

## Aruna Podcast Transcript

Good afternoon, Aruna. It's really nice of you to be able to join us and join us for the podcast. And we would love to hear about what you do. Please introduce yourself, tell us who you are, and tell us what you do. And before we start, Louise said that she's been hearing about you for around 15 years.

Oh, okay. Yes, all good things. I hope so. Yes, definitely. I mean, I've been working with CRI and CGF and Citrus Academy for a very long time. And I've been hearing about this lady that does fruit flies, and she knows them, and she's really helping us. So please, tell us about your work.

Thank you, Louise, and thank you for all the flattering. That's all true good news. Yeah, so I'm Aruna Manrakan, and I'm a research entomologist at Citrus Research International. I've been in this position since 2008. So luckily, the years have brought me a lot of experience. And I think I've gained a lot of understanding and respect for the citrus industry. It's a massive industry, and I'm proud to be part of that.

So research entomologists do a lot of studies on insect pests of citrus. And then I'm the coordinator of the fruit fly research program at CRI. So I sort of direct the fruit fly research projects.

I solicit new projects based on the problems that I experience in the industry, and based on what I feel would be important to control these pests that are problematic to citrus that we export, because that's where the problem comes. A lot of the countries that import citrus, they don't want any fruit flies in their fruit, obviously. And also, we can't have poison in the fruit, so we have to manage it in a way that we won't have the poison, and in a way that we can have a fruit that is not having any fruit flies in it.

OK, so what are the main fruit fly species? Thank you. The main fruit fly species, and what is the status on these at the moment in the citrus industry?

Yeah, so in southern Africa, there are three species that are pests of citrus, sorry, are they pests of concern? Yes, all three of them. But there are more varieties of fruit flies, only in the street. Yeah, in southern Africa, there's a lot of fruit fly species, hundreds of them. They are attacking other fruit, not necessarily citrus, some are not pests.

Some would be occurring on indigenous fruit of no concern, you know, commercially, but out of, let's say, the hundreds of species, there are three that are problematic to citrus, because for these three, we have rayed them from citrus, and it's known to occur on citrus in other parts of the world as well.

So the three species, one is called the Mediterranean fruit fly, Natal fly, *ceratitis capitata*. Yes, that's the one. Yeah, it has a nice head.

And *ceratitis rosa*, the Natal fly, and then we've got a new fruit fly species that was introduced, unfortunately, in the country in 2013, *bactrocera dorsalis*, the Oriental fruit fly.

And it's currently, luckily with some measures of control taken in South Africa by the government, it's still restricted in its distribution. So it has been in the north of the country since 2013. It's still mostly restricted to the north, and northeast, luckily, although now the numbers, the population of this fly is increasing in the north. And so there's a higher risk of spread.

For which markets is the BD a problem? So *bactrocera dorsalis*, BD is a problem to Europe, our main trading partner, as is other non-European fruit fly. It's also a problem to America, you know, the Western countries, because in the east, that's where it originates, although it's also a problem to Japan.

Yes, I know about Japan. So there are very important markets that have a concern on this species. I recently saw an article where it was published. I found it online. It is an international publication that they have recently found BD in California.

Oh, yeah, they regularly find that. But it's also one of those things that it has been found. It wasn't the best. But I'm talking under complete correction, I think. But they said that they found increased numbers all of a sudden. I must go back and find the article again.

Yeah. But California, you're right, is regularly threatened by this fly. There are the flies present in Hawaii and, you know, with the movement of people and maybe commodities between the two regions. It is not unlikely that they regularly get interceptions of it. But California is well, you know, funded with regard to trying to keep California fruit fly-free. So they don't have *seratitis capitata*. They don't have *bactrocera dorsalis*. They have a lot of resources to for early detection of these pests and a lot of resources for eradication. Should there be a detection? They want to keep their citrus completely free of fruit flies. So we've worked with quite a few of the market access stuff. But there might be people that don't know.

