

Screwworm Episode

Screwworm Firsthand: One screwworm infestation that goes unreported could erase the tremendous gains that have been made in the Southwest against this insidious, multimillion-dollar pest, the screwworm. Eradication workers can protect the gains, but only if they know where the pest strikes. You can help. Stopping screwworms is your concern especially if you own livestock, or a dog, or cat, or any other pet. All of you can help by finding and reporting screwworm infestations. Examine your animals at every opportunity. Look for cuts, scratches, or other wounds. If you find a wound that contains insect eggs or larvae, take about a dozen worms and all eggs from the wound. After you've taken the samples, treat the wound with approved insecticides. Place the samples in a container or a jar, in alcohol or water. At this point, speed is important. Call your county agent. He'll tell you where to send the samples. He'll tell you what action to take. Positive identification will be made by experts and measures taken to eliminate the parasite. A screwworm infestation confirmed by a positive identification sets off a series of emergency activities at Screwworm Eradication Headquarters at Mission, Texas. Here, millions of screwworm flies are being reared each day and made sexually sterile by exposure to gamma rays from radioactive cobalt. Released in special patterns and in large numbers, these laboratory-reared flies fight for us against an outbreak. These sterile screwworm flies mate with native flies, which, in turn, cannot reproduce. Release of sterile flies combined with intensive livestock inspection and use of insecticidal treatments has already stemmed outbreaks. This new technique for insect control is eliminating screwworms from the Southwest. Complete success depends on quick discovery, quick reporting, quick action. Remember: Examine! Collect! Treat! Call your county agent and help stop screwworms

EAU: that's the whole episode. Is it not?

EW: Isn't that amazing?

EAU: It's so comprehensive.

EW: so comprehensive. I, okay, so that was from, um, I found that on and the USDA National Agricultural Library in like screwworm exhibit. And it's, it was a video produced in 1963 and it's called Lookout for screwworms. And I just, it was, I think I didn't realize the extent to which Screwworm was such a big deal during that time period for decades and decades and decades. Enough so that there are like promotional videos like this available.

EAU: I'm really excited, Erin, to hear you talk about the history because I was reading and didn't realize like a lot of the history of like ranching in the US was driven by screwworm.

EW: Yeah,

EAU: What?

EW: I know. I know, and it's so funny. Yeah. I mean, there's, there's so much to cover. We'll

EAU: Right, right, right. I

EW: I, I like wanted start right now,

EAU: Yeah. I want you to.

EW: Um, we'll start instead with introductions.

EW: Hi, I'm Erin Welsh,

EAU: And I'm Erin

EW: Allmann this is, this podcast Will Kill You.

EAU: and today we're talking about screwworms.

EW: True Rooms. Specifically for my, for me, I'm talking about New World Screwworm.

EAU: We'll, we'll go over both different types of screwworms, new world and old world. Um, but realistically, we're mostly talking about new world screwworm today

EW: The one that's been in the headlines,

EAU: the news.

EW: in the news, uh, it's gonna be a really interesting episode and a little bit maybe creepy crawley as as to

EAU: a little bit creepy crawly.

EW: crawly. Yeah. Some of the descriptions I have are hard to stomach.

EAU: Okay, that's good. I don't have that many of those.

EW: Okay.

EAU: I'm keeping it basic

EW: Um, but before we get into all of that.

EW: It is quarantine

EAU: Anytime

EW: Yeah. What are we drinking this week?

EAU: we're drinking the screwworm driver,

EW: Yeah, it was screwdriver, which is, um, vodka and orange juice. And with the addition of a gummy worm

EAU: gummy worm

EW: to

EAU: to make it a.

EW: screwworm.

EAU: We are getting real creative with these. Erin,

EW: You know, I think that's okay.

EAU: it's totally fine.

EW: Okay. It has to be. It has to

EAU: We can do nothing else.

EW: Yeah.

EAU: Uh, we'll post the recipe on the places that you can find it. Like our website, this podcast will kill you.com someday, but also definitely on our socials. This podcast will kill you. What socials?

EW: Oh, I have, I tried to post one. I don't know if it works very well. I can't figure out the dimensions, but hey, we're working on it.

EAU: You know what, listen,

EW: There's a way.

EAU: there's a lot of other great stuff on our website.

EW: Yes, there is. If we've got transcripts, we've got references for all of our episodes. So if you wanna read more about Screwworm, that's a great place to go. We've got links to merch to our bookshop.org affiliate account to our Good Reads list, to Music by Blood Mobile. Contact us form A, submit your firsthand account form, Patreon. Um, other things. Probably check it

EAU: There's a lot there. This podcast will kill you.com. If you haven't yet radio reviewed and subscribed, please do that. We'd really love it. Uh, we're on YouTube on the exactly right network channel, and we're on all of your favorite podcasters, including iHeartRadio, apple Podcast, Spotify, the like. Moving on.

EW: moving on. Are we, are we done? Should we

EAU: You ready?

EW: Yeah, I am.

EAU: Uh, I'm gonna tell you about the biology of Screwworm really fast so that you can tell me about the history.

EW: Okay. Okay. Let's take a quick break and then we'll get to it,

EAU: The star of today's show is the Screwworm, which is a larval form of a fly. Most people, when we say screwworm, mean the new world Screwworm, which is the species *Cochliomyia hominivorax* might have pronounced that wrong. Honi hum. *hominivorax*? Listen, it's the new world Screwworm, but

there is another one, the Old World Screwworm, which is a species called *Cryomya bezziana*.

EW: Okay.

EAU: And these are two different genera of fly, but both of them are blowflies overall, not entirely dissimilar to the flies, whose larval forms not that long ago in an episode, we hailed for the benefits of their ability to help heal wounds.

EW: Yeah, this may change our feelings on maggots, I

EAU: It will, because today we're talking about pretty much the exact opposite.

EW: Yeah.

EAU: Unlike most other species of blowfly, the new world and the old world, screwworms, larval forms feed not on necrotic or dead tissue, but instead on the warm and living tissue of warm-blooded animals.

EW: Yeah.

EAU: So screwworms are a type of fly who lay their eggs in the flesh of living mammals in a way that causes really significant harm,

EW: Kind of like bot flies, but more harmful.

