EPISODE 224 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.

Amy

Hello, everybody, and welcome to this segment of Two Bees in a Podcast. Today, I am joined by two of my very dear friends. I'm excited to interview them today. And the first of the two is Dr. Pierre Lau, who's a Research Ecologist, Pollinator Health and Southern Crop Ecosystem Research Unit at the USDA ARS in Stoneville, Mississippi. The second of my dear friends is Jennifer Standley, who used to be a master's student here at the University of Florida Honey Bee Lab, and she is currently a PhD student at the Auburn University Bee Center working with Dr. Jeff Williams in the Department of Entomology and Plant Pathology at Auburn University in Auburn, Alabama. Thank you so much, Pierre and Jennifer for joining us today.

Dr. Pierre Lau

Thank you for having me again, Amy.

Jennifer Standley

And thank you as well. It's great to be back.

Amy

So, we brought you both on to discuss a very interesting project that you've been working on. Some of the people here in the United States know the plant as a Chinese tallow plant, and you both have been involved with Chinese tallow research.

And so, before we get into that, many of our listeners here, they've probably heard you speak on our episodes before, but some listeners will either start backwards, or they just go through and listen to random episodes. So, why don't we go ahead and have you all introduce yourself again here? I'll have you go first, and then Jennifer, after Pierre is finished, you can share with everybody how you got into the honey bee world.

Dr. Pierre Lau

Yeah, so I got into the honey bee world from the science side of things. So, when I was in college, I ended up finding a bee lab that I was really interested in, and it was actually a native bee lab on watermelon pollination, and I got really interested in that.

I was able to apply the concepts I learned in ecology into the work that I was doing in the lab. And I found the honey bee lab afterwards with Dr. James Nye, and I learned a lot about their behavior and was completely fascinated with honey bees. And from then on, I've been non-stop researching bees and studying them from a nutrition and behavior perspective to improve their health.

Jennifer Standley

OK, well some of it for me, so, I come from the non-research side. Originally, I was a hobby beekeeper since 2014, and I just fell in love with everything about honey bees. As I think a lot of us have found out with beekeeping, their complex biology fascinated me.

Beekeeping itself just gave me that peaceful kind of Zen moment. I really appreciate the community beekeepers and then, of course, all the good things we get from honey bees. And as a beekeeper, I got to know the UF bee lab and all the great things that they were doing, as you guys were doing. And I had contemplated going back to school.

I also became a UF IFAS master beekeeper. So, I decided I wanted to pursue Graduate School. I wanted to do research on honey bees. I was lucky enough to acquire funding with the UF Entomology and Nematology department as the outreach coordinator to do my master's at the UF bee lab under you, Jamie.

And once I finished my master's, I decided, you know, I love research so much and that's where I belong and I want to continue with my PhD. I heard about Dr. Jeff Williams and Auburn University Bee Center, and I've heard great things on them. And so, I decided that, you know, that's where I wanted to go get my PhD, and hopefully, I should be finishing up in a little over a year now.

Jamie

Well, Pierre and Jennifer, it's really, it's great to have you both on this podcast. And we're, of course, today talking about some Chinese tallow research that you're both involved in. And there's recently been a paper published, "Chloroplast markers for detecting Chinese tallow DNA in environmental samples." We'll get into that.

But before we do that, a lot of our international listeners and people outside of the area where Chinese tallow is present in the US really want to know what this is in the first place. Why would this be a topic that we share with our listeners all around the world? So, hey guys, what is Chinese tallow and how's it related to beekeeping here in the US?

Jennifer Standley

OK, so I'll just give a quick background of it, and I'll just call it tallow just so it's easy to say, but its scientific name is Triadica sebifera. And I think it's really cool when you break down words. But if you want to break it down, translated from Latin means tallow bearing. And tallow is also fat, so fat bearing.

And it gets its name because of the oily seeds that it produces. It is originally from the China region, but it was introduced into the US at several time points, but the first time in the 1700s for the use of production of things such as soaps and fuel.

But at this point in time, now it is considered to be a highly invasive plant in the US. In the US, it's commonly found in the southeastern regions, considered highly invasive for its high seed production, the dispersal rate of the seeds, it reduces native biodiversity, and it's been slowly expanding its range and abundance throughout the southern US.

