

Science_By_The_Slice-Mosquitos-Ep1-Eva_Buckner-2_mixdown-2

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SPEAKERS

Ricky Telg, Phillip Stokes

Phillip Stokes 00:02

Hello, and welcome to Science by the Slice. I'm Phillip Stokes. And right now I'm standing outside in my yard in Gainesville, Florida. You can probably hear the insects, the frogs, it's currently nighttime and our yard is pretty wooded. And the reason I'm standing out here is because of certain insects that are flying around me, and those are mosquitoes. And if you're familiar with Gainesville, and the University of Florida, you may know that it's nicknamed the swamp. Of course, swamps have lots of water, and hence lots of mosquitoes. And if you know just a little bit about mosquitoes, you know, they can spread disease more specifically, they are the vector that spread the pathogens that cause disease. But have you ever asked yourself why are there more mosquito borne diseases in some countries than others? We know that they're more prevalent in the tropics and subtropics. But why do some countries even within similar geographic regions have a higher prevalence of these diseases? Why do I need to be concerned about malaria when I traveled to sub Saharan Africa, and not so much here in Florida, I can tell you that according to records reported by the Florida Department of Health, malaria was very prevalent in Florida in the early 1900s. I can also tell you that the species of mosquitoes that can transmit the parasites that cause malaria still exist here in Florida. So what is changed? And what is changing even today? And what's your part? What's my part in reducing mosquitoes, and the diseases they can carry? Those are all questions you'll gain insight on in this podcast series. Now, before we get started, I do want to say that there are plenty of other mosquito borne diseases here in Florida that are still a threat. You'll hear more about some of those in this series. But for now, I think it's time that I head inside and get away from these mosquitoes. Oh, and this series includes interviews conducted by Jacqueline Aenelle, a PhD student at the University of Florida, and she'll introduce herself a little bit more, as well as our guest that she interviewed right after this.

Ricky Telg 02:25

This is Science by the Slice, a podcast from the University of Florida's Institute of Food and Agricultural Sciences Center for Public Issues Education. In this podcast, experts discuss the science of issues

affecting our daily lives reveal the motivations behind the decisions people make, and ultimately provide insight to solutions for our lives.

Jacqueline Aenelle 02:52

Hello, my name is Jacqueline Aenelle. I'm a doctoral student at the University of Florida Department of Agricultural Education and communication. And I will be your host for this series of science by the slice where we will be discussing mosquito borne diseases, mosquito control, management and how you can help prevent mosquito borne illnesses. Today you're going to hear from Dr. Eva Buckner, a medical entomology Extension Specialist at the Florida Medical Entomology Laboratory. Dr. Buckner provides training and information to UF/IFAS extension faculty and staff, the US community and the general public on topics related to medical entomology. Keep listening to hear more about Dr. Buckner, his research on mosquito control and management.

Dr. Buckner, thank you so much for being here today. If you don't mind starting off just by introducing yourself and telling everyone a little bit about your current career and areas of interest. That'd be great.

Eva Buckner 03:54

Well, thank you so much for having me. So yes, I am Dr. Eva Buckner, and I focus primarily on extension and research. I provide extension on anything related to medical entomology. And so some people might be wondering, like, what is that? It's really, I like to think of it as insects such as mosquitoes and biting flies and other arthropods such as ticks, any of those creepy crawlies that can provide discomfort and also can transmit pathogens that cause diseases. So primarily, we're thinking about mosquitoes here. So I provide extension to the public on any topic related to that. So mosquitoes are the biggest topic that I deal with mosquitoes, mosquito borne diseases, mosquito control. I work closely with the mosquito control programs throughout the state of Florida, I help them get resources for identifying mosquitoes and the appropriate products to use for controlling their mosquitoes, things of that nature. And then of course, like I said, I work with the general public provided advice, when there are situations where people have mosquitoes bothering them, I can certainly provide advice on things related to that, for my research, certainly my research and extension are tied together. So I like to say that I conduct research on mosquito control and its impacts. And what I mean by that is, you know, I do look at forms of mosquito control, such as like traditional methods of mosquito control using insecticides. I also look at novel ways of mosquito control, other than using insecticides. And then I also when I say I look at the impacts, I looked at the outcomes, such as pesticide resistance and mosquitoes. And so a big research project that my lab has been working on over the past two years have been testing mosquito populations across the state for insecticide resistance to commonly use active ingredients. And so monitoring for the insecticide resistance in these mosquitoes.

