Episode 245 Transcript: Beekeeping Advisory Services in Sweden with Lotta Kristiansen

Jamie

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Professor Grace McCormack Joins to Discuss Irish Honey Bees

Hello everyone, and welcome to another episode of Two Bees in a podcast. Today I'm super-duper excited because we are joined by Professor Grace McCormack, who's in Zoology at the School of Natural Sciences and the Ryan Institute at University of Galway in Galway, Ireland. Grace, thank you so much for joining us on Two Bees in a Podcast.

Dr. Grace McCormack

Thank you so much. I'm delighted to be here. Really happy to be to be invited. So yeah, hello, good afternoon.

Jamie

Yeah, I'm very stoked to have you because a couple years ago you and I were both at the same meeting of the British Beekeepers Association and I was watching your talks, and I just was fascinated with your research. You and I think a lot alike about, gosh, I'm getting ahead of myself. I'm so excited about wild and free-living honey bees.

We brought you on today to talk about the Irish honey bee, which has kind of been your thing recently. So, I'm so excited to introduce our listeners to your research. But Grace, before we do all of that, our listeners just want to know how you got where you are. So, could you talk to us a little bit about how you got into the beekeeping world and how you ended up studying honey bees at the University of Galway?

Dr. McCormack's Unexpected Path to Honey Bee Research

Dr. Grace McCormack

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Sure. Yeah, Well, I'm first and foremost a zoologist. I love animals, love nature. So, I did zoology and yeah, really lucky to end up as a professor in zoology in Galway. I guess I learned skills in evolutionary biology, particularly using DNA to look at relationships between things.

So that's my background, phylogenetics and systematics. And I've applied this to different organisms actually. And it was around 2014, I wasn't really working on bees at all, I was working on marine sponges, mostly, at the time, which are also another fascinating group of animals, and a beekeeper came into my office and wanted help to provide scientific evidence for something.

I had read the book *A World Without Bees*, so I was aware of the background around issues with colony collapse, and I had been thinking, oh, beekeeping might be an interesting hobby to have later on. And this beekeeper that came into my office introduced me to the Native Irish Honey Bee Society and the issue with native bees.

And I was kind of a little bit horrified, actually, at the lack of research at the time. And it was an area of science that fitted really well with my passion. I'm really interested in the population species border that you know, how populations become species and so on and relationships at that level.

I went to a meeting, at the same time, there had been an ad for a tender for a grant application on Varroa. So, Varroa had entered Ireland in 1998. So, this is the parasitic mite that has, you know, contributed hugely to colony collapse.

And I didn't apply for the funding because I thought, well, there's must be lots of people working on this that are better than I. So, I didn't actually apply. And then I realized, well, actually there wasn't. There was not very much research being carried out. And at the time, there were a lot of assumptions being made around that the native Irish honey bee was extinct in Ireland and therefore people were importing bees into Ireland, and also that wild colonies went extinct.

Both, there were 2 population crashes, one in the 1920s and one again when Varroa hit. But when I was looking into it, I couldn't find any evidence to support these assumptions. And then the second thing that happened was there was some money available to work with students and I thought of getting a beehive and it all kind of just rolled in together over a very short period of time.

We were successful getting that money. We established a beehive, and then a really good student who came approached me about doing a PhD on something and I was like, Oh my God, there is this question here around honey bees in Ireland and adaptive evolution and what's going on.

So, he applied for money and got a scholarship because you know yourself, when you don't have a track record in something, it's very hard to get funding. So, I had no funding. So, I had this PhD student. I had lots of ideas and yeah, so that's how I started.

An Equal Opportunity Institution.

And so, I got the hive to teach me about beekeepers, really, what was it about? Like, what were the questions? If I'm going to go out in the community and look for wild bees and talking to beekeepers around either Varroa or wild bees, well, I needed to understand what they were talking about, what their passion was.

And yeah, I got sucked into the passion very, very quickly and ended up with 10 hives within the year. And yeah, started off that way.

Unveiling the Importance of Ireland's Native Honey Bee

Amy

Grace, I have so much to follow up on with your story. I feel like I could sit around and talk to you forever about things. First of all, I think if I ever am not doing bees, I'll probably get into marine sponges because that sounds really cool. And the other thing is, you know, it's just amazing that you've done so much work.

And I think people can probably hear it in Jamie's voice when he introduced you is that he completely is nerded out and excited about talking about the Irish honey bee. And so, you were talking about how people thought that the Irish bees were extinct, how the wild bees were extinct.

And you've done a lot of research, as you mentioned, on the Irish honey bee. So, I guess can you describe to people what this honey bee is and why it's so important?

Understanding the History and Distribution of the Dark Honey Bee

Dr. Grace McCormack

OK. So, the honey bee is a very variable species, right? It has distributed itself over a very large geographical area since the last Ice Age. And so, it has met lots of different environments and climates and it has adapted to those.

And so, it has developed this variation. So, some of those, they have been identified, they're morphologically, genetically, behaviorally distinct, but they can still interbreed. So, they're called subspecies. And right across the top of Northern Europe, right away from the West of Ireland to the Urals in Russia to the tree line in Sweden and Scandinavia and down to the South of France was the distribution range of this thing called the black bee.

So, it's called the black bee, the dark bee, the brown bee. And this is the pioneering subspecies that Rutner, so he's the godfather of honey bee taxonomy, did a lot of work on Linnaeus. It's the subspecies that Linnaeus himself actually identified the name, the honey bee.

It was the black bee that he used to describe that. And that's the bee that made it into North America first. It's the bee that made it to New Zealand. Anyway, that bee was an opportunistic bee and it actually had a very large distribution range.

What's happened since the 1880s, once Langstroth developed the movable hive with movable frames, there seemed to be a preference for bees that behave better in a hive, in a box. And so, all across Europe, people started buying in like Italian bees and Carnolian bees and Buckfast and Starline and replacing their dark bee with these more commercial strains.

