Smithsonian Folklife Festival Interview

Dr. Nathan Schiff
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Stoneville, Mississippi

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Interviewer: Michelle McAnnally

[Tape begin with approximately one minute of shots of Nathan Schiff's lab. Occasional voices in background, too faint to be heard.]

[Nathan Schiff shown sitting in his lab.]

Michelle McAnnally (MM): All right. Tell me your name and your title here.

Nathan Schiff (NS): My name is Nathan Schiff. I'm a research entomologist. I work for the Center for Bottomland Hardwoods Research in Stoneville, Mississippi, and I study bugs that carry diseases that kill trees.

MM: What's your home town? Where were you born?

NS: I was actually born in New York, but my family moved to England when I was six. We lived there for ten years. And since then I've lived in nine states. I think of myself as an American.

MM: I see. Tell me about your education, your background.

NS: I went to the University of California at Los Angeles for my undergraduate degree. I took some courses at UC Berkeley independently after that before I took a master's entomology at the University of Arizona, followed by a Ph.D. at the University of Illinois. I did several post docs trying to figure out what I wanted to do, including honeybee population genetics, molecular biology, and I finally ended up here, studying wood borers and how they spread diseases that kill trees.

MM: Tell me how you ended up in Stoneville, Mississippi.

NS: Stoneville, Mississippi is actually quite interesting. I… When you're a post doc you always need to have a job next year, and a permanent position opened up in Stoneville, and they were very interested in having somebody look at bugs that carried diseases that killed trees. I happened to specialize in a group of insects called sawflies. They're primitive Hymenoptera, or primitive bees and wasps. They don't have the constricted waist, but they all feed on plant material. They tend to be fairly host-specific, and the ones that feed on trees use a fungus to help them eat. Insects can't digest cellulose, which is what trees are made of, and so they have to use a symbiont to help them digest the wood. The wasps that I study use a fungal symbiont, and the fungus, the female lays her eggs in the tree. She has a gland in her abdomen which contains the fungus. When she lays her eggs she squirts a little bit of fungus in there. The fungus grows through the tree and it produces extra-cellular cellulases or enzymes which digest the wood. The larvae can then eat the fungi and the digested wood. The fungus of course devalues the tree.

MM: So here at the Center then I guess you work with people, with foresters, and different things. Tell me a little bit about the different projects that you work on here, specifically.

NS: Okay. I work on a number of projects in collaboration with several people. My colleague in the office next to me, Dan Wilson, is a mycologist. He's very interested in wood decay fungi. So he and I have built a little team that work on the wood wasps. We work with a collaborator in Japan. We have a chemist in Canada who does our chemistry. We work with a behaviorist who works for the Agricultural Research Service across the road, Libby Williams, and he helps us do behavior. All trying to elucidate the biology of these wasps that kill trees.

We also work, I also work with Kenneth Mininger, who's another plant pathologist, on Xzlella Fastidiosa. This is a bacteria that kills a lot of plants, but probably the most famous example recently is Xylella Fastidiosa kills grapevines in California, and it's spread by an insect called the glassy-winged sharpshooter. I've been very interested in trying to figure out how the glassy-winged sharpshooter spreads this bacterial disease to sycamore trees which otherwise would be a very good production tree down here in the South for paper. The bacterial disease kills the tree after seven years. If we could just get it to grow for eleven years before the bacterium kills the tree, we would be able to have a marketable product. So I believe there's a breeding program in the future there.

I also work on an endangered species of plant called pondberry. Pondberry grows in the forests in the southeastern United States. Some people describe it as our most endangered shrub. It causes a lot of problem because it lives in the forest and you can't harvest the forests, or you can't collect trees where the plant grows, so we've been working on a project for five or six years, myself and Margaret Duvall, and recently we've added a number of other scientists and some post docs, to study the biology of this plant to see whether we can find new places for it to live, or basically what are the factors that control how it grows. That's a fairly big project.

I've worked on a couple of other projects here. One of the big problems with forests nowadays are invasive weeds. Originally when I came here I worked on an invasive weed we have here in the South called kudzu. I got to travel to China to look for insects that feed on kudzu. I no longer work on this project, but some nice work in being done by the lab in Athens, Georgia, and they're using a sawfly to… well they're trying to think of using a sawfly to control kudzu. Sawflies are very interesting for biological control because they tend to be very monophagous. They only eat one plant. And so they make a good thing to introduce, if you can find one that feeds on kudzu. We found several.