Jacqueline Aenelle 06:30

It sounds like you cover a very, very wide range of topics and challenges that all have to do with like you said, not just mosquitoes, but for this episode, and for this discussion, focusing in on mosquitoes, because they are, as we all know, very prevalent in Florida. So what are some of the main challenges facing mosquito control and management,

Eva Buckner 06:51

In terms of some of the big issues facing mosquito control, there's certainly going to be a lack of funding for mosquito control, especially in some counties, there's anything about the mosquito control programs, sometimes the programs are just not well funded. And so in, especially in our in our northern counties in the state, their mosquito control program isn't even year round. So the same person that can be responsible for conducting mosquito control could also be the same person that's like the county dog catcher. And as you know, there's there's not a lot of always a lot of resources put into these programs. There's also not always a lot of resources put into the research to develop new products and new tools for mosquito control. And so as a result, we see sometimes and over use, and this is not an across the board statement about every mosquito control program, I want to be very clear about that. But there are certainly some programs and this is worldwide, where there's a overuse of insecticides, especially to try and treat the adult mosquitoes. So there is an over reliance on the what are called adulticides. And as a result that's led to insecticide resistance in these mosquitoes. So an insecticide resistance doesn't necessarily always lead to lack of efficacy, it really just it but it can certainly eventually lead to the lack of efficacy of these products, because they're just being used in used, then they're not as effective against the mosquitoes anymore.

Jacqueline Aenelle 08:46

Yeah. You mentioned how there's like, you know, these control programs, and you said there's like insecticides, adulticides, and then other novel ways of controlling, can you explain like, what are what are some of those novel ways? And what, what are the components of these programs that consumers should know about?

0 Eva Buckner 9:03

Absolutely, and I love talking about this, because I do feel like we live in, in the state of Florida, and we are, where we live, we do have some of the best mosquito control programs and in the whole wide world, in my opinion, you know, working and getting to go to these different mosquito control programs and just seeing the people that work there and seeing how passionate they are about trying to, you know, reduce the nuisance that residents are affected, you know, how badly residents are affected by the nuisance of mosquitoes and also how much they want to help with the public protect the public health of people from mosquito borne diseases. You know, I'm always just so impressed by the passion of people in mosquito control. And, you know, there is certainly a range of mosquito control programs and what they do. Yes, at the absolute simplest program, there will be maybe a truck that puts out adulticide spray. But you know, that's just really one facet of mosquito control. And really the the best programs use what is called integrated pest management. And so that's using multiple tools to try and kill the mosquitoes. Because what a lot of people don't realize is that mosquitoes actually have a complex life cycle, where the aquatic immatures, or the immature stages are actually aquatic. So everyone thinks about it, oh, mosquitoes are just these insects that are flying around, but they actually spend at least half of their lifecycle in water. And so and then when they're actually in water, and you know, it really depends on the mosquito species, what type of water they spend their immature stage in, whether it's like a pond, or just, you know, a cup with a little bit of deserted cup with a little bit of water. And it really just depends, but it's really one during that stage that they're the easiest to kill, because they're contained within a body of water other than flying around. So integrated pest management is using a variety of tools, and trying to kill the mosquitoes and at different life stages and not just focusing

on the adult stage. So this would be using larvicides. So to kill the immature mosquitoes, like I said, when they're in the water, you can also use biological control, and you know, biological control to kill the immature mosquitoes. It's additionally, biological control can be used to kill the adults. But again, it's a lot easier to kill the immature larvae when they're in a container of water. And so then, of course, using the adulticides the spray that kills the adults, that's always going to be an important tool. And but again, we don't want it to be the only tool. And the reason I say it's important is because we need to have that available during virus outbreaks or the other mosquito borne disease outbreaks. And so some of the additional tools, what people may be hearing about right now, this is not something that is widespread, but it is some you know, a tool that's currently being researched is the release of genetically modified mosquitoes. That's another tool of mosquito control. And one method that I'm study is the spread of a larvicide. That is called pyriproxyfen. And the mosquitoes of a certain species or actually two different species *Aedes aegypti* and *Aedes albopictus*, the vectors of multiple viruses, like Dengue, Chikungunya, and Zika, they actually can just get a little bit of this, pick up a little bit of this larvicide on them at the adults. And then they go and find other spots to try and lay their eggs. And as they do that, they actually deposit a little bit of this larvicide in the containers, and then they kill any larvae that happened to be in those containers. So it's actually using, it's called auto dissemination, because you're using the mosquito to do the work for you, too, rather than you disseminating the insecticide, they're doing that work for you. So that's the type of thing that I like to look into.