And so, this has caused a massive crash in the population of the dark honey bee right across Europe. In fact, there are very few pure populations this subspecies left. There are almost pure populations in a few places and there are small conservation areas that have pure, almost pure AMM.

So, I call Apis mellifera mellifera is the subspecies and I shorten it to AMM. And in Ireland, what we found when we did some work we published in 2018, we found that over 97% of the bees that we sampled were pure AMM. So, we have really, really probably the purest versions of this subspecies left in Europe, and we probably have the largest population now left in Europe.

So, it's right across Ireland. Ireland is an island, and so we have a very healthy population of Apis mellifera mellifera left here.

How Irish Honey Bees Evolved for a Tough Environment

So, that's one reason why it's important. Ireland is now a refugee for Apis mellifera mellifera, which was the original kind of honey bee. The second thing is that after the last Ice Age, as bees started to recolonize Europe, they made their way to Ireland and then Ireland, the water levels rose, so Ireland became isolated from the rest of Europe.

So, we have a very depauperate floor of fauna in Ireland. We don't have a very rich biodiversity. We have reasonable biodiversity but not compared even to England. So, the bees have been isolated here largely in that time.

They have evolved in that 11,000 years to adapt to the unique climate and environment in Ireland. Ireland's a very tough place for honey bees because it's the extreme western edge of its distribution. It's west you know, everybody knows that Ireland is famous for its weather, right? The bees do well here, and they have evolved different strategies in order to do well in Ireland.

So that's important. We've proposing, we strongly feel that that there is a distinct ecotype of Apis mellifera mellifera in Ireland. And in fact, you know, I'm going to check our data and see, interrogate it a bit to see if it could be something more. I don't know, like we definitely have, you know, the morphology is different, the behavior is different, the genetics is different here in Ireland. So that's important. We have a distinct evolutionary significant unit sitting in Ireland.

The Role of Hobbyists and Wild Colonies in Ireland

The other unique thing is that the beekeepers in Ireland are different. So, bees were never very common, we don't have a very high density of apiculture in Ireland. We never did because it's very hard to keep bees in Ireland.

But it's been part of our culture and heritage going back thousands and thousands of years. So, it's made its way into our language, into our place names, and it's a part of traditional heritage in Ireland that a lot of houses in the country would have had a hive in the bottom of the garden to produce some honey for themselves, for the family and also for sale.

In fact, we had a unique set of laws in Ireland called the Brehon Laws around 700 AD and there was a whole set of laws uniquely geared towards the honey bee called the Bee Laws, part of the Brehon Laws.

So, it was a really important part of Irish culture. So Irish beekeepers know that, they're interested in biodiversity, so we don't have this massive apiculture that goes on in some other countries. Most beekeepers are hobbyists. They have maybe 3 to 5 hives.

We have very few people that have over 100 hives and there's a handful, maybe 5-10 people that have over 500 hives. So, that's different and because of that, our bees are different. And because of that, we have wild colonies. The bees have been able to exist outside of apiaries, and this is rare in many, many countries.

And I think it's because beekeepers have always – swarming and swarms have become part of the dealing those Brahon laws. And since then, beekeepers, they're nervous of wild bees because of the disease thing. We can come back and talk about that maybe later, but most of them will collect swarms from the wild.

They might keep them somewhere else until they see that they're healthy and then bring them into their apiaries and they release swarms into the wild. So, we have this panmictic population. And another thing, beekeepers, about 30%, I'd say, beekeepers don't treat. Never treated. Some of them have never treated, even when Varroa came.

They just can't be bothered. They don't like chemicals. Because the hives are at the bottom of the garden, they're neglected except for when they're pulling a bit of honey off it. So, we have this natural resilience in our bees. They've been driven by natural selection rather than the strong artificial selection for traits of interest to the beekeepers.

So, all of these things combined make Ireland a really unique place for honey bees and makes our honey bee unique. So, I guess it's important to preserve that for its own sake. I think, from an ethical perspective, that population of bees deserves to exist, but also it holds perhaps a promise

and a reservoir of genetic resource that can actually be useful in apiculture, not just in Ireland but certainly in Ireland.

So, we need to mind it. We don't want to get to a point where the bees need people to live. If we come to that point, I think that that will be a disaster. The bees are doing grand. They have a nice relationship with humans, and we need to mind that, I think.

Shifting Focus to Free-Living Honey Bee Populations

Jamie

Well, Grace, that was really a beautiful description of the Irish honey bee. I mean, it makes me really want to revisit Ireland and see this thing in the wild, which really helps me pivot to this next question. In addition to studying the Irish honey bee specifically, you are also becoming very interested in free living colonies in general.

Of course, free living colonies of the Irish honey bee, but also elsewhere. This idea that colonies live in trees and other places, could you talk a little bit about that? You know, your work around free-living colonies.

Public Reports Lead to Discovery of Free-Living Colonies

Dr. Grace McCormack

Yeah, so as soon as I kind of started working in this area in Ireland and I gave my first talk at a beekeeping conference, I guess I was intrigued by the fact that somebody said in a reading that they didn't exist. And straight away I was like, whoa, like, why wouldn't they exist?

So, I talked to some of the older beekeepers around this first to see what their understanding was. And the idea was that they've certainly had gotten a bit rarer. But almost as soon as I had started these conversations, people were ringing me, saying and coming up to me after meetings saying, hey, there's bees in this chimney or there's bees in this wall.

There are bees in that tree. I collect swarms from here every year. So, I was like, oh, wow, OK, this isn't the case. There's stuff here. Applied for funding, was told they don't exist. We're not funding you to look for them. So, we linked up with Dick Alstrom who was the scientific journalist in the Irish Times and we wrote an article.