So, FCM fruit fly, all these things where they talk about the getting interception means that they get a live larvae inside of fruit in whichever market it is, wherever that thing that we classify as an interception. So there are certain things called sterilization that it's used on uncertain markets to kill these things.

Why is it such a big thing? What can happen? Should an orange or something be found in another country with a live larvae? Yeah. What? Why is it such a such a such a big thing?

Yeah. Well, with let's say fruit flies, if you have enough fruit about two or three larvae that manage to make it through, it could be if the conditions are right. I mean, the temperature and if it's, let's say, yeah, it's summer, there's a lot of European fruit around and these fruit flies will be able to go on this European fruit. This could be a means for them to get a new

pest on their fruit industry. So it would. So the presence of the fruit fly in a fruit producing country is a problem because it will affect the industry eventually.

And how likely is it that that could occur?

If you look at the percentage, maybe there's a five percent chance that if a larvae survives and they get to maturity level there. Yeah.

Do you guys know a percentage that could be of every five percent chance that they could infect more fruit if they do arrive alive, which is not an odd idea.

Well, it depends on the species and the trait of the insect. So, for instance, let's put Mediterranean fruit flies as an example. If you have, you know, one larva, obviously it's that your chances of a population development. Yeah, it takes two to tango. It takes two to tango. But if you have, you know, many different larvae in a fruit, it is possible with Mediterranean fruit flies that they build up a population, albeit very small initially. But a female can lay 300 eggs in her lifetime. So it just requires a couple and then they will be able to if the conditions are right, there's ripe fruit. They'll survive and they'll build up in numbers. So.

But let's let's take another example of a species that is more of a specialist. If it doesn't have the right fruit and you have two or three larvae, no right fruit, then, you know, your chances. So it's very difficult to put a kind of a risk or a percentage chance. It all depends on the conditions prevailing in the importing countries. The fly itself for to determine that kind of a risk.

But there is with trade with all, you know, control measures, especially in Southern Africa, where there are lots of control measures being implemented. Trade is not the route that is not the highest risk route. The highest risk is is just somebody taking a fruit from a home garden. That would be more of a risk because there's no control measures. The infestation is higher in that fruit. Then there is a higher risk.

OK, so tell us about you know, you you've done a very good job of outlining the problem and what you what you work on. What are the control measures that are in place by the industry and how do you how are you involved with that?

So the control measures for fruit flies have been implemented for quite a long time in the industry before I even joined the industry. So there are two components to the control. One for fruit flies is monitoring to just find out what are your population levels and continue to monitor as well. And the other aspect is the actual control.(...) Luckily, with fruit flies, it's great in that sense.

There have been good attractants developed for them. So all fruit flies, particularly the females, they are in need of a protein to mature their eggs.

So that trait is used in their control. So a lot of the control techniques for fruit flies is called attract and kill. So you attract them with a with an attractant. In this case, protein is a good one. And then a toxicant is placed in the mixture to kill the flies. So a lot of attractant kill methods form the basis of the control. So we have less use of insecticides and also less chance of development of resistance, because there's only a certain population that goes for these protein baits.

That's interesting. What proteins is there in the citrus fruit?(...)

No. So the fly actually uses the citrus to lay eggs. But before she lays the eggs, I'm saying the female fly, she requires protein to develop these eggs. So in nature, they'll find the protein sources like bird faeces. So birds in the orchard or some of the secretions on the plant can have some protein content. Or let's say you have mealybugs on trees, they secrete honeydew. Honeydew has some amino acids. So all these are utilized by the fly in nature to obtain its source of protein. The protein hydrolyzed that's used, that's like digested protein, vegetable proteins, or brewer's yeast. So beers that you drink, you know, there's some protein in it when you put an enzyme or you hydrolyze it, you put an acid, you break down these yeast cells and get protein in it. So over-end netting to keep birds out could potentially help?

Well, of course, then if you apply your protein baits to kill them, there will be no competition. Because in my younger days, when I was doing my PhD, I was looking at the attraction of, say, bird faeces versus an artificial protein. And bird faeces do pull a lot of flies. They are somehow more attractive.