Amy

So, as Jamie mentioned, you recently published a paper, Pierre, I think you published a paper that recently came out. So, you can tell us a little bit about this. I'm interested to know about the background of this project.

Dr. Pierre Lau

All right, so throughout my PhD, I did a lot of work on understanding the origin preferences. And part of that work did involve some collaborations with Jamie and University of Florida starting 2014-2015. In a lot of that work, we looked at what bees were collecting at different regions of the United States and Texas, and also how it can vary over time.

And in that study, we did find Chinese tallow in some of the pollen that bees were collecting. And in a separate project, we found Chinese tallow in some of the nectar and honey that we were analyzing as well. So, Chinese tallow's always been in the back of my mind. When I started my position here at the USDA, there was a lot of interest to understand Chinese tallow as well, too, especially because there are initiatives with the USDA APHIS to control Chinese tallow because of how much it spreads. So, in many parts of the southern US, tallow is very and highly prolifically invasive, but it still provides a major nectar source for honey bees.

And traditional surveys for detecting them usually rely on visual identifications, which can, especially when you're looking at pollen, it can be a big miss because pollen identification can be very difficult. But you can also do ground surveys, but that is a very time-consuming process where you have to send someone out and do a bunch of ground truthing to identify where a lot of the tallow plants are.

So, we basically saw an opportunity to bring environmental DNA tools, and in this case, chloroplast martyrs into ways that we can monitor this plant. So, by identifying the tallow DNA in the samples such as honey, pollen or even like soil samples or water, we can help streamline and make it easier for us to understand tallow populations and distributions for applied ecology.

So, what ended up happening was we created this task force for researching Chinese tallow, which was comprised of USDA researchers, USDA APHIS, and also stakeholders and beekeepers. And we met at a summit, tallow summit, a couple years ago in Louisiana to talk about how we can research Chinese tallow to better understand its importance for bees and also its invasive nature.

From this meeting, Jennifer actually got in touch with some of the USDA US Forest Service folks, and this project came into fruition. So, I'm going to let Jennifer take over here to talk about how everything was brought together.

Jennifer Standley

Thanks, Pierre. So, yeah, you know, I started my PhD at the Auburn University Bee Center with a focus on tallow, and that is my primary PhD thesis. I'm investigating the connections between honey bees and tallow pollen specifically.

And through my research, I attended this tallow research summit that Pierre was speaking of, presented some of my preliminary data, I spent two years of survey work in southern Mississippi and throughout Alabama collecting honey bee curricular pollen.

And yeah, the researchers, the two main head authors on there, Mohammad and Rabiu, had contacted me who are interested in developing a primer for identification of tallow.

Jamie

All right, Pierre and Jennifer, you gave us a little bit of background for your motivation for this project, you've talked a little bit about what Chinese tallow is, but I really want to help our listeners, especially around the world, know why this is an issue for beekeepers. I think it maybe kind of pops up a little bit in what you've said, invasive species, honey plant, things like that. But could you elaborate on that for me please?

Jennifer Standley

Sure, Jamie, I guess I'll go and speak about a little bit. What we know about tallow for honey bees, we do know tallow produces a copious amount of nectar during its bloom, which is early spring in the Southeast here in the United States. And it's generally regarded by beekeepers as a producer of good quality honey, a copious amount of honey as well.

And so, it's a good source of income for beekeepers in those regions during the flow. So, in addition to honey production, it's also thought to provide colony build up for commercial beekeepers in which these beekeepers then use their colonies to move throughout the US for pollination services.

While we do know it's a highly nectar producing plant, there is literature out there, there was not much known about the tallow pollen, as I mentioned, investigating how tallow pollen plays a role for honey bees, but I can say that you know, through my research, as I mentioned, the corbicular pollen I collected over 2 year period and working with some really great beekeepers, I have to say, commercial beekeepers, in Mississippi, I really appreciate – they were very generous in letting me have the use of their colonies for the two year period. But some of that preliminary data does show that the corbicular pollen that honey bees did collect ranged in 2023 from like 7.6% up to 78% was the relative abundance of tallow pollen collected, and then in 2024 it was from 33% to 92% tallow pollen. And as we know, pollen is very important for brood production, and so this could be attributed to colony build up for these colonies.