We wrote 2, actually, at the end of 2015 and then in spring, I guess of 2016 and it was published later that summer and we had over 200 calls within a couple of weeks around, you know, reporting bees. Now about, maybe, 10% of those were bumblebees or wasps or something like that, but there was a significant proportion that were honey bee nests.

So, myself and my student that I talked about before, Keith Brown, who's now obviously finished and working away, and a technician in the university, Owen McLaughlin, has been absolutely amazing. We just got in the van, and we're driving around and following up on these and then we tracked them.

We tracked them during Keith's PhD so we could prove we knew for sure that these were surviving. We were collecting swarms of them and putting them in our apiary. So, what I do realize is that the situation in Ireland is quite different again from elsewhere because we have very low forestry, firstly, but the bees have adapted and they are largely present in agricultural or urban environments.

So, we have an awful lot of old castles and walls and farm sheds and dilapidated buildings, walled gardens, old estate houses and stuff like that often have colonies in the cavities in the walls. And where we have forests with big enough old enough trees, those cavities will have honey bees.

International Collaboration to Understand Wild Honey Bee Survival

Because of this unique, I think situation in Ireland, we have a very robust population. I think when I went to the SICAMM, so the International Society of Conservation of AMM meetings, I was intrigued to learn about attitudes in other countries.

So, the presence of wild colonies in Poland for sure. And then there's all the tree beekeepers you hear about. But in some countries where there's very intense apiculture, wild colonies are killed right? When they're found, they're killed. And I think legislatively they have to be killed because of this threat to the managed colonies.

So, 2014, I went looking in the red lists and I was horrified to see that the honey bee was data deficient in the IUCN, the International Union for Conservation of Nature, the European thing where they draw up red lists of, of species that are, you know, threatened or extinct or vulnerable.

They categorize them into this list. And honey bees, it was data deficient because the group that wrote the report in 2014 didn't know whether honey bees existed in the wild. So, these are wild species. So, I was kind of really horrified at that, that for such an important species that's global, that we didn't have information on whether they existed in the wild.

I couldn't really understand that. And then I came across Honey Bee Watch, which is a group of people developing a network around understanding more about wild bees. So, we have seen quite a few papers coming out in recent years suggesting that in Germany, for example, that most of the colonies in the forest are escapes from apiaries.

And because they're so highly bred and they're susceptible to Varroa because they're treated multiple times a year, those aren't tending to survive. Of course, Tom Seeley's work in the US is a totally then polar opposite where he's been studying them for years and he's found that they bounce back after Varroa and they are surviving.

So, there's a real mix of countries. So, we now have this project called Free B, the website's nearly live, where we're working with Honey Bee Watch. They're a partner in this as well. And we are now looking for wild colonies in Poland, in France, where we know there's colonies in France, there's a lot of work done by Fabrice Requier and beekeepers before that.

Even in Portugal there have been some wild colonies described before this project. Andy Oleska's involved from Poland and involved the tree beekeepers' population and then Joachim de Miranda in Sweden. We're open to other collaborations in other countries, actually, because our aim is to report the existence of wild colleagues and then have established a monitoring platform, something like what we're doing in Ireland, and try and really kind of get a handle on where these populations are surviving and how they're surviving and advocate for them, I guess, you know, advocate for their importance.

You know, honey bees are first and foremost a wild species. They're not, they've never been domesticated. So, I think we need to get rid of this language out of our dialogue to do with honey bees, any idea of domestication and feral honey bees, because they are wild species that we can't control their mating and we can't control the forage.

There are exceptions, I guess. There are some groups or some areas where they have highly bred bees and they use instrumental insemination and they control what they feed, and they control as much as possible. But in Europe, in Ireland, certainly, there are wild species that we manage to some extent, and in some other parts of Europe that will be the same.

So, I think we need to understand more about this, advocate for them as a wild species, and protect the biodiversity.

Custodian Tracking Program and Proving Lineage Persistence

Amy

Grace, as I was listening to talk, I had like a thought or a question for every single thing that you had just said. No, it's awesome. It's making my brain really work right now, which is great. My brain should work most of the time. So, I guess a couple of things. So, you had discussed when you were a PhD student, you were finding wild colonies, you're finding, you know, nests that were in areas and then you would track them.

So, I guess the first question that I had was related to tracking them and how you did that and what your method was for that. And then, you know, you're talking about Free B, and I'm just thinking about your collaboration with all these other countries.

I know that you had already said that you collect, you know, the location of that, but what else is being done to those colonies or nests once you and/or colleagues are going to find them?

Dr. Grace McCormack

So, what we do here, what we've established in Ireland, is we have a reporting tool, so we link with the National Biodiversity Data Centre, and they hosted it on their system so that it's actually independent of me. If I changed to go back to marine sponges, it'll always be there for Irish people to report, and for beekeepers, the location of nests. That data gets exported to us.

And then we set up a platform, a monitoring platform on our website that we created in the last project we had that was funded by Research Ireland. So, I got funding for four years to learn more about the Irish bee, the wild bees in Ireland. And so, we've moved, we've done a lot in that project, which is great, but a lot we've yet to do.

So, we set up a monitoring system and a protocol and that was published last year, a protocol that's there for people to use where we ask. So, if somebody reports a colony, then we obviously validate it and we go talk to them and have the chat.

That's really important. Build a relationship. And then we invite them to become a custodian of that colony where they report activity multiple times a year. It's not enough. In the early years we, you know, we're trying to ring everybody it, you know, it's not very efficient and we're getting not very much activity maybe once or twice a year.

But it's really important to get the activity before and after swarming. So, we tend to get the crucial thing, you get the activity really after winter. So, you see that they survived the winter. But then, in Ireland, certainly, we have a very tough spring. And if you don't check them again till the end of the summer, those colonies could have died out multiple times in that timeframe.

So, they could have died out in a cold spring, they could have been replaced then when swarming comes in, but they could actually have died out again. It could have been an unsuccessful swarm, could have died out again, and another swarm could have come in during the summer. So, you could have a high turnover. And that's what they find in Germany.