MM: I understand you have quite a bug collection and show your bug collection around to school groups and different things. Let's take a look at that and look at your bug collection right now. What's your favorite one you want to show us?

NS: Excellent. I probably do about ten presentations a year to school groups, and I talk at some museums. I've traveled extensively. When I first got a little bit of money, when I had a real job, I decided I wanted to see some of the tropical rain forests. I worked with colleagues at the Bohart Museum at UC Davis, and basically we organized trips to places where the museum doesn't have very many holdings, and we go and we collect bugs. We work with NGOs and we work with governmental organizations and forestry groups in these countries, and we look for species, and we collect a lot of insects.

[Rises and walks to the table containing insect display.] I was on a trip in Papua, New Guinea for about five weeks, and here are some of the insects that we collected. These are just butterflies, but the large insect in the middle is a walking stick that's about eighteen inches long. These were fascinating to us. Me and my two colleagues, Terry Sears and Steve Hayden, were unable to find any of these insects by ourselves, since they blended into the trees that they sat on very well, but the natives… We hired a, we basically hired everybody in a little village, the village of Tekadu, in the middle of nowhere in Papua New Guinea, to collect insects for us. We taught them how to collect insects and [prepare] them. We were there for five weeks. And they found us a lot of these walking sticks. Walking sticks are native to Southeast Asia. There are probably two thousand species there. We have probably fifteen or twenty in America. And this large one, about eighteen inches long, it won't fit up and down in the drawer, it has to be on the bias. They collected these for us. This one's faded, but in real life they're absolutely the same color as the green leaves of the tree. The natives can find them because they eat them. It's a very large insect, and you would think there's a lot of insect to eat there, but they don't eat the abdomen. The tree that this particular insect lives on has very foul-tasting leaves. So the abdomen, which has the stomach, tastes bad. But the thorax, which has all the walking muscles, doesn't taste bad because there's no stomach in there. So the natives would just collect these and take a bite out of the middle. They would bite the thorax and then throw the front and the back away. This fascinated us.

We did try many of the insects that they eat there. One of my, one of the best insects they eat, I used to call them popcorn beetles. They would take the larvae of the weevil that lives in palm

leaves; they would dig them out with their knives. They would stuff them into little pieces of bamboo. They'd put the bamboo in the fire, and then they would roll the bamboo in the fire. When the bamboo was black they were done. They would just snap the bamboo, and these—it looked like popcorn to me—these weevil grubs would come out. The natives found these absolutely delicious and they ate them eagerly. We also ate a number of other real grubs. It was… They all taste like corn oil to me.

We were in Papua New Guinea for five weeks. It was a tiny little village of about a hundred people. You flew in on a little airplane. The runway wasn't particularly long, so when the plane was slowing down it would go down the runway and then it would have to make a right turn because the runway wasn't long enough. We overheard a big speech early one morning in the little marketplace they had there. One of the ladies was very mad at the men because they were lazy and they weren't mowing the runway and so she was afraid airplanes weren't going to be able to land there. They had approximately two airplanes a week. It was sort of like a bus stop. And she got really mad at these guys. They don't actually have lawnmowers .They had machetes that they mowed the lawn with. There was no electricity there except the electricity we brought with our generators.

I think we caught approximately half a million insects for the museum, and these insects were deposited in the museum and the extras were shared with other museums. I know we found at least one new species of silk moth. We found several new [Teramalids]. Once you've collected the insects it takes a long time to figure out whether any of them are new, just because there aren't necessarily experts that are familiar with all the groups that you can find, and it's just, it's difficult to know which one is the new bug. I'm sure we found a hundred new species, I just don't know which ones they are of the half million insects that we collected.

I have lots of other insects. I have displays of wood-feeding insects that come from North America. I show these to children so that they can see what they're like and we can talk about their biology. I have another drawer of insects which I call fantastic insects. My favorite insect in the world is in here. It's Fulgora Lateneria.. It's sometimes called the peanut bug. I like it particularly because it uses two different kinds of mimicry to protect itself. It has eye spots on its hind wings, which make it pretend to be an owl or a bird of prey, to scare away other insects. [Corrects himself] To scare away predators. But also, there's a large knob on its head which sort of looks like a peanut, but if you look at it closely you can actually see that it has a pattern on it which makes it resemble the head of a little lizard or a little baby alligator, and so it can also use that to scare away potential predators.