EAU: way more harmful. , So that, so what I wanna do in this part of the episode is really just kind of take us through like what are these flies? What do their life cycles look like and why do they cause as much damage as they cause so that you can tell us about all of the history with them. 'cause I know it's really interesting. So adult flies of, of these, both of these species, they look fairly similar. Most of what I'm gonna talk about is about *Cochliomyia hominivorax* or the new world screwworm. But it mostly all applies to the old world Screwworm as well. They look a tiny bit different, but otherwise they're really quite similar.

EW: I'm so interested in their evolutionary history, which I didn't look up like the relationship between them. Was it like independent? Yeah. Anyway, like

EAU: it, I didn't look it up either, but that's really interesting. Like, how did they both end up evolving this way of life that's so different from all of their other brethren?

EW: right. I mean, it's a, it's a great, you know, open niche I guess. Like someone else has got all the dead ones you can get the live ones

EAU: Right. Exactly.

EW: anyway.

EAU: the adult flies, um, all entomologists everywhere are gonna kill me for saying this. They look like a fly. Mm,

EW: How big,

EAU: how big? About, a little bit larger than a horse, A house fly.

EAU: Not, not a horsely housefly. Um, and they, that's literally what they look like. 'cause they are blowflies a lot. A lot of the house flies that we see, not house flies, aren't necessarily blowflies.

EAU: But you, you see these around, they've got almost like a metallic ish, kind of bluish, greenish body, like most blowflies do. They have these big giant orangeish eyes across their heads, and then they have these three black and gray stripes along their back. The old world screwworm has two of those stripes.

EAU: Um, the new world screwworms are native to essentially the entirety of the Americas. Though they are primarily a tropical species, they need warm, moist soils in order to complete their lifecycle, which goes something like this. The adult flies emerge from the soil where they pupate. And it is only the adult females as is usual for flies who cause the majority of the problems they mate just one time. This is important usually around day three to five of life and then they start laying eggs right around that time. Day five to seven. After they come out of their pupil form, these flies lay 200 to 300 eggs. Some estimates say as much as 500 eggs per clutch. It keeps getting worse because they lay additional clutches every three to seven days for up to 11 clutches of two to 300 eggs in a lifetime.

EAU: And we can Erin math this though, we don't have to 'cause it's all over the papers. They lay a maximum of 3000 eggs per single female screwworm fly throughout the course of their 20 plus day. Adult life.

EW: I mean, that is some hard work.

EAU: It really is. They also often leave each one of their clutches in like several different egg masses.

EAU: So not all like 200 in one spot. They'll lay them like over a, a course of a few minutes or a couple of hours in. Multiple times.

EW: Right. Don't put all your eggs in one lesion kind of a mentality.

EAU: times. Exactly. Erin. Exactly. And they do, they lay their eggs in lesions on the margins of wounds, on warm-blooded animals. Mammals, possibly birds, though they don't tend to prefer birds, but they can. Um, but all mammals and they tend to prefer the kind of drier margins of fresh or bloody wounds compared to wounds that are severely infected or really wet or have a lot of like bacterial purulence.

EW: They want the freshest of flesh.

EAU: The freshest of flesh. And they especially prefer wounds that have already been infested with screwworms. Kind of like a signal that gets sent out, like, Hey, this is a really great wound. Go ahead and lay your eggs here.

EW: Yeah.

EAU: However, they can also lay their eggs on other easily accessible parts of our, like thin skin or mucus membranes.

EAU: So say the corners of eyes or in noses

EW: Yep.

EAU: or near the perineum, or especially in places like in say, newborn mammals, like newborn cattle or goats or horses that have an umbilical, uh, you know, stump that's not fully healed. That's a really common spot.

EW: Yeah.

EAU: And then after a day or so, these eggs hatch into hundreds of maggots, the larval form of a fly. And these maggots eat their way in, around and under

the skin of their host, literally burying themselves in the process, which is how they get their name screwworm.

EAU: Their wriggly little maggot bodies are even grosser looking than most maggots. Um, they have Is that a thing that

EW: I mean, that is a high bar, like maggots are disgusting looking.

EAU: maggots

EAU: are gross looking? A hundred percent. But these ones have particularly sharp hooks, uh, as their mouthpieces and their bodies have these sets of rings that kind of point backwards of these spines, these rings of you know, like the kind of spines where like you can drive over them, but don't drive backwards.

EW: yep, yep, yep.

EAU: And that is what helps them literally corkscrew their way deep into the living tissues on which they're feeding.

EW: How big do these larvae get?

EAU: that's a really good question. I actually didn't see anything about the particular sizes. I mean, they're not large, they're small individually, so like maybe few millimeters, uh, big they can, yeah.

EAU: Um, they feed for about a week before dropping off to pupate in the soil for another week, and then they'll emerge as adult flies.

EW: And once they emerge. Okay, so I'm thinking about like going to in a place where Screwworm is present, how many, you said that the females only mate once, and so how many rounds of females. A year is happening. You know what I mean? Like Right. It's not

EAU: I have no

EW: If it's like one week, then do they over winter, et cetera, that kind of

EAU: Yeah. So I mean, they tend to live in the tropics and in the tropics they're there all year round. Right. And so they're gonna be continually, and each female adult females live for about 20 ish days. And then, you know, they're

gonna lay their eggs starting on day, like four or five. And the eggs only take about an a a day before they hatch.

EAU: And then they feed as larvae for about a week, and then they pupate for about a week. And so their whole life cycle is maybe, what's that? Like a month? A little more than a month.

EW: Okay. And

EAU: you could be getting 12 plus rounds. I mean, plus each female is laying like 3000.

EW: yeah.

EAU: I can't even calculate. That's a lot.

EW: It's just hard to comprehend like how, like they, I feel like they would run out of living tissue to.

EAU: It's an interesting, so. It's actually really interesting that you say that. 'cause one of the, uh, one of the papers that I read was looking at like the, the ova position behavior of these flies. And they were pointing out that like if you look at the way that they oviposit and like how frequently they do it and how they lay their eggs in these like multiple different clutches and all of this, um, but they do it multiple times in their life, right?

EAU: Like a lot of, a lot of flies or other insects might just lay like one giant clutch and then go ahead and die. Um, but the way that these particular screw flies do it, they, at least in this paper we're saying that this fits with this strategy of like exploitation where they might be evolutionarily. Finding niches that aren't always there, right? In an environment that's not always favorable. And so you gotta be able to like take advantage, lay a whole bunch of eggs as soon as you can and as quickly as possible when you find the right wound. 'cause you don't know when you will again.