Amy

You know, it sounds like you both are obviously working together, that's why we have you on this podcast. But you both have done independent projects from each other. I'm interested to know, I guess, you know, our listeners today are getting like a two in one deal. But I'm interested to know, you know, how did you conduct the research for detecting the Chinese tallow DNA? What were some of your program objectives? And then how did you basically conduct the research?

Dr. Pierre Lau

Yeah. So, I just want to give a shout out to our US service collaborators on this too. So, they were the ones that primarily did all the lab work for this research. So, when Jennifer met up with them in at the pollinator summit or the tallow summit, they agreed on transferring some of the pollen that we have already identified as Chinese tallow and providing them a few samples.

So, what they ended up doing was they mined the complete genome of Chinese tallow and they looked for short DNA regions that were unique to tallow but conserved enough to be reliable for amplification. So, they ended up designing 2 primer sets, one that was very specific to tallow and one that's a little bit more broad that are close relatives to the same subtribe.

So, some of the plants within that same family would include plants like Queen's Delight, for example, and they can be difficult to distinguish those on the molecular level. So, these primers were tested on the plant tissue for specificity, and then they were mixed with environmental samples as well, including honey and bee pollen to confirm that they were able to pick out Chinese tallow pollen DNA in those mixtures.

So, this will really help out with those environmental monitoring studies where we're really trying to just focus on tallow itself and understand its distribution and spread in the environment.

Amy

So, Jennifer, what about you and some of the preliminary results? How did you conduct your research and what were the objectives that you had?

Jennifer Standley

Well, that's great, Amy. Thanks for asking on that. So, some of the preliminary data, overall through like the pollen, I have a series of projects, but the pollen survey work over 2 years, I was interested in one, are honey bees collecting tallow pollen, and two, I'm very interested in alternative forage for honey bees.

What if tallow did go away? What are other trees that we or forage that we can promote for honey bees? So, this consequently let me into the world of pollen ID where Pierre has been super helpful and being my mentor for that. Additionally, looking at alternative floral sources and if honey bees do collect how pollen, I was interested in some of the alternative floral sources and how they influence honey bee physiology.

So, I did dietary hoarding cage work with the different pollen sources. Additionally, I'm interested in the in vitro larval development too, when these larvae are fed the pollen treatments as well. So, I'm looking at all avenues of one, how does tallow specifically influence honey bee health and physiology as well? And then how do some of these other alternative floral sources influences honey bees as well?

Jamie

Well guys, these sound like really neat and very needed research projects on this particular topic. I'm going to ask if you can share what are some of the key findings you've made today, and maybe Pierre, you go first, and then Jennifer, you next.

Dr. Pierre Lau

Yes. So, the main finding that we found was that these specific primers were able to amplify specifically just tallow DNA, and it didn't show any cross reactivity with any of the local flora. So that's a great sign. So, even though we had a mixed set, it was really able to narrow down and ID that tallow, whereas the broader set reliably flag tallow along with its close relatives in the environmental samples known, from like known tallow areas, we actually detected a plant DNA in both the pollen and honey. And so, it really just demonstrates real world applicability. And for some of the other researchers out there, some of you might be familiar with DNA metabarcoding. If we compare this study to all those, why don't we just use DNA metabarcoding to detect that?

Well, DNA metabarcoding is a way to really screen the broad community snapshot of what's there. And it's a much broader way to look at everything as a whole. It can capture like hundreds of different plat taxa and really uncover unique and cryptic taxa that you may not be expecting.

But it is a lot more expensive per batch and some of these rarer species can be missed, whereas for this targeted approach here, it's extremely specific. And if we're really interested in developing a research question that is focused on Chinese tallow, this single species approach will be much faster and will also be much cheaper because there's no community context in this.

So, if we're trying to maybe look for early detection of tallow and then spread and distribution or where beekeepers can, if they're searching for tallow in the environment and we're trying to look at like pollen or honey samples, we can really just amplify that specific part of the chloroplast and look for tallow as a whole.