You get these turnovers. So, we ask custodians to give us activity this time of year before swarming season starts. So, we take that it survived the winter, then we take it again after swarming season, again after the summer, then going into winter. And that's really important.

So, we have sampled a lot of colonies, but of course it's expensive. We've carried out some genomic work both on, you know, getting the diversity of the colonies. We've done some work on – we're now trying to put the paper together where we've proved that it's the same lineage.

So, we always get kind of skepticism when we present the work. “Well, how do you know it's the same colony?” And that's true because even with four times a year, a colony could die out and get replaced and you missed it. So, how can we prove that that's the same lineage? So, what we did is we've collected samples at multiple time points across from – the most we have now is about 5 years because the very first samples I collected, I didn't really collect enough bees because I was didn't know enough when I was minding the colonies, didn't want to kill too many bees.

But we have used genomics now to prove that the colonies that we sampled last year were either the granddaughter, the great granddaughter of the original queen that we sampled few years before. So, now the longest we have that we know is the same lineage is over five years.

We have a few colonies that we're tracking of many – some of them are still going since 2016, but we've only proven that they're still the same lineage in the last five or six years.

Comparing Disease Prevalence in Free-Living and Managed Bees

So, with the Free B, what we had planned to do was look at pollen, look of look at what the bees were bringing in. Were the wild bees bringing in different pollen, different foraging stuff than the managed local managed bees? And what about the pests and pathogens?

So, my PhD student who is just finishing up, Alex Valentine, done a nice study comparing wild and managed bees to look at the presence and absence of pathogens, so, the 16 major pathogens. And we've shown at least in Ireland and those colonies that she looked at, so, there's 100 colonies that there's no significant difference between managed bees and wild bees in the numbers and types of pathogens that they have.

The only thing that was significant was Nosema cerana, which is kind of overtaking Nosema Apis, was significantly higher in prevalence in my actually treatment-free apiary, and it was that year there was quite a lot of Nosema surrounding. Didn't kill those colonies.

Those colonies are still going, but there was a significant difference. So, it wasn't between the wild and managed bees, but it did show that treatment-free approaches you might find certain outbreaks of disease, and we also found that the managed and the wild colonies had multiple infections, but there were sublethal effects.

So, we didn't get to do the pollen work because where we were at the time, it was difficult to get foragers. The weather was really bad, and we thought, really, they're using the same environment here. It's not like they were going to bring in different pollen. With the workload that we had,

We just had to leave it out. So that's been brought in the Free B project. We are looking again not only at the present absence of pathogens, we're also looking at pollen. So, what the plan is for Free B is across these five countries is to collect samples four times, so spring and autumn, two years, and we will screen them, so from wild colonies and the nearest managed colonies that we can get.

So, it's the same area, the same pressures or whatever, and look at pathogens and pollen. And we're also collecting to continue the work we've been doing on the persistence of the colonies. We are going to do the kinship analysis and try and see, follow the colonies in these countries to see, can we prove as well that they're surviving in that time?

Impact of Hybridization on Wild Bee Survival in Ireland

Jamie

Grace, I hear you talk about this stuff and a lot of your research parallels some of the stuff that we're doing in South Africa that we talked about on this podcast before.

But I want to circle back to one of the statements you made earlier a bit in your introductory part. You were talking about genetic evidence for free living populations of Irish honey bees, right? And so, I want to think about that because I think about all the movement of bees in and out of Ireland and all over the Europe in general.

And you find these wild colonies, you collect these bees from these colonies, are you seeing these wild colonies or these free living colonies being mostly pure Apis mellifera mellifera, are you seeing them with integration of other subspecies? I mean, talk a little bit about that, if you don't mind.

Dr. Grace McCormack

Sure. So, I would say that in Ireland our evidence would suggest that it's a panmictic population. So, we're not getting a distinction between wild and managed bees in any area. I would say that there's local breeding populations, so we can distinguish bees from Donegal compared to Ireland, compared to Galway, compared to Tipperary.

But within each of those areas, the wild and managed bees are mixing on trees. Integration is becoming a problem in Ireland. During COVID it became a very big problem because we had a high number of imports. In comparison to other countries, we don't have as many imports, but they're having an impact on integration for sure.

What we find, now we're trying to prove this, and this year actually has been a really tough year for bees in the UK and some bees in Ireland. What we find is that the non-native queens don't

seem to survive in the wild. Now, there might come a point when if integration increases, then imports keep coming, that that will not be the case if we get a lot of hybridization going on.

But at the moment we're not finding very many non-native queens in the wild. We're finding a lot of low-level integration that we think come from drones. So, when people bring in bees from abroad and they're let fly, it's the drones that are mixing with local AMM, and they're mixed with the wild and the managed equally, right?

So, they're all sharing the same drone congregation areas. That's for sure. What we're finding, this year, for example, it seems like my student was just doing a check on activity in Donegal. He's saying that of the ones that died, they all seem to be the hybridized bees that have died, haven't made it through winter, whereas the pure bees are making it through winter.

And it seems to be similar in the UK. In areas where they have a lot of integration this winter, those hybridized bees are not making it. So, this is all anecdotal right? At the moment, we've no proof of this, just observations. So, it remains to be seen with Free B, and in the next 5 years, now that we've a lot of genomic data and we're tracking all of the survival, we'll need to be putting this together.

The work we're writing up at the moment, sorry, in terms of survival, the pure AMM bees have higher survival, higher longevity, higher persistence of the same lineage than the hybridized colonies. We have very few numbers though.

So, that's what it's indicating. So, with the Free B, one of the questions that we have and one of the questions I have, but I haven't had time to answer it yet so it can go into this next project, is the surviving wild colonies. If we look at their genomes, are they retaining more of the AMM genome in the ones that survive than the ones that don't?