My goodness, we're learning a lot here. That's interesting. OK, so here's another question. And remember, a lot of the questions I ask is because I'm really curious about this. Good. I'm thinking about. So with this whole new regenerative agriculture thing and people putting down manure and compost and all that... Yeah, you're right. Does it attract... Could that attract possibly?

It's something we have to investigate, but it has the potential. If it releases ammonia, that's... It should go. That's, you know, detaching the fly from going to where you want it to go.

And it could possibly bring more into the orchard.(...) It could, yeah. Wow, interesting.

Wow. OK, so let's talk about what area-wide controls are there being done by the fruit industry to control Mediterranean fruit fly? I think maybe that's something to talk about. Fruit fly Africa and all of that stuff. So area-wide control with fruit fly.

So this is like controlling the fruit flies in different environments where it occurs. Ideally, you know, fruit flies are highly mobile. They would move from your home garden or farm garden into the orchard to the neighbouring bush and so on and so forth. So for you to really suppress the fruit fly populations, you would want to tackle it in all its environments. It's like

a house. You want to control cockroaches. If you just do it in one cupboard, you know that there might be others. Ideally, you want to control everything so that your chances of the pest development is lower. So that's what it means by area-wide control with regard to fruit flies, just placing these control techniques in the different environments. Obviously, you don't want to put pesticides in, say, the natural bush, but you could use other methods.

For instance, you know, these attract and kill the bait stations. They are not, you know, not spraying insecticides. So that could be an option or natural enemies. We don't use that.

We don't use it in South Africa, but it's an option that can be explored. And I've seen I've seen trapping records while I was in Zimbabwe recently. We looked at quite closely at some of those records and where they show that look at there was a spike in numbers. They put out the tracking kill and it went like down 80 percent from week to week.

Yeah, we've seen that as well. So if it's properly done, it's a very effective control tool. The problem often that I face and I see in the citrus industry is the if ever that control measures is implemented too late when the populations are too high, then there would be a frustration that the numbers are not going down. But it's simply because this control started too late.

You will not control effectively if it's if it's, you know, the numbers are too high. You're better off starting early. So but if it's done properly, I'm not surprised that it that you see a reduction in the numbers as soon as you have the control measures on. They are effective. Very interesting.

OK, so what is the citrus industry doing for control measures? What how is it implemented other than the attracting kill? Is there any kind of particular initiative from the fruit from the citrus industry that's dealing with this? Can you elaborate?

Yeah, so they are implementing these attractant kills. Orchard sanitation is a key component as well. I didn't mention it in the beginning, but I mean, that's that already reduces the inoculum. So the populations of the pests within the orchard. So that's something that we're trying to, you know, continuously recommend. And it's being practised in many of the orchards. I was just with the with the student of mine now. And he says in these orchards, it's clean. The floor is clean. He doesn't find fruit on the floor. That's a great initiative. So keeping these orchards clean, implementing the control measures as recommended is what is being practiced in the industry.

So in terms of their initiative, I think, you know, just taking into account these control measures, I don't see, you know, there's no new techniques being developed per se. But yeah, the implementation is key.

Interesting thing now.

It's when you said that fruit fly might be attracted to bird faeces more than other things. A lot of people are employing like ducks and geese in orchards to clean up snails. Yeah, and turkeys, which I saw in Zimbabwe now, big flocks of turkeys.

And they would I presume they would scratch out pupae in the leaf litter, in the orchards and eat that. But then the faeces might attract more flies. Yeah. But then there is a way to circumvent that, obviously. So the knowledge of this kind of we want these kind of natural inputs to to the orchard. So a way to circumvent that is the knowledge of what could be alternative sources would inform on the grower placing more of these bait attract and kill more of these units. So now you have to kind of compete with the natural sources by applying more regularly or having maybe increasing your the dose of the attractant could be and not the pesticide, but the attractant making it even more a better stimulus than the duck faeces. This is so there are ways to balance it all.

OK, so are there any are there any trends in particularly in the citrus industry where is the control of the fruit fly? Are you winning?