Jennifer Standley

Okay, just to follow up with Pierre. So, first in reference to the manuscript that we're speaking of, you know, I would just say that it highlights the utility for invasive species monitoring such as floral source tracing and also eDNA for based ecological studies.

And if I want to just go on to with my current research and the applications that I have been able to demonstrate that honey bees do collect tallow pollen, and then as far as the other work, I'm still in the process of going through all those results.

Amy

So, Pierre and Jennifer, as we kind of end this podcast, I'm wondering what are some of the practical applications, you know, regarding tallow beekeeping and what does the future look like?

Dr. Pierre Lau

I see really three areas where this research and the results of this research can be taken away for practical use. So, for beekeepers, it's really a good way for them to verify whether or not tallow is contributing to their honey flow.

So, let's say that they got a honey sample and if there's a lab that's able to take a look at that, they can send it out and that lab can just amplify that specific marker and look for tallow to see if there is any tallow in their honey sample at all.

For researchers, this can be a very useful tool for monitoring tallow and same for regulatory agencies. It's a really good potential early warning system. So, let's say that they have honey samples from across the country, and they can just easily run through those samples if the question is whether or not tallow is present or absent in the samples.

And they can detect the tallow DNA and use environmental samples. And it can possibly reveal areas where tallow can be spreading and where trees can then be identified in person and possible control can happen for a more targeted management.

So, really, I see three areas of benefits for beekeepers, researchers and regulatory agencies for land conservation.

Jennifer Standley

And as Pierre pointed out, this will be, in terms of environmental monitoring, will be good as we know, as I mentioned, that tallow is slowly moving more northward and detection in those areas. Additionally, on my end with my research, I'm interested in, nutritionally, how tallow does apply for honey bees.

But you know, I'm really interested in nutrition and finding good floral sources for honey bees, especially some that might be more of a native origin here in the US. So just definitely important to have the beekeeper and the honey bees' interest at heart.

Amy

Yeah, absolutely. Well, you know, even though tallow's been around for a long time, it's really great that you both are doing research on this, and I'm excited to see where your research is headed in the future. Thank you so much, Pierre and Jennifer, for joining us today. As I mentioned, you know, I'm excited to see where your research is headed.

I'm sure I'll see you at conferences. I'm sure people will see you and hear your research at conferences. I'm excited to see that there's a lot more research going on with tallow, and I appreciate having you both again on the podcast today.

Jennifer Standley

Hey, Amy, yeah, it was great being on the podcast. As you know, I also look forward to seeing you at conferences, even Jamie.

Amy

Even Jamie.

Jennifer Standley

And miss you guys. I really had, I had a great time being at the UF bee lab. And anyways, thanks for having me back on.

Dr. Pierre Lau

Yeah, thanks for having me as well too. We really enjoyed it.

Amy

All right, Jamie, what did you think about the research and the episode and the topic of tallow?

Jamie

Yeah, it's great to have Pierre and Jennifer on. It's great to know that they're working on this topic, and I know we've got a lot of people out there listening, going, why is this an issue at all? Why do you care about something like this? And it's really simple, Amy, you know, as we were listening to them talk, it's very clear that honey bee colonies use tallow. We've known they use it for nectar and the conversion to honey.

It's an important honey crop for a lot of beekeepers in the area where tallow is present. Jennifer is, you know, trying to discover, trying to research how much or if bees also use it for pollen. So, we know beekeepers use this. We know their colonies use this.

We know it's important to them. But if you remember back to the very beginning of the interview with both of them, this plant is also very invasive in the areas where it occurs. So, it's this kind of tension, as it were, and you know, this isn't the only example, we've talked about this in other episodes of the podcast, but it's kind of this tension between this plant that's invasive and there's control efforts targeting it versus, you know, bee colonies that use it and beekeepers who derive significant, you know, economic benefit, so much so that it can compose a lot of their honey production for the year. And so, it's really good to know that Jennifer and Pierre and their colleagues are studying this plant. They're studying how bees use it. They're studying, you know, its contributions to apiculture to add those data to the pile of data that people are considering when they're trying to figure out how to address this issue.

You know, we're here just talking about it, we're here highlighting their research and it's great to know that there are people working on it.