Jacqueline Aenelle 14:07

Yeah, that's, that's very interesting. And I'm glad you mentioned how its integrated pest management, I think a lot of the topics that are covered in extension, and by extension specialists, and agents is always an integrated process. There's always a more complex, multiple solutions. It's more holistically viewed. So I'm glad you kind of made that point. I have one follow up question before we move on. And that is you mentioned, you know, mosquitoes spend a lot of their life in water sources. He said, you know, whether it's a large body of water, or maybe it's just a cup that's outside on a patio, and it has a little bit of water in it. And I think a lot of people will have a question come to mind, if we're using these larvicides or insecticides or adulticides, near water sources, the question of like safety might arise. So is that something that consumers need to worry about are all or how does that affect water quality of these sources?

Eva Buckner 15:00

Larvicide that is being used by mosquito control program has been EPA tested and EPA approved. Mosquito control programs also are most interested in using products that are going to be the most specific against mosquitoes. There is a lot of interest in conservation and ecology in mosquito control. And I think that's a misconception people have about mosquito control. One of the most popular actually, there's really two highly used larvicides. And one's a juvenile hormone, an insect hormone, analog. And so it's only going to affect insects, it's only going to have an impact on insects. Even more specific than that is a bacterial toxin. It's that it's called BTI. And that BTI only has an impact on mosquitoes and midges. Many of the products that are used have very specific impacts, because the goal is to have as little non-target impact as possible. And that's actually one of the benefits of trying to use larvicides is that they are typically more specific than some of the adulticides that are sprayed.

Jacqueline Aenelle 16:41

Earlier, you mentioned your admiration of how passionate people are about like public health or serving public health public interest, especially with these mosquito-borne or transmitted diseases. So can you talk a little bit about how your research addresses the challenges of mosquito borne diseases?

Eva Buckner 16:59

My research, like I said, I try and look at the novel methods of mosquito control. And one of them being the transmission or an other dissemination of pyriproxyfen. And I think, you know, that is trying to add another tool to the toolbox against the mosquitoes and controlling mosquitoes. Additionally, with my labs project that we've been working on for about two years, testing the insecticide resistance in Florida, populations of *Aedes aegypti* and *Aedes albopictus* and *Culex quinquefasciatus*. These are the mosquito species that are they they transmit it used to *Aedes aegypti* and *Aedes albopictus*. This as I said earlier, they in turn can transmit Zika, chikungunya and dengue virus, *Culex quinquefasciatus*, this other house mosquito, it can transmit West Nile virus. So these certainly are the species that in Florida have the most negative impacts on public health, because they can transmit viruses to humans. And so my research and extension are very closely tied together with this. And so what we've been doing is, with the effort of mosquito control programs, they've been very instrumental to this project. They've been collecting mosquito eggs throughout the state sending in the mosquito eggs to us, we rear them up to adulthood in my lab, and we test them for resistance to the active ingredients that are commonly used by the mosquito control programs. And then what I do, as part of my extension, is that I communicate the results of the resistance testing to the mosquito control programs. And I provide population specific resistance results, as well as management recommendations. And so usually, what I'll do is I'll communicate with the manager of the mosquito control program, the local mosquito control program, all let them know what the results were. And then also tell them, you know, this active ingredient was able to produce the highest mortality results for your mosquito populations, you know, this is, I usually try and give a recommendation of one or two active ingredients in different insecticide classes to use so that those products can be rotated. And I let them know, maybe, you know, because these products or these active ingredients didn't really yield the highest mortality rates. Maybe we should try and take a break from using them so that there might be increased efficacy of these products later on. And so I give them ideas and suggestions for which products are going to be the most Effective, and how to be able to utilize those products over the long term, so that they continue being effective, and continue keeping people safe against hopefully the mosquito borne diseases.

Jacqueline Aenelle 20:16

That's great. You're looking at the big picture, the long haul. So looking forward, what are the what's the future of research? What are the next steps that you're looking to look into.