I have another drawer which has some of the largest beetles in the world. These beetles are literally larger than a small child's fist. I always find it easy to talk to a group when you have something that big to show them.

And finally I have a drawer full of really ugly insects; those are the ones that I actually study. I've been to forty-three countries around the world nowadays. I've collected for the museum, and I just keep a few specimens to show children. I really believe in this kind of stuff. Most people never get to see insects from the rain forest because they don't get to the rain forest. I think this is a valuable function of zoos as well. It's one thing to know that these animals exist, that they

need to be protected. It's another to see a little glimpse of what they really look like. Normally the children are always fascinated. Sometimes the parents are a little aghast, but the children always like it.

[Holds up a bug.] It can use the eye spots to pretend it's an owl, and scare away a bird predator. These are incredibly accurate mimic… We know these are mimics of eye spots because they really faithfully mimic what an eye looks like. There's the darker on the outside, there's the color in the middle, there's the black of the iris, and there's always a white mark in the eye. And what that white mark is is the glint of light glancing off the wet surface of the eye. These are tremendously accurate eye mimics. The other reason why I like this insect is 'cause if you look at the side of the head, you can see the eye, the nose, and those little black and white marks on the side make it look like the smile of the alligator. So what this does, it hides the rest of its body behind a leaf, and it just sticks that empty, hollow structure out there, and that says, I'm not a bug, I'm a lizard. Stay away."

So most everything is in the museum, but I really like to have some of these big specimens because it just captures the imagination better than anything else does. You look at one of these things and you think it flew into a light. The way you catch these is you go out to the middle of the jungle with a battery and a light. You set up the light against a big sheet, and then you wait. The insects navigate by the light of the moon. On a night when the moon is not full the insects navigate by your light, and then they just spiral and fly into the light and land on the sheet. And these big guys really do fly. That's how you catch them. These guys come from Africa. I was in Cameroon collecting them, the goliath beetles. Basically they sit on trees at night with relatively narrow stems. You walk up to the tree and you bang it as hard as you can. That jerks the branch that they're sitting on, they're heavy, they drop, they fall on the ground, then you have to jump on them before they decide to fly away. It's really a very muddy proposition.

Oh, actually, I do want you to get a shot of my bugs.

MM: Yes. Let's get a shot of your bugs.

NS: These are relatively small and ugly. This shows some of the damage and some of the emergence holes that larvae make in the wood. This is a dish which contains some of the fungus growing on an auger medium. These are some of the parasitoids that kill my bugs. It's really a very complex system. There is the tree, which we're trying to protect. There's the level of the fungus, which the wasps use to eat the tree. There are the wasps. There are several levels of parasitoid wasps that attack the wasps that spread the fungus that kills the tree. Then there are nematodes, which have an alternating life cycle. They spend half of their time feeding on the reproductive parts of the wasp; the next generation they feed on the fungus. And then there's the damage in the trees. There are a lot of different wasps; they use several different fungi; and I've done a number of experiments with Dan Wilson showing how the fungi compete with each other. If you put two different fungi on the opposite sides of a petrie dish, one'll race across the dish and colonize as much space as it can. The other one will grow much more slowly. In one of our experiments it turned out that the fungus that grew much more slowly didn't capture as much of

the dish, but eventually it ended up growing over the top of the first fungus, winning the dish. Presumably this is analogous to what would happen in a log in the forest.

A lot of the places we collect are in tropical rain forests. Tropical rain forests are known for their diversity. These came from several places, but I wouldn't be surprised at all if I could catch all of this in one morning in a forest. There are many, many, many, many, many species of butterflies in rain forests… this one is upside down. [Re-arranges butterfly] But I've been to Rondonia in western Brazil, which is the place that has the most number of species of butterflies in the world. I believe there are over fifteen hundred species right now that have been described from there. [Corrects himself] That have been found there. When I was there there were only twelve hundred species, and this was the first time that this red one had ever been found at that site. So even though they had already found twelve hundred, we were finding new species there all the time. I keep representative examples because you just can't see this in a butterfly house. Most of the materials are deposited at the Bohart Museum, Most of my sawfly collection is in the Smithsonian, where I work with one of the [job title unclear] David Smith.

END OF INTERVIEW