Amy

Yeah, absolutely. I think, you know, just the future of honey bee research, a lot of it is, from what I think I see, is a lot of it's going to go into nutrition, and I'm really excited for that. So, you know, we'll see what happens.

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, did Apis mellifera always store excess honey or is that a result of beekeeping and

us kind of manipulating like hives and frames or is that just an Apis mellifera thing? Do all bees store that much honey? Tell us about that.

Jamie

This is a thoughtful question I've never had asked of me before. OK, so, you know, if you've listened to me on this podcast, you know that our lab believes that there's 12 species of Apis, so 12 species of true honey bees. Eleven of those occur in Asia. One is Apis mellifera.

The one the question is actually about, Apis mellifera has that natural distribution in Europe, kind of western Asia / the Middle East and then all of Africa. OK, so let's pause for a second. It is currently believed, though not definitive, that Apis originated probably in Asia, though there's some folks who think it may have been more in the Middle Eastern area, but probably Asia just because of the Apis diversity there.

All of the current living species of Apis store honey. So, that's definitely something, I mean it's in the common name, right, honey bees. So, it's definitely something these bees do. Now, the question was about mellifera specifically.

Has it always stored excess honey? Well, yes and no. Honestly, the bee that we keep is probably not all that different from the honey bees that are in the wild. I mean, they're a step away from being a wild animal.

Apis mellifera, the wild Apis mellifera that still exists in Europe, in the Middle East and Africa, store honey, but they often don't store as much as our managed colonies. And it's not because our managed colonies are special. It's just that we, as beekeepers, do things to manage them, to get them to store more honey than they otherwise would.

For example, we control diseases and pests. We make sure we've got good queens. More importantly, usually during the honey production season, we control swarming. So our colonies tend to be stronger than the wild or feral colonies. And really, it's just a size issue.

Because we manage colonies to be stronger than they otherwise would be, we get more honey. Now, it's possibly a trait for which you can select. I mean, some bees are better honey storers than others, but all Apis mellifera wants to store honey, and in theory, all of it, under management and under certain circumstances, could produce even more.

So, I think the answer to the question, have they always done this or did humans have a role in it? It's a little bit of both. I think one of the keys to copious amounts of honey storage specifically, is swarm management because colonies naturally want to split in half.

They want to swarm when those honey flows start. And so, a lot of what we do to keep the bees in place is what helps us out with them making more honey than they otherwise would. I mean,

there's perhaps been a little bit of selection on it over the years, but a lot of it just has to do with just sheer management to keep them stronger than they would otherwise be on their own.

Amy

So, the second question that we have is about freezing extracted honey supers in plastic bags. If you freeze your extracted honey and extracted supers in plastic bags, and then you store them out of the freezer but it's still in the bag, could this cause mold to grow and does your honey ferment? What happens with this?

Jamie

Yeah, a lot of chemistry going on in there. I mean, I read – the questioner had a little bit more information, right? They said that their honey is 18% moisture on the refractometer, but it's fermented 2 years in a row. And that's an interesting comment because, you know, generally speaking, when we are educating people about the right moisture to have in honey to keep it shelf stable as it were, it usually fluctuates between that 15.5 and 18.5% moisture.

In other words, if you keep honey in that range, in theory, it's supposed to not want to granulate because it's not too dry, or not want to ferment because it's not too wet. It should be that sweet spot, pun intended, to keep it exactly where it needs to be so that neither granulation nor fermentation happens.

But the questioner saying, well, I was at 18%, but I'm wondering if it maybe it has something to do with the fact that I freeze my honey in plastic bags and then keep them in plastic bags outside of the freezer. And I honestly think when you do stuff in plastic bags, you kind of create those little greenhouse effects, right?

Where moisture can escape, you can build it up. And I don't know that that's what's causing your honey to ferment. But there are a couple of things to say on this. If you are wanting to store honey in the combs, the best option is to put them in a freezer and leave them in the freezer until it's time.

Now, my guess is since this question is being asked, there's not a lot of freezer space to be had. So, you're hoping that you can freeze it to kind of kill everything in the combs, wrap it up in a plastic bag, and then you keep that in storage. But you're experiencing problems with fermentation and a lot of it has to do with that.

