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Parasitic Wasps Podcast and Scientist Interview
Microplitis demolitor

Sometimes it's hard to tell where one organism stops and another begins. That's especially true with the kind of evolutionary race that takes place between parasites and their unwilling hosts.

Transcript

Ari: From the Encyclopedia of Life, this is One Species at a Time. I'm Ari Daniel.

The deeper we go in this story, the more intricate things become – to the point where we're forced to reconsider where one organism stops and another starts. Michael Strand holds up a clear plastic jug with what looks like flitting grains of black rice.

Strand: This is *Microplitis demolitor.*

Ari: It's only a matter of time before these little *Microplitis demolitor* wasps decide to mate and lay their eggs, but they can't do it alone. Strand – who's an entomologist at the University of Georgia – reaches into a fridge in his lab. He pulls out some petri dishes containing several dozen pale caterpillars. They're soybean loopers, or *Chrysodeixis includens.*

Strand: Normally the caterpillar would grow like this…

Ari: What – to be like really plump and…

Strand: Big, plump, and fat and happy.

Ari: There are definitely a few fat ones crawling around. But most of them are just plain scrawny.

Strand: They're a little scrawny because they can't grow normally.

Ari: And that's because those little wasps pierced these caterpillars with their stingers, and laid an egg inside each one. Once the eggs hatched, the wasp larvae began consuming the caterpillars from the inside out… by lapping up their blood. You see, *Microplitis demolitor* is a kind of parasitic wasp. And these caterpillars are scrawny because they're being starved to death.

Ari: Eventually, a wasp will burst out of that caterpillar.

Strand: Exactly, so you can see that occurring right here.

Ari: I can make out a small shadow inside the caterpillar.

Strand: So… here's one coming out of the body of the caterpillar right here. Just chews a hole right through the side of the caterpillar, and crawls right out.

Ari: Now, I would bet some people would think this is kind of gross.

Strand: No, I'm not grossed out at all.

Ari: Strand finds it difficult to be disgusted by something that's so common. There are hundreds of thousands of species of parasitic wasps all over the world, infecting hundreds of thousands of species of other insects. And they're really good at it. Back in his office, Strand tells me their secret. A virus.

Strand: This virus infected the ancestor of these wasps 100 million years ago.

Ari: The virus no longer makes the wasps sick. Quite the contrary – nowadays, they've come to depend on each other. The only place where the virus emerges inside a wasp is in her ovaries.

Strand: So when a wasp injects eggs into the host, she injects a quantity of this virus into the host as well.

Ari: So these wasp viruses actually infect the host insect, which is where they do their real damage – by suppressing the immune system of the host.

Strand: So they render the host incapable of defending itself from the parasite.

Ari: These viruses manipulate the host insects in other ways too, depending on the species – all to serve the needs of the particular wasp.

Strand: They might make hosts develop more quickly, or they might prevent a host from molting.

Ari: My favorite is what the virus does to those pale caterpillars Strand showed me earlier. It makes them go diabetic, so the caterpillar dumps massive amounts of sugar into its bloodstream – sugar that a growing wasp larva slurps right up.

And the really crazy thing is that the viral DNA has actually integrated itself into the wasp DNA.

Strand: It's much more difficult to discern what is wasp and what is virus. The virus has essentially become part of the wasp.

Ari: So to recap – parasitic wasps are extra parasitic because of the help they get from their viruses. Now not all insects resign themselves to a wasp's injection and viral infection. Some fight back.

Oliver: Yes, right, there are aphids.

Ari: This is Kerry Oliver, also an entomologist at the University of Georgia. Aphids are teardrop shaped insects, and they're tiny – about the size of a splinter. They tend to mind their own business, sipping plant nectar. But when a parasitic wasp attempts to lay her egg inside an aphid, it will defend itself.

Oliver: They can kick.

Ari: Does the kicking work?

Oliver: Not very well. They can drop from the plant, but that itself is dangerous.

Ari: Sounds kinda hopeless, but some aphids have a better weapon in their arsenal – a kind of bacteria that's passed from a mother aphid to her offspring.

Oliver: The wasp will still lay an egg inside of the aphid, but if the aphid is carrying this bacteria, the wasp is unable to complete development within the aphid.

Ari: Oliver isn't sure how the bacteria safeguard the aphid, but he does know they can't do it on their own. The bacteria need to be infected with a virus for the aphid to receive protection. So the aphid, the bacteria, and its virus are all on the same side.

Oliver: Their interests are essentially all aligned for the aphid to survive that attack and to reproduce.

Ari: It's still possible to tell these organisms apart. But give it enough time, and Michael Strand says they'll start blending together too, just like the wasps and their viruses. Their genomes will become co-dependent, and they won't be able to exist independently of one another. Life is just too complex to conform to our simple system of classification.

Strand: Before you know it, you have many different agents that have influenced the biology of each other in a way that's increasingly difficult to separate.

Ari: At the moment, the aphid seems to have the edge. But eventually the scales will tip back in favor of the wasp. This is an evolutionary arms race after all, being fought out by insects on blades of grass and the undersides of leaves… with bacteria and viruses serving as the fiercest of allies, and DNA orchestrating every maneuver.

Our series, One Species at a Time, is produced by Atlantic Public Media in Woods Hole, Massachusetts. I'm Ari Daniel.

Meet the Scientist

Meet Dr. Michael Strand, featured in the Parasitic Wasp podcast:

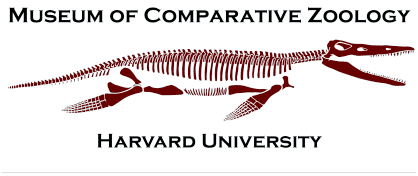
Where do you work?
I work at the University of Georgia, Athens, Georgia, USA.

What do you study?
I work on the interactions between insects and different kinds of parasites.

What are three titles you would give yourself?
Entomologist, Invertebrate immunologist, virologist.

What do you like to do when you are not working?
Mainly work in a garden we've developed at home and hike a good bit in Southern Appalachia.

What do you like most about science?
I enjoy learning about how different physiological and molecular processes function in insects and I also enjoy learning about how insects interact with different types of pathogenic and mutualistic microorganisms.



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