So, Apis mellifera mellifera is the bee that is opportunistic and is surviving this, you know, remarkably harsh environment. So those bees that can survive in the wild will need to maintain those traits. So, the bees that are managed and artificially propped up by beekeepers by giving extra food and by treatments and all of this stuff, we know from biology that maintaining traits is expensive, right?

Energetically and genotypically, right? So, if a bee doesn't have to feed itself, a bee doesn't have to compete, you know, to fight against pathogens and maintain those genes, those traits, those behaviors that protect themselves, then they'll likely lose them, right?

That just makes sense. So, the bees that are in the wild having to do this all the time are retaining those traits. So, it'll be cool to prove that. Well, of course, we have a lot to understand about these things. There's an awful lot of work to do to show this. But that must be the case. That makes biological sense.

Exploring Supersedure, Genomics, and Epigenetics in Bees

Amy

So, Grace, what do you think some of the future research that needs to be done for this bee is?

Dr. Grace McCormack

I think we need a systems biology approach, a holistic approach to the different omics and behavior. So, one thing I'm doing for the next 5 years is looking at supersedure as an adaptive trait.

This was introduced by Beowulf Cooper in his book in 1986 and it hasn't really been in the scientific literature. So, I want to actually produce scientific evidence of this. The idea is that, in Ireland, the climate's so bad that bees will sometimes struggle to mate, to go on their mating flights, right?

In July, we have a lot of rain. And the native bees will mate very locally. So, we understand, right, that, I suppose literature would suggest that bees, queens and drones will fly some distance from their hives to avoid inbreeding. And we have polyandry going on, right?

So, they've mated with multiple drones and will go quite far sometimes to access those non-related drones. So, the idea in Ireland is that, basically, if it's raining, a queen will sometimes even mate within the hive and certainly within the apiary. So, there's a high likelihood that the virgin queen's going to mate with related drones.

In which case, you're going to get a high degree of very low viability, brood viability, and when the weather improves, the bees will replace her by supersedure. With bad years, beekeepers seem to see quite a bit of supersedure and sometimes quite late then by the time the weather gets good.

And so, it really depends on whether you've got drones present in the area when the queens are produced. Otherwise, you get queen losses. So, that's something I'm looking at for the next 5 years and looking at impacts then on, you know, so imported queens won't be able to fly in the bad weather.

So, you should get a difference in – it’s probably why there's some reproductive isolation going on and how we've been able to maintain pure AMM in Ireland because the weather is not suitable for mating, even for other non-natives. I did want to do some transcriptomics.

So, we know that I don't think that the genomes are very different, but there might be a difference in allele frequencies in certain genes in the bees that can survive in the wild and the and the bees are very susceptible. So hopefully, we'll pick up that kind of stuff in the next few years. But what about the expression?

So, there could very well be a difference in the expression of genes, so the olfactory genes or behavioral genes or some other metabolic genes that are expressed differently in wild and free living than managed bees that could actually aid their survival.

And what about epigenetics? I'd like to have done a transcriptomic study, but I think it needs to be a proper one. I think we need a big one. We were going to do some, but I think they'll just be too much noise, and I won't be able to pick out patterns. So, I have held off until I can get in a project that would yield a really good study.

And it's the same with epigenetics. We know that epigenetics bears a big role in honey bee behavior. So, this is where you've got environmental signals that change the expression of genes. So, they add little chemical moieties to the DNA to make it either able to be expressed more or not be expressed at all.

And those moieties that get added to the DNA due to the environment can be inherited, right? So, the DNA itself doesn't change, but the structure of the DNA changes so that, into the future, different behaviors might be inherited.

It's really cool, this intergenerational behavior. I mean, I think it's a really interesting thing. So, we know that it's important for defensiveness in bees and for honey production. And we know epigenetics is a role to play in whether a bee becomes a queen or a worker.

So, there must be something there as well. I think that would be really cool to look at. So, if you look at that in a holistic manner, you're looking at the DNA and change the DNA, but you're looking at the RNA and then looking at proteins as well. That would be really cool.

I think that work needs to be done, and it will be done, I'm pretty sure, on wild bees into the future, now that we're finding them, they're popping up everywhere and there could be such a good resource. I think from a production point of view, even we need to understand what's going on better.

Supporting Native Irish Honey Bee Conservation Areas and Infrastructure

Jamie

Well, Grace, I want to expand on that a little bit because there are also some management or conservation needs, and so there probably has to be some research behind conservation strategies to protect the free-living Irish bee. Could you elaborate on this a bit?

Dr. Grace McCormack

Yeah, I mean, it's difficult. That's a good question. I think, from a research perspective, it's quite difficult to do. There is a paper, I hope it should come out, I'm not involved in it, around looking at conservation areas and the impact conservation areas across Europe.

So, I think it was part of a European project looking at their efficacy, and that is difficult to do. So, in Ireland we have the native Irish Honey Bee Society that has been doing really good work. And in the last five years, I think the number of voluntary, I should know this, they'll shoot me. But the number of conservation areas has shot up from, like, about 50 and then up to 90, but now it's at like 450 to 500 voluntary conservation areas in the country.

The thing is they're not legally supported. So, these range from a back garden to a big park. It would be lovely to do some research to see how efficient that is. I mean, it's like the, I guess, nature-based solutions involving citizen scientists.

You obviously have a really effective extension laboratory doing that work. So, Native Irish Honey Bee Society are doing that in terms of encouraging people to develop planter conservation areas, but there's no research being done to see how well they're working.

And doing that, even with our national parks. It would be great to have our national parks in the country as voluntary conservation areas, but that takes a lot of manpower to look at how that's going to work, the research needs. And there's a lot of work needing to be done, I think, on, well, in Ireland producing enough queens.