Well, yeah, I think, you know, I have been saying this in these workshops we've been going to in that since 2022, there has been no interception of fruit fly in the EU. So this is proof that the you know, the systems approach with the control measures before harvest and control measures after harvest are working. So we're hoping that if it diligently, you know, applied, we should be having clean records like this, like what we've been having over the past two years.

That's excellent news. Yeah, good to know. And particularly, we understand that some of our our markets are looking for any fighter sanitary excuse. Yes. To create trade barriers. So if we've got the lid on the on the fruit fly, it's a very good thing. Yeah, I think it's as with the strict implementation, it should be possible to keep the records clean.

Let's hope so. Yes. And it's ironic that we're dealing with something called Mediterranean fruit fly. And people from the EU are complaining about a pest which is home from from this side. Yeah, so that's the that's a really unfortunate thing because we found in our research that the Mediterranean fruit fly is the dominant one on citrus.

I've done some surveys since twenty twenty one and that's the only species I could rare from, you know, citrus that were infested in the orchard. So what happens possibly is when fruit are going to the EU and there's an interception, if there is a larvae, if it's not identified to species level. And often, if you look at the records, you don't see the species. But because it's coming from a third country, it's assumed to be a non-European fruit fly to one needs to check that out. And the only local one that could pose a threat is Natal fruit fly. And Bactrus red or Salis, especially from the northern regions. Yeah, those are the two non-European fruit flies that we should try and keep out of our citrus. And they are easy, easy to control. Have the people ever found the whole Mediterranean fruit fly in the W?

Well, it's originating from Africa. It's an African species, possibly from the Ethiopian East African region.

So move down, move down. Yeah. So it's not an exotic pest. It's well established. And now another question I've got is all these countries got all these trade barriers or fight the sanitary issues in South Africa. Do we have the same with fruit coming into us? Because we do import a fair bit of our fruit in counter-season. Do we have the same kind of measures?

Yes, yes. OK. Yeah, I think we should have because I mean, these are three pests that we don't want. And there was a third one that came in, *Bactrus* red or *Salis*, it's a new pest.

If we could have kept it out, it would have been better. But, yeah, there are other species out there that are problematic to citrus that we don't want in South Africa. And we have to have quarantine measures to really regulate this trade. So if there is a risk of, say, another fruit fly that is problematic to citrus and we want to import fruit from there, from an area where this pest we don't want is, you know, we have to have some strict measures to prevent it coming and quarantine measures have to be in place.

Interesting. Because you never hear about those things. You hear about the restrictions that's on South Africa and quarantine pays from our stuff today. But South Africa has restrictions also for fruit coming in from other countries because we don't want to increase the number of pests that we have on our list. Is there any of those that you can, off the top of here, say, from fruit we import, let's say, from Egypt or Australia?

Yeah, Egypt is one. So Egypt has *Bactrocera zonata*, which is a very close, same sort of genus as *Bactrocera dosaalis*. So it is a pest of citrus in Egypt. It's also now in Israel. So, yeah, we don't want it to come here. So I'm not sure that I'm not fully aware of the measures that are implemented with trade coming from Egypt or from Israel on citrus. But I'm sure the measures that are in place would mitigate the risk of *Bactrocera zonata*. That's one of our in one of our top 10 biosecurity lists. Peach fruit fly. And we've got all these strict measures and control and industry bodies like CRI doing this for our growers. Do those countries also have similar scenarios? I think Israel would be having, you know, institute focusing on citrus research. I'm not sure of Egypt, but yeah, it is. I think it makes a difference when all the industry have, you know, specific research done for them. It's more focused and then would eventually benefit the industry.

Yeah. So I think there are some countries that have that. I know Israel maybe have some specialized units on it. Spain, for instance. But, yeah, it is probably recommended for other citrus industries around the world. Because a fruit can come on grapes as well. True.