EW: Okay.

EAU: Um, which suggests that in nature, the perfect wound oviposition site might have been harder to come by, but then enter livestock and now there's basically free terrain.

EAU: Because when I, before I started researching this, and when I thought of like the wounds that screwworms were causing, but also that they were first laying their eggs in, I always thought of like a huge gaping like wound, right?

EAU: Like some kind of large hole, some infected something, but actually that's not the right image to have. types of wounds that these flies can over posit in to begin with can be as small as a tick bite.

EW: and often are from a tick bite.

EAU: Exactly. And so it's any break in the skin, a scratch from a thorn or a fence wire. Like I said, the belly buttons of newborn animals insect bites. The wounds that can then be caused are. Incredibly substantial. And animals, especially livestock animals, can die within a number of days to weeks after infestation with a screwworm, or it's multiple screwworms because of how deeply these screwworms can wander and destroy tissue along their way.

EAU: And because of things like secondary bacterial infections that can occur from, you know, just the, the open wound that is caused by these maggots. Uh, so that's, that's like mostly screwworms, Erin.

EW: And okay, so between the old world and new world, are there differences in the severity or in the number of eggs or, you know, whatever it is,

EAU: It's a good question. It was like weirdly hard to find great papers on the old world screwworms. Um, so from what I can tell, they, they don't tend to be maybe quite as severe or at least not as deadly as quickly.

EW: Okay.

EAU: Um, I don't, I don't know exactly why, like what are, you know, all of the specific differences between them.

EAU: Um, as I know you'll probably talk about the biggest difference in how we've dealt with them is that there are not as many programs that are widespread to try and eliminate the old world screwworm. So it is very much still a problem throughout its distribution. Um, whereas we have changed the current distribution of the new world screwworm.

EW: Yeah. Against its will.

EAU: yeah. And then in terms of like, how do we manage it, aside from what you're about to talk about, I just keep like putting little. I'm putting little teasers out there. Um, we don't have any kind of vaccine. We don't have any kind of like specific treatment for screwworms. It's basically when we're talking about livestock insecticides on the wounds, uh, or like insecticide dips and things to try and help prevent the screwworm's infection to begin with.

EAU: We can also use ivermectin like ivermectin, so for humans with when there is human infection, because there can be, and there, there is. This is also a public health problem, not just a livestock problem. Um, it requires oral ivermectin, and this doesn't like get rid, get rid of the infection per se. What it does is paralyze the larvae, which then have to still be removed thereafter.

EW: Okay. It paralyzes the larvae. How

EW: interesting.

EAU: Yeah.

EAU: Yeah. So our mainstay of dealing with. The new world Screwworm has been sterile insect technique.

EW: It's so cool. Prevention.

EAU: about it

EW: Um, is it my turn? Really

EAU: Yeah, I don't have any more. I told you it was gonna be basic and straightforward.

EW: I'm, I'm, I'm excited. All right. Let's, let's get started.

EW: I, So to help me set the stage for the history of screwworm, I've brought along some assistance.

EAU: I can't wait.

EW: please open the video titled Screwworm one.

Who Shall Reap?: 300 million years before man appeared on Earth, the insect was here. With time to develop varieties so diverse, their numbers are beyond conception: roughly a million species. Along with ticks and mites, three-fourths of all the animal kingdom. Of these, 10,000 species are man's mortal foe, endlessly vying with him for food and fiber, endlessly looting what he has sown and tended

EAU: ticks.

EW: Ah, did you like that?

EAU: I loved it, Erin. I really hated the grub. Those were grubs, not maggots.

EW: Listen, the video is like everything grubs, Grubbs

EAU: Oh, totes.

EW: yeah. Um, it's so fun. So that I, I loved it so much. That video is from, uh, it was produced by the US Department of Agriculture, the USD DA in 1969. And it goes into some of the various like insect and plant pests, including screwworm that have plaguing farmers across the globe. Uh, I also thought it was interesting 'cause it was like 1 million species and I looked it up and I think we're now at like 5.5 million

EAU: Yeah. I was like, that is such an underestimate

EW: It's like Doctor Evil, like \$1 million. Like that's kind of what it reminded me of. 1 million Insects. Yeah. Um, but yeah, I went all in on video clips for this

EAU: I can't wait. Yeah.

EW: So yeah, there's an amazing, uh, archive work at the National Agricultural Library on the USDA website, uh, and as well as the internet archive, which is just one of my favorite things in existence. But, but I wanted to start the history of screwworm with that clip because I feel like it transports us back to a time when New World screwworm was among the top threats to agriculture here in the us. And by the way, I'm going to just be focusing pretty much only on New World Screwworm for this, which I'm just calling Screwworm for short.

EAU: That's what most of the literature does. That's why it was hard for me to find stuff on Old World Screwworm.

EW: Yeah. Um, but its eradication from North and Central America in 1991, which spoilers it was eradicated and spoilers its back. It marked a tremendous achievement in pest control and a demonstration of what was possible without the use of toxic pesticides. It was a big deal. Hence the sheer volume of material that's out there about the Screwworm eradication program. And after it was eradicated, it dropped outta the news cycle for the most part, except of course, in the places where it was still prevalent, like most of South America. And the recent headlines about the reemergence of screwworm here in the us, that might be the first time that many people have learned about or heard of this parasite. But in fact, it has plagued wildlife, humans, livestock in the Western Hemisphere for thousands of years. And so using genetic analyses, researchers recreated the historical spread of this parasite and found that it seemed to follow human migration throughout the Americas. So, yeah, as human migration continued across North America and then down into, uh, central and South America, the screwworm followed them. And then the introduction of European livestock starting in the 15 hundreds of course, provided even more hosts and wherever it went, as long as it found a host on which to feed, and it wasn't too picky, it'll pretty much feed on anything that has living flesh and, uh, with

EAU: like reptiles.

EW: Yeah, yeah, yeah.

EAU: A warm flush.

EW: Warm flesh. Yep. And with suitable climate conditions, it would just do its horrific thing wherever it could. And so last season we talked about how we did this episode on medicinal maggots and raved about how cool they are, which is so true. But the myis from screwworms is another matter entirely.

