Speaker 1:

Welcome to Urban Plant Health Network's podcast series, The Good, The Bad, and the Bug-ly.

Drew Radford:

Being able to sample water or air, and tell if there are traces of an invasive pest sounds like the stuff of fiction. It's not though. It's science that's being developed and deployed to help keep Australia free of a range of pests. G'day. I'm Drew Radford, and technology like this is part of life for Tim Hurst, who is a surveillance design and analysis officer with Agriculture Victoria. Tim, thanks for joining us for this Urban Plant Health Network podcast.

Tim Hurst:

Thank you, Drew. Always fun to be here.

Drew Radford:

Tim, previously, you and I have talked about the importance of citizen science and the broader community reporting in biosecurity. Really, in regards to targeted surveillance programs. But there's been new advances with technology. So let's just talk broadly about some of those before drilling down.

Tim Hurst:

Yeah, that's great. And there has been, and traditionally, when you look at surveillance it's a bit of a three-part-er. You've got to know where to look for the pest. You've got to have a tool that you can know you’re going to find it, and then you have to be able to diagnose it, i.e., know what it is. And that's very traditionally you go and you set a trap or you look somewhere, you get a sample and you take it back, and a little while later, somebody tells you what it is, and that works well enough, but we are getting a lot of new technologies now in modelling, remote sensing, drones, smart traps, meta bar coding, all of these nice little buzz words that have really given us a better handle and a better way to approach early detection and surveillance of our exotic pests.

Drew Radford:

There are a lot of nice buzzwords in there, and I love a good bit of tech, but so now you know where to look, but how do you find them once you're in the right place, and how do you know you've found or not found an exotic pest?

Tim Hurst:

Yeah, well, I mean, you say that, we know where to look, and that's the first part of it. And we're really seeing these aren't new ideas. We've seen a lot of new ways to look at modelling where you can take a lot of different inputs about the pest, about the biology, the ecology, the environment, its host preferences, and really be able to target where it's going to be on a map. You've got things like remote sensing. You can use a satellite now to kind of look over an area and tell you where the hosts are, which trees do I want to look at to set my traps or to even just take samples from those trees. You can use thermal imaging now. There's a lot of groups that are looking at the heat signatures of trees and they can actually pick up that the heat signature from a tree that is sick is different from one that is healthy.

So you can target individual trees in an orchard or a forest, and you can go look at those thinking that they might be infested with a pest for instance. Drones are very similar. You can fly a drone over the top of a forest or an orchard, equipped with that type of thermal imaging or some very high-resolution cameras to pick up exactly where you need to look rather than have to send out a crop scout to look over hectares and hectares of land. And it really allows for a more targeted place to look. And it's helping us cut down our manpower and our man-hours a lot.

Drew Radford:

These are phenomenal pieces of technology and science-based. So you assume they're very accurate, and you're not just depending on the goodwill of the public to get this information to you. What about some of these other technologies, eDNA and metabarcoding, and Department of Agriculture, Water and the Environment (DAWE) camera trials on containers? What are they?

Tim Hurst:

We kind of, we know where to look now. And so now we want to be able to find the pest, and those ones you mentioned are what we'd call diagnostics, being able to identify what that pest is once we've found it. And they're a little bit more wrapped up in actually capturing the pest itself these days.

Think COVID, I mean, there's a very good analogy. Everyone's very much front of mind. And at the moment you think Polymerase Chain Reaction (PCR) versus your rapid antigen test, your RAT. And so we can go and we can take a sample and we can send it away for PCR. And that takes some time. And maybe three days, a week later, we know very certain whether we're positive or negative. Now, a RAT gives us an almost instant result. It might not be as accurate, but we have a very good assumption that something's wrong, and we can respond to that straight away. We'll call that real-time data. And that's what we want for our plant pests.

And something like LAMP is a technology that you could consider. It's an infield mini PCR. You can take a small machine out into the middle of an orchard and say, "Well here’s a fruit fly. I wonder if that's exotic." You whack it in the machine and a few hours later, you get a result. And that's the type of thing that we're really wanting. There are what we call smart traps now. And I use the fruit fly example because there's a lot of money that goes into fruit flies because they're a very big problem, but there's a few different smart trap companies around. So these companies have developed traps like our traditional traps, but they have some added extras. They might have an onboard camera, high resolution camera, a laser kind of monitoring system. So that as soon as something flies into that trap, it takes some photos, uploads it to the web in real-time, sends whoever is responsible for that trap a text with a photo, and they can look at that straight away and have a fairly good idea of what's there.

As that technology improves, it could even get to the point where the trap itself does that ID for you, and it just sends you the results straight away. And you can imagine the time and cost savings that we could achieve through those types of traps.

Drew Radford:

Tim, you're listing off a range of remarkable technologies, and that's going to help so much more with Australia's biosecurity. Where's that leave though, general surveillance and enthusiastic citizen scientists who used to be such an important part of detecting invasive pests?