You're already sitting at that 18% moisture. You're kind of on the upper limit and any of the stuff that's going on in winter when you're storing that could push it to 18.5 or 19. You also mentioned in your question that you've got 16.5% moisture honey, and that doesn't have problems.

Well, that's because that's squarely in the middle, if anything, on the slightly lower side. So, my guess is that your honey fermenting happens to be more related to that you're on the higher end of what that recommended moisture content is. So that's the first thing you could do. You could put it in freezers and keep it frozen.

But honestly, sometimes when I want to store honey, I just store it on strong hives that already have enough honey, so I'm not worried about them eating their way into that stored super. It sounds like the fact that you're storing it tells me that you're not wanting to extract it and use it for human consumption.

Otherwise, you would just extract it. So, it sounds like you're wanting to use it later on hives. And when I do that personally, and I'm as a hobbyist beekeeper and I've got limited space in my freezer, I'll just put those supers of honey on strong hives and know that they will protect it and not be likely to eat into it as long as they have enough honey on their own.

So, I think you're experiencing this problem because you're already kind of at the higher end of that moisture content. Honey likes to absorb water as well. So, it's probably very easy to push you over the top. So, I would either keep it in the freezer, you know, until you use it, or store it back on a hive where some bees take care of it for you until you need it somewhere else.

Amy

I think that makes sense. All right, the last question that we have for today is on thymol or thymol. What do you call it, Jamie? I call it thymol, but I've heard people call it thymol.

Jamie

Yeah, I call it thymol, but I think it's often referred to in other areas around the world as thymol. But to each his own.

Amy

OK, well, tomato, tomato. I'm going to call it thymol. So, this question is about thymol. First of all, this person has recommended that maybe we do a short segment on thymol, which I definitely think is possible. And they have read a handful of papers that say too much is devastating.

But then just the right amount can be really great for your taking care of tracheal mites, Varroa, and just bad hygiene in general. So, with all the different options and opinions out there, what is just the right amount of thymol that you can put into your colonies that will help?

Jamie

Well, I hope I've got just the right amount of answer for you for this question. This one is easier for me. All right. So, the questioner is asking, essentially, is there a way that I can use thymol to the benefit of bees, right? OK, there is a way. And it's a way that you don't even have to worry about getting the amount right.

It's the fact that there are labeled products that include thymol as the main active ingredient. One of those is Apiguard. I hate to say this one because I can't remember what it's doing right now. It may not even exist, but it probably does. I'm not 100% sure.

But we did research years ago, colleagues, years and years ago, over 20 years ago, ApiLife Var. That's a thymol containing product, if it still exists, and there's two options right there for you already, at least one. I know with Apiguard that you have a labeled option at your disposal where you don't even have to guess.

It will be the dose that, when you follow the label, does its thing against Varroa and helps out. I, for one, am not very big on kind of mystery mixtures of essential oils that I put into hives because other people said they're good.

So, for example, I don't have a recommendation on just thymol to mix into sugar water pollen patties because, number one, those aren't labeled uses; number two, I don't think there's strong evidence for delivery that way; and number three, there are already products available for you to accomplish the same thing.

So, when it comes to thymol, that's my recommendation is just to go to those options that already exist that are labeled for use in these contexts.

Amy

Yeah, absolutely. And you know, for the listener out there, they said that they read a handful of papers. It'd be great to have links to those papers, and maybe we can invite some of the authors to come and talk more about thymol as well.

Jamie

Yeah, Amy, I love that idea. If you dabble around Varroa health at all, for any length of time as a researcher, you'll quickly discover that lots and lots of essential oils have been put into colonies for the control of Varroa. There are lots of papers out there, there are a lot of tests that have been conducted.

And I say all that to say that we still only have thymol-based products available to control Varroa. So, what does that tell you about the rest of them? Exactly. That they probably aren't very efficacious. So, people really like essential oils. They want to put them in sugar syrup or this, that and the other.

I mean, this is a big, huge, broad blanket statement, so it's not true in every situation, but generally speaking, there have been a lot of strikeouts, even if people kind of get the warm and fuzzies when putting essential oils into their colonies.

Amy

All right, listeners, those were the questions for today. Keep them coming. You know how to send them over to us. Send them to us on e-mail or 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

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