EAU: not the same.

EW: It is not the same. I found a quote from CE Scruggs from 1975 that I think pretty much sums it up for me. Quote. "It is doubtful that the mind of man could create a more vile scene than that of worms consuming the live flesh of one's body. The imagination almost refuses, particularly in this day and age, to conjure up the horrendous pain and outright revulsion that must come to a person infested with a writhing, seething mass of worms steadily tearing and consuming his flesh." End quote. It's, I mean, it's truly awful. It is truly awful. Yeah.

EAU: Yeah.

EW: And this feeling, this image, this sentiment towards my Isis, this might've been what the guy who first described the New World Screwworm, uh, was thinking when he gave it the name, the species name of *Hamin Vorax*, which is Man Eat. Is what it translates to.

EW: And so the guy who who did this was named Charles Cockrell. He was a surgeon in the French Navy, stationed at a penal colony cayenne in French Guiana in the mid 19th century. Conditions at this penal colony were so awful apparently that it was given the name Devil's Island. And while he was there, he treated five men who were suffering from screwworm infestation. Flies had laid eggs in each of their nostrils, and masses of larvae developed in their nasal sinuses, consuming the surrounding tissue. I know three of the five men died as a result of these infestations. And apparently 300 larvae were recovered after rinsing the sinuses out with water.

EAU: Yeah. Nasal passages seem to be a really common place when there's human infestation. Um,

EW: I mean, it makes sense. You just can't get at it as easily.

EAU: Well, and, and a lot of times too, there's like, there's, there's something else going on. Like you, like you're in a, a place where you don't have access to be able to move around or clean your surroundings or whatever, um, or that you are sick with something else, so you're not able to like swap flies away. That's that sort of a thing. Um, but it's still, it's ugh.

EW: It's, it's truly, it. It is truly awful. And I think that coll himself was quite a bit taken back by what he saw. And he wrote in this description of, of treating this, these men, that science is, quote, "powerless to prevent these terrible ravages."

EAU: O.

EW: And in that he would ultimately be proven wrong, but it would take another a hundred years or so for science to have a fighting chance. And in the meantime, screwworm continued its path of destruction. In the second half of the 18 hundreds, cattle ranching expanded greatly across the southwest. Us, especially Texas, and millions of acres were transformed by grazing and also for grazing. Windmills were built to bring water to the surface for water holes, screwworm flies like water.

EW: So that was one, you know, helping it, helping it along. Overgrazing meant fewer prairie fires, so more continuously occupied habitat. More continuous host for the screwworm. And deer replaced antelope as the dominant game animal, which grew even more abundant.

EW: So like deer herds, of course are like, can be enormous. So that's like even more hosts for the flies. According to one researcher's observation from 1959, deer are often victim to repeat infestations leading to two to 3000 larvae in one wound.

EAU: Oh goodness.

EW: And that amount of maggots, so two to 3000, can destroy an area apparently seven inches wide and seven inches deep, or 18 centimeters wide and deep, seven

EAU: mean, how many areas on a deer's body can you go seven inches deep without hitting some vital structure?

EW: I, yeah, I guess you, that's, you can't, yeah. I mean, wounds, wounds like these are, can be deadly, are often deadly. And in bad years, up to 80% of fawns of white-tailed deer were killed from these infestations. Yeah. And these deer also provided ample hosts for ticks, specifically the Gulf Coast Tick or AMB Matatu, which prefers to feed on the ears of livestock.

EW: And as we know, screwworm can lay their eggs in any wound and including tick bites. And cow's ears are often a casualty. You can tell, is this a screw worm infested area? 'cause all of their ears are just like gone or shriveled, or. Yeah, partially torn. Um, and apparently up to 90% of some of screwworm lesions start from a tick bite in some areas where the tick is, uh, especially prevalent.

EW: And then others through common farming practices like castration, branding, dehorning, and then like you mentioned, new newborn livestock are all, all often infected at the naval. And, um, on top of that, so we've got all these things going on, right? Like we've got more cattle, we've got um, water, we've got deer, we've got fewer prairie fryers.

EW: This is all happening. And then you've also got the demand for beef skyrocketing since the development of refrigeration allows you to ship the meat that you don't sell locally, which previously had restricted herd size. And so

now you've got the opportunity to create these massive herds because you can ship

EAU: ship it. Oh wow. Erin

EW: Put it all together. And what you have are the perfect conditions for, for a screwworm storm.

EAU: just takeover.

EW: Absolute takeover. And this parasite truly plagued the areas where they were established. And it was a horror for livestock owners. Quote, this is a quote from one of these owners. "A particularly disgusting and sickening job was when cows or calves got screwworms in their mouth and gums. This came about in two ways. One, the cow or calf, if they could reach the wound, would try to lick the worms out of the lesion. Thus, some live worms would get in the mouth of the animal and take hold. In some cases, I'm sure that flies would also lay eggs in the mouth of the newborn calves. You couldn't use any medicine. Just remove the worms and hope you get them all. Some cases would be so bad that an animal might lose some of their teeth. It sure wasn't a job for anyone with a queasy stomach" end quote.

EAU: Oh, I've seen some pictures of that in like sheep's mouths and it's so awful. Erin.

EW: Awful. And so you're trying, I mean, imagine you have a, a herd of cattle and you have to spend so much of your time trying to do this. Like it was a losing battle too because as you mentioned, infected lesions will attract more, uh, flies. So they, they ooze a quote, "straw colored and often bloody discharge that attracts more flies resulting in multiple infestations by hundreds to thousands of maggots of all sizes. Death is inevitable unless the animal is found and treated." End

EAU: Mm-hmm.