So, this balance between apiculture and conservation, that could do with a lot of work as well in terms of, you know, you've got people who need to make a living out of keeping their bees, but then you don't want them to impact conservation of an important population.

So, I think both sides of that could do with some research there on that as well in providing support to both of them, producing enough native queens for sale that people aren't going on the Internet to buy them, and there isn't the infrastructure in Ireland to do that.

So, we need more infrastructure, we need a Bee Research Institute. We don't have anything like that in the country, which, part of me thinks is why we've managed to maintain the population as it has. And I would be loathed to change the ethos and the vibe that goes on in Ireland around beekeeping.

But at the same time, we need to do some. There are queen rearing groups now, the Native Irish Honey Bee Society, again, they're leading the way in terms of volunteer people getting money and providing money to help people train people to rear queens locally so that we're advocating for the use of local bees now and that there are enough queens locally to do that.

So, there's a lot of work to be done there. There needs to be better research infrastructure and better support. We don't have any genotyping service in the country. It's a struggle for anybody to do something innovative, right?

Advocating for Legislation to Protect the Irish Honey Bee

Amy

Yeah. I want to elaborate a little bit just on the collaboration and working together to make some of this research happen and being able to kind of get the word out there. Can you describe some of your work with the government officials through this process?

Dr. Grace McCormack

OK, there's a bit of an issue because honey bees are one of the only species that are regarded as domestic and wild. It's a domesticated species. It's involved in all of the trade, right? So, global trade in honey bees is allowed and this is an issue because the importing of non-native honey bee subspecies into an area causes a problem for the local subspecies.

But from a government position it's difficult because there are European laws around free trade so it's a difficult situation. So, conversations with government officials have been going on for a long time to try and protect the bee. Firstly, they were of the opinion that the bee was extinct, so we had to disabuse them of that notion and produce proof that AMM exists in a pure form in Ireland.

And then it was, well, how much does it exist? You know, then the free-living bees, proving they existed and now, you know, there's a lot of evidence to suggest that we have something unique in the country, and we need to protect it. But the government still has the issue that they have to go to Europe and advocate for this now.

European Union allows for member states, strongly encourages member states to protect their biodiversity, and bees are so important. But if the government official has to, you know, try and prevent another country from blocking imports, then it's a problem if Ireland are trying to block imports.

So, you know, there are these understandable issues. But that being said, I think it's incumbent upon the government to protect a unique resource. So, something has to be done. The next question is well, which department office deals with this?

So, at the start it was the Department of Agriculture, because bees are domesticated agricultural animals. And now we've proven, actually, that our Ireland has this distinct ecotype of wild colonies, the wild bees that needs to be protected. So, that's the National Parks and Wildlife, which is a Department of Environment and Enterprise.

So, we were lucky in that a senator – so we have two Houses of Parliament in Ireland. We have the Seanad, there's the lower house, and then we have the Dáil Éireann is the upper house, and senators are in the lower house, the Seanad and we have TDs in the Dáil. So, a senator became a beekeeper, became aware of the situation of the native Irish honey bee being a threat.

And he was also a barrister, and he involved the climate association. This is a bunch of lawyers, barristers in the east of the country that do pro bono work for climate. They're really passionate about these things. So, they used our scientific evidence, had lots of meetings with them, and they wrote this protection of the Native Irish Honey Bee Bill in 2021, October 2021 that was introduced, Seanad.

And amazingly, you know, it is absolutely amazing to listen to the debates and stuff. Thursday night before bank holiday, senators actually stayed behind instead of going off with a long weekend. And they stayed in the Seanad and debated the bill.

But there was no debate because everybody in the room was totally supportive of the bill. And the chairman actually said he was really surprised. Very, very rare. Never heard of the situation where there wasn't actually a debate at all. So, that passed through the Seanad, and it's now at the Dáil, has stayed through the Dáil.

We were invited to the agricultural committee a number of weeks ago to present and discuss this with them, and they were also total cross-party agreement around that table around that something had to be done. So, there's been research done. The Department of Agriculture were unsure for a while and they're still unsure as to whether a ban of imports is a proportionate response to the threat.

There was some research carried out by an international team of which I was a member at the time, leading this group to look to see what was the evidence, was there something unique in Ireland? A whole series of questions. So, we've completed that report.

It hasn't been released yet. And so, yeah, it's been a long struggle, as it always is, right? Because it's a difficult thing for them to do and they have to be sure. So, it's been frustrating waiting and waiting and waiting and, you know, giving data and then waiting and waiting and waiting.

I'm cautiously optimistic that something will give. And, you know, even if I don't know that something has to be done, I think at this point in time it's really clear. But I do understand the difficulty that some of the government officials are in if they make that decision.

Ethical and Genetic Reasons to Preserve Free-Living Honey Bees

Jamie

Well, Grace, listening to all of this, listening to everything you've said about the Irish bee, all the research that you've done, all the obstacles you've had to overcome, my last questions may be the most important question of all, why is protecting free living bees important?

Why should anyone put the amount of effort you've put into this and others pursuing similar things? Why is protecting free living bees important?

Dr. Grace McCormack

Well, there's loads of reasons from an ethical and moral perspective. The honey bee is such an important species on the planet. It has evolved and diversified to such a degree. It's an amazing beast. I mean, we haven't even talked about, you know, the sensitivity of bees, the intelligence of bees, anything like that, what we can learn from bees, how they go about their business.

This is digressing a little bit, but I was at a – Robert Pickard came and gave a workshop in Ireland, a lecturer in Ireland a number of years ago. Most of his lecture was about love, and it seems really weird, but I came away from that lecture with a greater awareness of the importance of love.

Anyway, that seems weird and a big digression. But the thing is that from an ethical perspective, I think honey bees are a wild species and they deserve protection in their own right, full stop. The second thing is though, we have changed so many things, right?