Do things like unseasonal weather, strange new like people, there's a lot of talk about climate change. And does does this fluctuation in weather and temperatures and moisture, does this affect the populations in any way? Yeah, definitely. I mean, if warmer, warmer

weather would mean more generations of this pest building up in higher numbers. And obviously, when they are in higher numbers, they are in search of resources, then there is a bigger threat. So, yeah, warmer temperatures would be problematic in the buildup of the pest.

Maybe, you know, reduced humidity might counterbalance that. Maybe they are not really some of the pests like Bactrosorad or Salis, they really like high humidity. So they might not do well if, you know, there is a drier, drier regions. But definitely warmer temperatures would be problematic.

OK, so when seasons, when the different conditions occur in different seasons, that would sometimes create a spike in populations. Yeah. OK. So obviously, people have to stay very proactive on keep monitoring and making sure that the pests are under control. And do you have much contact with the growers? Do people contact you? Yes. And you go out to the growers and explain to them? Yeah, so, I mean, growers regularly contact me and we also do a lot of field studies on control measures. So we have, you know, feeds on the ground to know what's going on and get a grasp of the situation, changing situation.

The performance of our control measures. So, yeah, we do have our feeds on the ground. Not only feedback from growers. So is there anything that we didn't ask you that you'd like to discuss or anything you'd like to finish up with?

Well, I think we've covered a lot. But I must say that I'm proud to to be working for this industry. It's very rewarding when you, you know, you you recommend measures and you also do some research and have some findings that has implications in the industry. So we have a good setup, I think. And I'm proud. And I hope this formula continues.

That the measures for control of pest is very science based and you need researchers to improve on the control measures and make the industry a bit more competitive.(...) Yeah. And for the growers out there, I know it might be a schlep to get somebody to do scouting and check the traps and keep the records and do the paperwork.(...) But it's vital. Yeah. If you as they say in Afrikaans, to measure is to know. Yes. And if they don't know. And look, it might not be a problem in your farm, but you could be creating a problem for your neighbor. Yeah. Yeah. So, yeah, that's the thing is to encourage growers to work together. That's that's how in an area, for instance, there's benefit in an understanding of the area in general, shared pests and shared threats so that then there is a more effective way of approaching a problem. So that is something we're trying to promote. And I think there are some areas that are taking that as a recommendation. And a lot of growers are implementing, you know,(...) the sort of processing of information and then decision based on the information that they gather. And also a lot of growers have diversified. Like if you take, for instance, eggs from a valley, which used to be a traditional table grape. There's a lot of citrus there now. Yeah. So you've got feeding grounds for the pest year round, not just in a season. And then



they might go off to where it was, where there's a new food source. Yeah. Yeah. So these changing sort of horticultural practices, obviously, then there is need for adapting, you know, control methods. Like if you say there are mixed crops,(...) then there should be sort of a change in when you do your control measures. It will no longer be just in the table grape season. Then it will be a work together between different industries as well.

So CGA and CRI until about four years ago, I think it was you were servicing South Africa, Zimbabwe and Eswatini.

But in the last three years, Botswana, Mozambique and Namibia have joined CGA and CRI. So that extends the range that you have to be working in and also takes the line further north into the tropical, subtropical and tropical areas. So this must impact what kind of what kind of fruit fly can live. And as you said, some of them are only in the northern region, but they must be north of the border, too. Yeah. Yeah. You're right. I think we will have some changing. We will have to increase our scope of work to address problems in a wider area. We've been the countries that have been, you know, the Zimbabwe, South Africa, Eswatini. We have sort of shared problems, shared threats, but we will have to increase our scope and no more what's going on in Mozambique, because that's a very different set up there. You're going more into the tropics. We are subtropical temperate. And so sort of populations are different, say in Mozambique compared to South Africa and Namibia. That's an unknown territory. So that's a new challenge for you. It will be a challenge. And I would love to take that on board. Yes. Well, if it wasn't difficult, everybody would be good. Yeah. Yeah. Thank you so much. Thank you. Very, very interesting. We love to listen and to learn and we learned a lot today. Great. So thank you very, very much. Thanks, Louise. Thanks, Dewald