EW: the horror of screw worm infestations was deepened by how inevitable they seemed. You could react, you could treat the animal, but how do you prevent them from attacking in the first place? Part of the issue was a misunderstanding of the screwworms biology, which was only corrected in 1933. So for decades, the screwworm was misidentified as just a, a regular type of blowfly. One who primarily fed on kerion and only on live flesh sometimes. So it was like, okay, opportunistic, live flesh feeder. And so it was thought,

okay, well if you get rid of all the carcasses on your rangeland, that is gonna prevent the screwworm from being problem. But since it, it feeds exclusively on live flesh, it actually doesn't really do anything. And so recognizing that aspect of its biology was a huge step forward. And that happened in 1933. And around the same time, there was another development that would revolutionize the way that we dealt with screwworm. And that was the, uh, a newly minted entomologist joining the cause. in 1934. Edward f Knipling. A recent master's graduate from Iowa State University started work at the USDA where he was tasked with, among other things, collecting and counting, screwworm flies, cotton traps. Knipling was no stranger to Screwworm. He grew up on a farm in rural southern Texas. He was one of 10 kids, and the farm is how they produced most of the food for this, his big family. So they would all be, you take part in dealing with the livestock and he described, um, removing, having to remove and look out for screwworm among other, uh, agricultural pests.

EW: Before he went to college, he was aware of screwworm and the problems that it could cause, but it was at university that he gained a fuller perspective of how much insects have affected humanity, not just as, as livestock or agricultural pests, but also as vectors of disease killing hundreds of millions of people around the world. He knew that control of these disease vectors and agricultural pests could save lives and livelihoods. And so while working at the USDA, he got to see firsthand how powerful some insecticides were, like DDT, which was just sort of like, you know, really

EAU: Kill it all.

EW: thing, kill it all. And also how quickly they lost their potency as insects grew, resistant, not to mention the toxic impacts of some of these pesticides. And so he realized that a different, more proactive approach was needed. Aaron play the clip titled Screw Worm too.

EAU: Okay. This is so fun. Screw Worm two is this

Edward Knipling: What we really need is some way to control the screwworms before they attack the animals rather than, than just wait until after the animal has had the screwworm then try to control it. I realized that you would never, never really control the screwworm that way. What we needed was some preventive measure, but how to, how to, control the screwworm on hundreds of thousands of square miles of territory of course seemed like a tremendous undertaking. And the use of insecticides or something like that seemed out of the question and no doubt was. But then I conceived the idea that perhaps we could rear the screwworm and have it some, some genetic

deficiency that then it would release, and release those genetically-deficient insects into the population. They would mate with the normal flies and transmit detrimental characteristics. Just how I came to that conclusion. I really have a little difficulty even today.

EW: Isn't that amazing?

EAU: He is like, I just kind of knew we had to do it. Don't know why I knew it, but I did.

EW: He's like, I did. Yeah. I, he's like, I, I don't know. I have this brilliant idea and I have no idea how I came up with it.

EAU: I love that.

EW: I love that. So that was, yeah, that was, that was Dr. Knipling himself interviewed in January, 2000 as part of an oral history project the screwworm eradication program. Yeah.

EW: And so what he's talking about here is what you mentioned, Erin, which is the sterile insect technique, which is an insect control measure where large numbers of flies are made sterile and then released, ultimately leading to a massive decrease in wild population sizes. And the idea behind this is that the sterile males are released will mate with the females. They won't produce any eggs. And so there will be fewer and fewer screwworms over successive generations. And there are a few aspects of the screwworms biology that help this technique to be successful. The first is that screwworms, like you said, Erin tend to mate just once. And so if they mate with a sterile male, there's no viable offspring. That's it.

EAU: The females mate once, but the males mate like up to 10

EW: times. Yes. Yeah.

EAU: So one sterile male could be mating with 10 non-sterile females and then they're not laying any eggs.

EW: Yep. It's, and then the second thing is that in the screwworm affected areas in the US, which is more like subtropical. Only a small proportion can survive over the winter. And so if you hit that area hard enough with sterile flies one year, you can really make a dramatic impact. And

EAU: You can really reduce that population size to begin with. That actually makes a lot of sense.

EW: Yeah. Knipling wasn't the only one to come up with this idea or idea similar to this, like eradication or elimination via sterilization. There were a few other scientists that also proposed something similar in like the 1930s and forties, but he was really the only one or the first one to get it off the ground and for a number of years. You know, after coming up with this idea, he was like, okay, he had the idea first, and then he was like, how do I actually implement this? Like. What, how do I make them sterile? And, um, he, a colleague in 1950 was like, Hey, have you, have you heard of this paper? Have you read this paper by HJ Mueller? He used X-rays to make drosophila fruit flies sterile in 1928, that's when the paper was, was published. And Mueller had actually been awarded the Nobel Prize in Physiology or Medicine in 1946 for what he had shown in that paper that mutations can be induced by x-rays. And this of course, like alerted the public to the dangers of radiation and was like part of the whole like, oh God, you

EAU: Oh no.

EW: But when Knipling read this paper, he was like, oh my God, this, this is it. This is what I've been looking for. You know, I mean,

EAU: Can I do this with my

EW: little bit. Yeah. And so he reached out to Muller to be like, Hey, do you think that I could use x-rays to make screw room sterile? And Mueller was like, sure. Like, I think that sounds great.

EAU: I'm at it, bro.

EW: And so Knipling borrowed an army hospital x-ray unit to give it a go. And it worked like not only were the males sterile, but the females that mated with them were also effectively made sterile, because again, they only produced once and later they switched from x-rays to like other, uh, methods of radiation, which gave more consistent results. But, you know, once they tested this out in the lab, all they had left to do was actually, you know, see if it worked in real world settings. And the first trials were carried out beginning in 1951 on Sanibel Island in Florida. And, uh, when it was 200 to 300 sterile flies were released each week.

EW: How did they get so many flies you might ask? Uh, they had to rear them in the lab. Uh, and because these live on, you know, like flesh, they used ground meat and blood. Can you imagine just like the smell of that rearing

EAU: like I read several papers where people were talking about the smell and like the process of finding the right. Actually, I read a really interesting one about the lures that they use now, like when in their monitoring programs they have a lu, the lure is called swarm lure. I think we're on version four and it's like this concoction that they made based on looking at what are all of the scents and the things that are emitted by the meats and the blood and the over position fluid and all of this other stuff to try and make a lure to attract them.

EAU: And it's like, blah.

EW: It's so gross. I love that though.

EW: I mean that, like, I don't, that seems to me like complete alchemy. Like that's magic. To be able to be like, what are these compounds? Let's make this,

EAU: Well there, there was so many people at U of I doing stuff like that, but for agricultural pests.

EW: Yeah. Yeah. I, it was just, it all sound, it all is amazing to

EAU: I love it. Yeah.

