, so if you all have questions, these are great questions, a lot of fun to ask and to look up and to hear about. So, if you've got other questions, don't forget to send us an e-mail or send us a question on one of our social media pages.

Hey everyone, thanks for listening today. We would like to give an extra special thank you to our podcast coordinator, Jeffrey Carmichael. Without his hard work, Two Bees in a Podcast would not be possible.

Jamie

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.