Tim Hurst:

Well, they still are. And probably more than ever, because one thing I haven't mentioned so far, and one of the biggest and most rapid evolving technologies of all is the smartphone. Almost everyone has a smartphone, and every smartphone has a camera. And there are a lot of companies that are developing apps that can essentially tell you what you've taken a photo of. Now, none of them are what I'd call perfect. For instance, if you want to play around, check out Google Lens, you simply can go into a Google search and you can actually click on a camera button. You'll see at the top in the search bar. And that basically says, we're searching whatever you take a photo of. You can take a photo of a stapler, and it'll take you to some pages that tell you about staplers. Now you can take a photo of a pest and it will take you to pages that it's ID that pest as. Now, it's far from perfect, but it's an example of where things are going.

And so absolutely, citizen science is going to be more important than ever as those types of technologies improve. At the moment, the MyPestGuide Reporter app, and that's a snap, send, solve type of app where basically, you take a photo of something unusual in your backyard, and you send it through. And in this instance, an entomologist will look at it for you, but you never know, in the future as this type of technology improves, it could all be done in real-time.

Drew Radford:

Tim, what other technologies are on the horizon that excite you in terms of helping with biosecurity?

Tim Hurst:

There's one in particular that excites me and it's something called eDNA, or metabarcoding. They're quite similar. The concept there is, you are taking an environmental sample. That's what eDNA is. So rather than me taking an insect from a trap and getting a diagnosis on that, oh, here's a bug. I think it's BMSB, I'll send it away. They'll do PCR, and they'll tell me it's a Brown Marmorated Stink Bug (BMSB) or not. What if, and this is a real technology. People are using it. What if I could take a water sample from a bird bath in an orchard that will likely have had a bird clean itself in it. And that bird may have had some faeces attached to it that has contained the little bits and pieces of the BMSB that it ate two days beforehand. And that water sample can tell me that BMSB was there.

And it can also tell me every other insect that that bird or birds have eaten from that orchard. And that is an incredibly powerful technology. That's an example of where we would want to use it. It's been used extensively in the marine space. You can take a water sample out of a bay or a river and tell if there’s exotic fish species or star fish species or urchin species, and know where you need to focus control and know where you need to look. Again, relevant example is COVID. Everyone would've heard about the wastewater sampling. And that's what that is. That's eDNA, that is taking a sample from wastewater that identifies that the virus has been shed from individuals, and it's gone into the waste stream and you can pick up these minute amounts of DNA and tell people what's there. So for me, this is a game changer in our industry. Being able to take a soil sample, an air sample, a water sample, and know everything that was there is huge. I can't stress that enough. And that's really exciting to me.

Drew Radford:

It does sound exactly that, hugely exciting. And suddenly you've got a location where you need to focus other technologies on, then I'd imagine to actually narrow down exactly where the pest is.

Tim Hurst:

Absolutely. And it allows you in some ways to not have to narrow it down, you could filter that water, the runoff from a surveillance site, that's going into some type of sump and you take a sample of that. And you know that those pests are in that area. And then you can focus and do your traditional surveillance to find where it is. It's a really exciting time. Another one that I didn't touch on. There's some camera trials that DAWE (Department of Agriculture, Water and Environment) are running on containers I think in Port of Melbourne, the Port of Brisbane, a few different places. And that is, there's a massive amount of containers that come into this country each year. And that is our primary source of exotic species. Now, the paper I read said, there's about five seconds from when that container is lifted off the ship and put onto the port, and then it disappears off into the ether.

And if someone hasn't had a chance to inspect every individual container, there's high probability something comes through. Now, what they're looking at is a camera loaded onto the crane that can essentially scan the outside of that container in that five or six seconds. And identify if there's something we need to worry about on the outside of that container now is that's very early in the piece, but I've heard that, you know, they're getting some quite promising results. So again, just amazing the way that technology is going. And I think it is going to fundamentally change how surveillance looks for us in the next five to 10 years and significantly improve it.

Drew Radford:

Tim, do the bulk of pests come on the inside of containers or on the outside, or is this just helping solve one part of that equation?

Tim Hurst:

Yeah, it's one part of that equation. Certainly the insight is where they're going to what, we'd say harbor, but if they've entered the container in some way, or the container might sit on a port dock for a long period of time before it is exported and they could be on the outside. And we might be thinking BMSB like bugs and something very tangible, that would be more likely inside the container, but there's a lot of pathogens and they could lay eggs and things on the outside of the containers. So we still pick up a lot of information on the outside of containers.

Again, when looking at the inside, traditionally, I don't know if you've ever opened a container at port. I certainly haven't, but I can imagine you open up a container and it's just boxes and crates, a nightmare to try and look through. And again, that's where something like eDNA comes into it, they are working on that technology in DAWE at the moment where they can take an air sample, vacuum the air or vacuum any of the kind of soil or debris that they can get access to. And that will tell them if there's something in that container we need to be concerned about.

Drew Radford:

Tim Hurst, you work in a very important space, and a really interesting space too, with the technology that's helping protect us from the incursions of unwanted pests. Thank you very much for telling us more about it all, and joining us in the Urban Plant Health Network studio today.

Tim Hurst:

Thank you, Drew and I hope everyone found it interesting.

Speaker 1:

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