EW: Um, but anyway, so with the Sandoval Island, you know, real world experiment, the screw room, fly populations did drop over a couple of years, but they weren't era. I mean, they dropped dramatically, but they weren't eradicated entirely.

EW: And that's probably because fertile female flies flew over from the mainland. But like, and what they really needed, I think what the US government was looking for, uh, outside of the USDA, but like the, you know, the people who were providing the funding were like, we need 100% perfect

EAU: It must be eradicated.

EW: Yeah. And

EW: so

EW: this was

EW: kind of. This. Yeah. And so they were like, we gotta do something else. Like what, what else, what else? But this, so there was a kind of a lukewarm reception to these results. And so the US government wasn't really keen on continuing trials. They were like, we tried it, but I'm not sure.

EW: But then there was an agricultural officer on the Dutch controlled island of AU who reached out to Knipling for help with their screwworm problem, which was huge in 1954. Knipling was like, let's do this. Um, so they dropped more sterile flies onto AU and Screwworm were eradicated within 14 weeks, which is four to five generations.

EAU: 14 weeks eradicated. Wow. I didn't realize it was that fast. That's bananas.

EW: And so this, finally, this was like proof positive that Knipling's idea could work. And the, so the US government was like, okay.

EAU: Okay, fine,

EW: I guess, and the, the dream of actual widespread screwworm eradication got a whole lot closer to reality, and it demonstrated that you could effectively control agricultural pests without the use of toxic substances like DDT.

EW: And actually in the, like one of the last chapters of Silent Spring, Rachel Carson wrote about Knipling's work as like a hopeful path for the future. Like we can use Biocontrol in a way that doesn't like

EW: poison. Yeah.

EAU: Wow.

EW: it's, it's, it's very interesting. And so construction on bigger fly rearing facilities began including one that was capable of producing 200 million flies a week, which was a feat that required 120 tons of meat.

EW: Uh, 114,000 liters of water and 38,000 liters of blood each week. Would you like to know what kind of meat? I really got into the, down the rabbit hole here. Okay. It included horse meat, whale meat, and ground up nutria, those little,

EAU: Whale meat.

EW: I, listen, I don't know. Later on I don't think that this str I think that they were like, this is not, um, sustainable.

EW: We need to do something else. And so they developed like a jelled substrate that was like dried cow blood, egg milk, substitute and some formaldehyde to prevent it from spoiling. So they found something else that was less.

EAU: not using whale meat.

EW: Yeah. Yeah. Um, and so after they constructed these, these fly rearing facilities, they were like, let's, let's get this going. And so in the early 1960s, an eradication program began that targeted the entire southwestern us. By this point in time, um, screw room had been eradicated from Florida by the late 1950s. And so over that decade, over the 1960s, screwworm populations plummeted. Erin, if you will, play the clip titled Screwworm three.

EAU: Okay.

Who Shall Reap?: In this half of our century, man has conquered the atom, the frontiers of space, the depths of the ocean. Could not this advanced technology be applied to control pests with even greater effectiveness and safety? Within the last decade, radioactive cobalt-60 has been used to sterilize millions of pupae of the male screwworm fly, whose parasitic larvae, breeding in the flesh of cattle, deer, and other animals, posed a major problem to our livestock industry in the southern half of the nation. Once the pupae developed, huge numbers of sterile male flies were dropped over infested areas to mate with female flies, soon drastically reducing the population of a major threat in America.

EAU: So that was the, that that was them doing the, the irradiation. Right.

EW: Yep. Yeah, that was them dropping. Yeah. So that, that video is from the same clip from, uh, that I played at the start of this from 19, the 1969 clip. And despite the haunting music, like the narration ends quite optimistically, right? Like this is the end of SC screws. We're starting to see like we are conquering. This. Um, by the way, the, the video, I don't know if I mentioned this, but the video is titled, who Shall Reap? I, yeah, it's kind of, anyway, the whole video is great.

EAU: It is. So this is a total side note, but it's so interesting to watch these old videos that are so like slow and the way that they're like, the narration is like this, and then like even the clips of everything and I'm like, if this was today, it would be like, screwworm. Like

EW: 1000 cuts like in

EAU: a million cuts. Yeah. You'd never actually see a fly. 'Cause it would just be like,

EW: yeah.

EAU: anyways.

EW: Education by a Million Cuts. It's true. Um, but yeah, so, uh, but this, I feel like the, the optimistic ending from that clip did play out for a while. Like that is the way that it was, it was looking at least in the Southwestern us, but the feeling was unfortunately short-lived. Because outbreaks of Screwworm began popping up in 1972 to 1976, and then 1978 as well.

EW: And you know what was going on? Part of it was suitable conditions for screwworm development. So like it was a period of warmer and wet weather that provided just more habitat. And then another was reduced care for livestock. So like fewer and less frequent in inspections. Once you think worms are gone, one gets through, that one starts a huge problem.

EAU: You're not checking as much.

EW: yeah. But these were, I think, relatively minor factors compared to the real reason for these outbreaks. And that is that parasites don't respect arbitrary political boundaries. They don't. And so the eradication program successful as they were only focused on the US side of the border with Mexico. And since these flies can travel up to 180 miles or 290 kilometers, fertile flies could easily travel to treated areas. That's a, a huge flight range. It's

EAU: It's such a huge flight range.

EW: Yeah. And the, so the, the flight range though of these, of these flies was not known when they started the eradication program. I think this was like one of the lessons learned right away.

EW: Yeah. And so after the first of these bad outbreaks in 1972, uh, which there was 95,000 cases were recorded, I'm sure that it was actually higher than that. Um, the two governments, the US and Mexico, signed the Mexico United States Screw Room eradication agreement and about 10 years and a giant fly rearing fac facility later capable of producing 500 million sterile flies per week.

EW: Unbelievable.

EAU: it's, the numbers are unfathomable.

EW: Truly, truly. Uh, but things started to look pretty good. Things were looking actually pretty great. And by 1991, all of the US and Mexico were declared free of Screwworm. And there was a, a scary blip from like 1988 to 1992 when infected cattle were brought into Libya, in fact infested with the new world screwworm.