And we've bred these bees that can't survive on their own. Look at how many times colonies have to be treated in certain parts of the country, multiple, multiple, multiple times, every two weeks in some areas against parasites. We know through failing bees that does not need to happen. Do you know what I mean?

That is alien. It is really not normal. So, if we don't protect these wild bees, if we don't pause and think about what we're doing and think about what these wild bees can do and survive and use that information in improving our own beekeeping, I think we'd be a little bit crazy if we allow these artificial strains that have been propped up by beekeepers to actually take over.

If we continue that trade and extend that trade and aren't careful, would we end up with kind of a hybrid bee that has got all the traits that a beekeeper might want in terms of, OK, if you feed it enough and you treat it a lot with chemicals and you put it in a specific environment that is going to produce the honey for you, but then it's totally reliant on the beekeeper.

My mind boggles that we would ever allow that to happen. The free-living bees show that they have all of these traits that allow them – they produce honey. I guess, like the colony I have taken from a wild hive, wild colony and put in a box produces 50-60 kilos of honey.

Maybe that's not a lot to a bee farm or whatever, but it's certainly enough honey, especially in the environment where they're in. So, the wild colonies are also able to utilize the environments that they're in. So, the Irish bee, for example, the wild bee we have tend to have a kind of what we call a June gap.

Sometimes there's not much forage in June. So, the Irish bees, wild bees will come off late, so they'll reduce laying. They're what we call they're very frugal with their stores. They mind their stores. They come off late until they start seeing good pollen and stuff coming in again. And then

she'll ramp up again very quickly and they can bring in a lorry load of honey within a few weeks in August to make up for the loss.

They also then go off late going into winter so that they're not utilizing stores. So, all of these behaviors, we'll just lose and then we don't have a bee that can live in the wild anymore. For me, it's enough to say these bees deserve to exist, but they do provide this genetic resource.

You know, genetic variability is the key to evolutionary success, right? And if we don't want to lose species, we need to maintain genetic variation. It's fundamentally important for honey bees. Genetic variation is crucial for their colony health. So, we need to maintain the biodiversity associated with honey bees. And they're all residing in these free-living bees living in the wild.

Concluding the Discussion on Irish Honey Bee Research

Jamie

Grace, I don't think I could have said it better. Well done, great interview. You've sold me. You sold me a long time ago, a couple of years ago when I saw you give these talks. And I congratulate you on your research. I also congratulate you on your fervor and your dedication to ensuring the survival of this important subspecies. So, thank you for being a guest on our podcast and continued luck with your research.

Dr. Grace McCormack

Thank you so much. It was a pleasure. Thank you.

Question and Answer Segment

Stump the Chump

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

Amy

All right. Welcome back to the question-and-answer segment. Jamie, the first question that we have today is talking about hobbyist beekeepers and what can a hobbyist do about developing mite resistant queens?

Jamie

Yeah, Amy, this was born out of a question I received when I was answering questions for the American Bee Journal, right? And I got a question from maybe someone who's really frustrated because they hear that we should be developing mite resistance stock, etc., and they're thinking to themselves, well, gosh, this sounds more difficult than I imagine.

What can I actually do? And honestly, Amy, my answer is, I think, going to be the reverse of what the questioner wanted to hear. I would say the hobbyist maybe shouldn't even try at all.

And I'll say that because, you know, there's only a handful of ways to get to that stock. You can just leave the bees alone for eons and they'll develop it on their own, right? Because if they didn't, then the mite would not have a host. And so, there will be a balance in the future, but beekeepers don't always have that time to wait.

I do know that there's research around the world suggesting that there's some feral populations or wild populations developing resistance. All that's good. But that's not something I would argue is going to happen very quickly in the backyard of a hobbyist. Therefore, the hobbyist only has option two, which is to start a breeding program.

But the fact that they're hobbyists means that they only have a few colonies and a breeding program is not really the best strategy for them. So, what I would say what a hobbyist has to do with this whole Varroa resistance thing is just support the breeders who are already doing this.

And I need to make sure my terminology is kind of correct here. Breeders are those individuals who are actively working to select for certain traits in their stocks. They're trying to breed those traits into the stocks. And then the producers, sometimes the same individuals, the producers are the ones who are trying to mass produce those stocks for sale to the beekeepers.

So, sometimes, the breeders and producers are the same people. Sometimes the breeders are the ones producing the stock and then they outsource it to the producers who produce it in great numbers. But support those individuals. Hobbyists should be buying their coins from those individuals who are really trying hard to produce resistant stock.

That's got replicable traits, like you use this stock and you consistently get these traits that confer resistance. And that's what I say is don't bother with necessarily trying to do it on your own. Allow it to be done by those people who are doing this for a living and support their operations.

And I would say beyond that, how do you find those people? Well, network with local commercial beekeepers or other beekeepers in your area to see what stocks they're using and getting good success rates with and reach out to the breeders and the producers of those stocks and say, what are you doing to ensure consistency in your stock, to ensure the Varroa resistance, to ensure honey productivity.

And essentially perform an interview on these folks to see if they're producing consistently the stock that you want to use. So that's what I would recommend rather than, you know, bashing your head against the wall, as it were, to produce this on your own. Rely on those individuals who are doing it for a living.

Amy

An Equal Opportunity Institution.

Definitely. All right, number two. The second question that we had, what are some things you wish you would have known when you started beekeeping? Of course, you started beekeeping when you were like 2 years old.

Jamie

Yeah. You know, I was young.

Amy

Let's say that you're a grown-up and you want to get into beekeeping and there are some things you just wish you would have known, good and bad.

Jamie

Yeah, that's a hard question because I was thinking about this when I saw that you were going to ask me. And I'm like, you know, I was thinking, well, gosh, it would have been great to know everything then that I know now about bees. But then I thought about it and said, well, honestly, one of the things I've enjoyed about bees is unwrapping the mysteries as I age.