Eva Buckner 20:29

I actually have a master student who is going to be graduating this summer, and she has been doing some incredible work we have with her research. And you know, this is an area I really hope to spend some more time in, we've been looking not just at what insecticides the mosquitoes are resistant to, we've been looking at the mechanisms as to what allows them to be resistant to them. So trying to understand why they're resistant. Also, she really, I thought it was awesome, because she looked at the resistance levels at different times during the day. And so she actually found that the mosquitoes for

Aedes aegypti, she actually found that they are more resistant in the evening, rather than during the day. And typically, this is what in the evening is when the mosquito control programs are making their applications of adulticides. And I hope to be able to make recommendations about timing of applications, not just you know, products to use and rotations of those products. But I hope to be able to make recommendations of when the timing when the product should be used when the mosquitoes are going to be most susceptible to these products. And then I also hope to be able to not just focus on looking at the resistance in adult mosquitoes. But I also want to spend more time looking at the resistance of mosquitoes when there they are in the larval stage because unfortunately, even though it's not as great as in for the adult mosquitoes, we are starting to see resistance towards some larvicides in certain mosquito populations. So I think it'd be really beneficial to spend more time researching that in the future. That's what I hope to spend my time on.

Jacqueline Aenelle 22:38

Before we wrap up the episode, do you mind telling listeners what they can do in their own homes, day to day lives to help prevent mosquito-borne illnesses or breeding.

Eva Buckner 22:49

So as I talked about, we have so many different types of mosquitoes. And they can be found in different types of water sources when they're immature and the vectors that can transmit the viruses, the *Aedes aegypti*, the yellow fever mosquito, *Aedes albopictus*, the Asian Tiger mosquito and then *Culex quinquefasciatus*, southern house mosquito, you know those are those are species, like I said can transmit viruses. And they actually they've come to become closely associated with humans. And so they like to take advantage of our items that we leave out around our houses that might fill with water. So a bucket or pot that might fill with water, they really have come to take advantage of all these items. So my advice is to go around your house maybe once a week, especially when we get into our rainy season, when it's raining on a regular basis. And just you know check for those items that you may not think about such as your if you have a small pool for your dog that might fill with water, maybe just dump it out once a week and do this for all items that might collect water around your house. And that is going to help reduce the number of mosquitoes that are in your neighborhood and around your house. And then additionally, there's other methods to look into for these containers that may not, you can't really dump such as bird bath. There's mosquito dunks that have the larvicide BTI that I mentioned that has only really impacts mosquitoes as well as midges. If you get those if you put a dunk like that in your bird bath, and then also investigate your local mosquito control program. Some of them provide free mosquito fish to go in ponds or something, anything that you have that you may not be able to dump out, see what your local mosquito control program can offer. And sometimes if you have issues where you have mosquitoes around your home, many of the mosquito control programs, if you call them, they'll come do a service request. And they will investigate the source of the mosquitoes for you. And so I encourage everyone to reach out to their local mosquito control program, and get them involved and see what they can do to help you, don't view them as the enemy they really are trying to help.

Jacqueline Aenelle 25:43

And if listeners are interested in learning more about mosquito control, transmission, mosquito borne illnesses, all that good stuff, any suggestions of where they can find more information?

Eva Buckner 25:54

So UF/IFAS, we have a great number of our EDIS documents. So if you just go to askifas, the website and just type in mosquito or mosquito control. There's some great publications, one specifically on mosquito control around homes and in neighborhoods to get suggestions. Like the ones I've just talked about, if you're like what, what did you say about that dunk? What was that? You know, you can just go to ask IFAS and find all that information.

Jacqueline Aenelle 26:42

I want to thank Dr. Eva Buckner for speaking with us today and providing insights into her work as a medical entomology extension specialist. Be sure to listen to part two in this series, where we will hear from Dr. Rickey Telg, the director of the PIE Center, and from Dr. Rhoel Dinglasan, a professor of infectious diseases, and the director of the CDC Southeastern Regional Center of Excellence in vector borne diseases as they continue our conversation on mosquito control and management. I want to thank everyone involved in the production of this podcast, Phillip Stokes Michaela Kandzer, Rachel Rabon, Ricky Telg, Sydney Honeycutt, Valentina Castano, Ashley McLeod-Morin and Alena Poulin. I'm Jacqueline Aenelle. And this is Science by the Slice.