EW: And then that made people super concerned that like, hey, this is gonna take over. Like this is going to spread everywhere, Africa, middle East, Europe. And so a bunch of sterile flies were released. And by June, 1992, the region was declared screwworm free. And this really demonstrated the importance of, well, first of all, it demonstrated the power of the sterile fly, the sterile insect technique and the importance of thoroughly inspecting livestock for possible sides of infection.

EW: But that can be difficult to do. But do you know who's really good at it? Dogs. There are dogs that have been trained for this purpose today. And I think the first screw room detection dog was, there's a paper, uh, his name was Cazador, which means Hunter, and he was trained by researcher John Welch to work at quarantine and inspection stations.

EW: And he had a success rate of 99.7%. And the only time that he like didn't identify is when he had like some GI bug. And so he was sick and needed to rest.

EAU: Oh, they made him work even though he was sick.

EW: I don't think they realized. Yeah. But it's like, it's so sweet. The paper, uh, uh, have it, it'll be on our, in our show notes or like in our, in our, on our website.

EW: And it's, he's thanked in the acknowledgements.

EAU: Oh my God, that's so cute.

EW: is. And his leash and his ashes are in the National Agricultural library. In the screwworm unit.

EAU: Wow.

EW: I know.

EAU: That's really special.

EW: Isn't that,

EW: I just loved that. Um, we'll put a picture of of Caz. We'll try to find a picture of Caz somewhere. Um, there are lots of

EW: them, but, so anyway, over the 1990s and into the two thousands eradication

EW: efforts in the Western Hemisphere continued into, uh, central America and the Caribbean.

EW: And they were largely successful, at least for a time. But eradication has proved to be a moving target, and Screwworm has reemerged in areas where it was previously declared eradicated. And in light of that, I wanna play just one more clip for you. So play Screwworm for.

Edward Knipling: What lesson can we learn from the screwworm program? Well, to me, it is a remarkable program and I sometimes wonder how it ever materialized in the first place and how they they were able to get this program underway. But it confirms something that I'm absolutely confident of and this is that if we're gonna deal with major insect pest problems, we're gonna have to deal with them from an area-wide standpoint. That we cannot deal with these pest problems by just trying to control them year after year on a farm-by-farm basis. Just like we never would've controlled the screwworm that way, we will never control the boll weevil or the corn, corn earworm or the cabbage looper or codling moth or whatever. You'll never control these insects this way. I mean, you'll control 'em, but you will not reduce the threat. But there is the possibility that we can do the same thing for dozens of other insects.

EAU: Oh, Erin, I love that. 'cause that's like the conclusion at the end of my section as well.

EW: I know. Like I, it just, so like I said, that interview was recorded in January, 2000, and

EW: the lesson is, is as relevant today as it was then.

EAU: And extends so far beyond just insect and agricultural pests.

EW: yes, it's,

EAU: Nippling. Thank you.

EW: If it's public health. Yeah, yeah, yeah. Like GL Global. Yeah. Global health, all of that. Um, and so, yeah. With that, Erin, I'm, I'll turn it over to you to tell me where, what the people really wanna hear, which is where we are with screwworm today.

EAU: Oh, let me tell you, uh, it's not great.

EW: Yep. Yeah.

EAU: Um, every week still to this day, for decades now, planes drop millions of sterilized insects, which are grown and irradiated. They use slightly different techniques now in a lab in Panama, they've moved. The, the labs are no longer, the rearing facilities are no longer in the us, no longer in Mexico.

EAU: They are in Panama, and millions of sterilized insects are dropped across the Darien gap

EAU: and the very first part of Columbia in an attempt to keep screwworms out of Central and North America. And yet, despite all the success that you talked about, Erin, in 2016, I think is when the first like rumblings that things were not all perfect,

EAU: began in modern, most modern times because there was an outbreak in Key West Florida.

EW: That's right.

EAU: It was relatively quickly contained. Um, but the deer population in Florida took a hit because of this. And despite the incredible successes of the program, the truth is that new world screwworms are still present. This fly is

still present throughout nearly all of South America, as well as many islands in the Caribbean, including Cuba, Haiti, and the Dominican Republic. And so since 2023. So in the last two years, cases have increased within like North and Central America from an average of about 25 cases per year to 6,500 in one year, in 2023.

EW: Okay.

EAU: And so since 2023 flies have been reported in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Mexico, with more than 20,000 new outbreaks reported like individual outbreaks as of August 22nd, 2025, per the World Organization of Animal Health or the WOAHA.

EW: Okay.

EAU: Most all of these outbreaks are in livestock animals. There are some cases in domestic animals. There have also been cases in humans, but some of these outbreaks have been hundreds, if not thousands of animals in infected. So right now on the APHIS website, which is the Animal and Plant Health Inspection Service. As of September 2nd, 2025, there are several outbreaks ongoing in Mexico that are of serious concern to the US government, which has resulted in the US government shutting down all live livestock, like live cattle trade between Mexico and the us.

EAU: There have been over 5,500 total cases in Mexico currently as of September 2nd, 777 active cases, and at least one confirmed case in a human in the us, which was a travel associated case with someone traveling from El Salvador and coming back with an infection they've recovered. In 2024. In Costa Rica, there were seven human cases that were reported, including one death, and in Nicaragua there were 124 cases in humans in the last year.

EAU: But this is not the case that like we as humans need to start panicking that we are all going to be infected with screwworm. That's not, that's not the situation here. But what this does show us is the fragility of our eradication efforts and the necessity of these one health approaches, and that they don't face the kind of budgetary cuts that we see currently playing out across every single health agency in the us.

EW: Budgetary and like intellectual cuts

EAU: Yes, a hundred percent,

EW: um, uh, I, I have a question about, so you, you, in terms of the numbers, we've talked about humans, we've talked about livestock, and maybe a little bit like domestic animals. What about wildlife?

EAU: question. What about wildlife? Certainly some of these infections are happening in wildlife, but we just don't have as good of numbers on wildlife populations. But, But, that is definitely a huge concern, right? Because not only is that like a potential reservoir, uh, but it's also just then we're affecting livestock populations and like the effects of this eradication program on benefiting the health of wildlife should not be understated as well too.

EW: Yeah.

EAU: Um, yeah, so that's kind of like where we stand with like what's going on with current, with current outbreaks. Um, the live cattle market in the US was valued in 2023 at \$3 billion per year, and it's gone up since then. And the USDA uh, says that estimates currently that an outbreak, like a true outbreak of screwworm in the US could end up costing something like \$10 billion in losses,

EW: So this is, this is something that I kept coming across too, was the Screw room eradication program, which has cost money.