I kind of liken it to marriage, right? You know, I've enjoyed learning and discovering more things about my spouse as we've grown together over the years. And so, that's been part of the fun and joy of marriage. Well, likewise, in beekeeping, I really just, I appreciate that I didn't know everything and that there's so much more than I get to know.

So, one of those things I wish I had known is don't rush to know everything. A lot of it is just to let it unfold before you as you grow in your beekeeping skill set. And honestly, that's one of the greatest things that I've known. I guess, if I had to worry about bees and keeping them alive, one of the things I wish I had known earlier is that the importance of managing queens and all the things that can go wrong in that space.

The importance of managing nutrition and all the things that could go wrong in that space. And of course, the importance of managing Varroa and all the things that could go wrong in that space. But beyond that, I really just liked my naivety and enjoying the process of discovering new things as my beekeeping experience matured.

Amy

Very interesting. I was not expecting you to answer that way. I don't know what I was expecting you to answer with, but that was not it.

Jamie

I mean, I was thinking about this, gosh, it'd be good to know how to control Varroa and manage feed and, and all that queen stuff. But honestly, I think not knowing it and having to work my

way through those things are things that taught me what I wish I had known back then is don't worry, Jamie, you're going to figure this stuff out as you mature and beekeeping and it's going to be OK, right? You worry a lot on the front end about things that don't manifest. So, I kind of wish I had known that.

Amy

That's funny. Yeah. I was thinking you'd be like, oh yeah, the management takes a lot more than you would have thought, but no.

Jamie

Just be patient with it, Jamie. I think that's what I wish that I had known. Maybe.

Amy

Be patient with it. Yeah, I agree. All right. So, the last question that we have for this Q&A, we've got a pretty short Q&A today, but I think it's still kind of fun, you know, to talk about some of these things. During Bee College, we have this event called Bee College, many of the listeners know that we have this, we do it twice a year, you know, and every single time we have Bee College, I put a survey out and I always ask people, like, what do you want to see for next time?

And oftentimes, it's funny, you can't make everyone happy. I know this. I try to make everybody happy, but it doesn't always happen. And something that always gets asked is, you know, we want some advanced beekeeping topics. And so, I guess the question for you, Jamie, is what would you consider an advanced topic in beekeeping?

Jamie

Yeah, again, I kind of saw that this one was on the way and I got excited about that. And so, I'm sitting here thinking to myself, well, what do I think is an advanced topic? And that's a little unfair because I've been doing this for so long and I do it from a research perspective. So, everything you know, anyway, from a beekeeping perspective, I think an advanced topic is selection, breeding, and production of queens.

I know it's easy in the sense that you can just dequeen a colony and they'll requeen themselves on their own. But if you really want to get into producing quality queens and learning the biology behind that and the scheduling that's necessary to get bees through the system, you know, that's an advanced topic.

And if you want to expand further, instrumental insemination and selecting for hygienic traits and all of those things, to me, this is an advanced topic in beekeeping. Again, specifically beekeeping because there's lots of advanced topics in honey bee science.

But from beekeeping perspective, the whole queen production thing I think is pretty advanced. I think another thing that's advanced that maybe on the front-end sounds like it shouldn't be, but it really is, is the knowledge associated with providing pollination services and meeting the pollination demands of the various crops.

And some people will say, no, no, no, no, Jamie, that's very easy. Just go throw your bees out in the field and the bees do the rest. Yeah, but you really kind of need to know stocking densities based on those species of plant. You know, watermelons have different stocking densities than blueberries do, than almonds do, things like that.

So, you've really got to understand plant phenology, plant biology, you know, weather effects on plants. And you also need to know management-related skills that keep colonies in the right strength and productivity, etc. to be able to provide those pollination services.

So, I think there's a lot of knowledge needed to do both queen production and providing pollination service as well. And I mean, you could argue the same for honey production. You really need to know plant phenology, plant bloom, what happens if the seasons are early or late or cold or wet or dry and things like that.

So, there's a lot of advanced topics related to that as well. And of course, the other big one I would suppose would be disease and pest recognition and control, right? I strongly encourage beekeepers to be able to dissect bees for tracheal mites, dissect bees for Nosema, do alcohol washes for Varroa.

And those things require some skill set and, and training and knowing the Varroa life cycle, being able to recognize when they're a problem. All of this is stuff that's not stuff that hobbyists just usually come out of the gates or brand-new beekeepers usually just come out of the gate knowing. It takes time, takes skill, takes practice.

Amy

I think it's a really fun question just because, you know, as you mentioned at the beginning of that, it's like we're all at different stages of beekeeping, but we all, you know, have different, I mean, we just all have different knowledge, right? So, like, what is advanced? It depends on where you are in your beekeeping world and also what you have focused on or who you've worked with. And so, that's a fun question.

Jamie

Yeah, it is.

Amy

I came up with that question.

Jamie

Yeah, well done. Well done.

Amy

Thank you. Thank you.

Jamie

It's fun. I mean, things that are really advanced for me from a scientific perspective these days would be different from honey bees. But you know, all the gene related work, what genes are responsible for what behavior, genomics, proteomics, metabolomics, all of that stuff.

The omics. The omics. I think about honey bee biogeography, which I thought was really simple at one point in my career, but now I think it's very complex. Understanding wild honey bee nesting habits, all that stuff's very advanced to me. And some of these new cutting edge technologies for disease and pest control, you know, RNA and some of these other things, it's pretty advanced.

But hey, you know, back to the second question. That's part of that magical unwrapping of new knowledge gaps all the time and getting to learn all the time. So, it's advanced, but it's also just straight up cool.

Amy

Yeah, I agree. All right, well, thank you all for your questions. I thank myself for asking one of the questions every once in a while too. All right, everyone, you know what to do. If you want to send us a question to send us an e-mail, we love follow-up questions. We love just thinking outside the box. And yeah, send us an e-mail.

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 An Equal Opportunity Institution. 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.