EAU: costs money. It costs a few million dollars a year.

EW: Yeah. It has saved so much in terms of revenue from livestock, people's livelihoods. And I think what is like, so it's like, okay, well we, we can do this. We did this here in the us we did this in Mexico, we did this throughout a lot of Central America and in South America. It's like, well, they couldn't afford these programs, but they are losing money year after year. And so it's like, again, it comes back to this has, this is an area wide program. I, I lack the words, the articulation needed to express this, but like, this should be a continental, a hemisphere wide effort.

EAU: a hundred percent Erin. And so right now what the US is doing is going absolute ham. They are reopening facilities in Texas. They are rebuilding a facility in Mexico. They're going to spend tens of millions of more dollars to start breeding flies in the US and Mexico for sterile insect technique.

EAU: It is going to take years, at least 18 months is the current estimate for these to happen and get up and running. This is essential that it happens right now and they have this like five point plan, which all sounds very much like war language, um, but they are taking this very seriously. And I think there was

a paper from 2000 actually that really exemplified what is the true kind of hero of the Screwworm story. And that is that in order for the success that we have had thus far to happen, a ton of cooperative agreements had to exist between countries for this eradication program to take place and to be successful because yeah, flies don't give a crap about our national borders the same way that infectious diseases like COVID don't honor these artificial divisions.

EW: Right.

EAU: Even though this program is currently kind of at risk, right? And we're having to re-up it, it was only possible in the first place because countries decided it was important enough to invest in and to work together, despite the difficulties and the like financial agreements that had to be made to coordinate the implementation of this program. But they agreed it was important because they could make a lot more money.

EW: I

EW: mean,

EAU: because the livestock industry.

EAU: Yeah, the livestock industry and the funding around this were considered important enough. The absence of these screwworms in the US is estimated, at least at a minimum, to be a \$1.3 billion benefit every single year.

EAU: So spending a few million dollars to keep this program running is nothing compared to that benefit.

EW: Yeah.

EAU: It would be great if we could recognize that this is also true for so many other things besides just screwworm. And yes, expanding this to be able to eradicate it throughout its entire range rather than just stopping at the border of Colombia, would go a really long way to improving the lives of humans and livestock and wildlife across the entire Western hemisphere.

EW: Yep.

EAU: And it is also possible that this could happen for old, old World Screwworm. They have very similar mating habits so they could also benefit from sterile insect technique programs. But there just hasn't been as much of

this collective agreement infrastructure buildup and the money upfront to be able to do this. Where old world screwworm, that's really hard for me to say, is endemic. And so the programs that have tried to get up and running there have not been as successful.

EW: Mm-hmm.

EAU: There's a lot of interest too in like creating like newer techniques to make this even more effective and even more cost saving, like doing transgenic flies so that you're only really rearing male flies. 'Cause right now you, you're rearing indiscriminately female and male flies. So if you could kind of whittle down the female population so that you're only releasing male flies, you're kind of doubling your efforts, but at a lower cost. But like all, all of that is, is amazing. Thi this is an amazing program. It is incredible. Let us apply this success to other

EW: It's,

EAU: of public health.

EW: Use it as a framework like this is, I mean, and it is like, it's,

EAU: It is, but it's also not.

EW: yeah.

EAU: that screwworm baby.

EW: Oh wow. Um,

EAU: what a fascinating thing though. Like also just the, like the, the, the entomology of it all. I love

EW: The entomology. I just also, I love, I think this is when I was like, oh, I could spend weeks just digging around on the USDA, like the, the National Agriculture Library website and then the archives, the internet archive. Like I was having a blast looking through these oral histories and the transcripts, and I'm like, there are more that aren't digitized. I want them, um, I reached out to a librarian, was like, can you help me find this? And they did. And I'm just like, I love library. I love libraries, I love librarians. It's, and also I, I think I had no concept how huge this program was because you, you can't find a lot of other agricultural, well maybe agricultural pest videos, but like other disease videos

from the 1950s and sixties and so on, not so much. Like this is a huge effort and it was a huge success story and it can still be.

EAU: Yeah, it will be, I think it will be successful. The funding is going there. It's happening, but yeah. Can it go further? That would be cool.

EW: That'll be cool. Should we tell the people where they can find more information? Okay. I have linked to all of those videos. I have a ton of sources, but I'm gonna shout out two in particular. So one was the, uh, the website, the Screw the Stop screwworms. It's a, it's an online like digital, um, collection. So it's selections from the Screw Room eradication collection on the National Agricultural Library, USDA website. It's very cool. And then also there was a fun, a couple fun chapters in, in a book, a popular book published in 1984 called the D the Dragon Hunters by F Graham. And it was, uh, these two chapters that I read focused on, uh, screw Room and Screw Room or eradication.

EAU: Love it. Uh, I had a bunch of papers I, I don't even know, Erin. Um, the one that I mentioned already that I did really enjoy was by wis. From 2000 called Screwworm eradication in the Americas. That focused a lot on like the success of these collective agreements and things like that. Um, there was also a paper from 2017 that was review of research advances in the Screwworm eradication program over the past 25 years. That was really interesting. Um, and then a couple of papers that are like quite old from like the eighties and nineties about the screwworm behavior and biology and things like that. And then I also have links to the USDA website where they have their new World Screwworm Domestic Readiness and Response policy initiative document, which is really interesting to read through. And then, uh, also the updates if you would like them, because I'm sure the numbers will be different by the time that this episode comes out. Um, but on the APHIS website you can find those like updated, uh, data on what the outbreaks look like in Mexico, what other cases have been reported and things like that. You can find it all on our website. This podcast will kill you.com.

EW: Thank you to Bloodmobile for preventing the music for this episode and all of our episodes.

EAU: Thank you to Lianna and Tom and Pete and Brent and Jessica and everyone else at Exactly right. Who makes all of this possible.

EW: and to you listeners who also make this possible, who, you know, let us keep doing this and our, our patrons, you know, a big, you know, thank you. Shout out to you as well. Your support means the world to us.

EAU: We love you.

EW: Yeah.

EAU: it.

EW: Well, until next time, wash your hands.

EAU: filthy animals.