

INTERVIEW

THE PLIGHT OF THE HUMBLE BEE

Our way of life depends upon bees, but these insects are under threat. **Amy Barrett** talks to **Samantha Alger**, an environmental scientist and pollinator specialist, about her work uncovering the secret lives of bees



JOSHUA BROWN



WHY DID YOU START STUDYING BEES?

I had an opportunity to study tropical ecology and conservation abroad, and I realised that you can be a biologist and study insects for a living – which was ludicrous to me, who grew up in a household where you could be a doctor or a lawyer. I didn't know that these things existed.

I knew I was interested in conservation, but I wanted to focus my efforts on something that was important not just for conservation in a tree-hugger sort of way, but also important for humans. I found out that you need bees for one of every three bites of food. They provide pollination services for most of the food that we eat, so the connection there was really strong. It's good for wild bee conservation, but also, it's important to humans.

WHAT KIND OF THREATS ARE FACING BEES?

The media will say 'oh, it's this chemical. It's RoundUp, or it's neonicotinoids, or it's this one disease.' Everyone wants to point their finger to a single smoking gun, but it's a combination of threats, including habitat loss. With land-use change we see vast areas that are getting converted to corn or parking lots, for example, which offer nothing for bees. Areas that were once really good for foragers are changing, so they are losing habitat, foraging and nesting resources.

We also know that bees are affected by disease. Of course, there's a tonne of different pests and pathogens that both managed and wild bees are affected by, but I think that the most concerning issue is the introduction and spread of novel or exotic pathogens to native hosts.

Also pesticides and herbicides are another threat. If you're using herbicides to kill the wildflowers or what we think of as weeds, that's affecting their foraging areas. Pesticides that we put on our crops to keep herbivores from eating them can also affect bees.

YOUR LATEST RESEARCH FOCUSED ON THE SPREAD OF DISEASE BETWEEN BEE POPULATIONS. WHAT DID YOU FIND?

We wanted to see if diseases, or specifically viruses, are spilling over from managed honeybees into wild bumblebee populations. This is something that had been suggested by researchers, but hadn't been tested. We found compelling evidence that this is happening. Bumblebees were way more likely to be infected by viruses when they were near honeybee apiaries. We also found

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evidence that this transmission of viruses could be occurring through the shared use of flowers.

A high proportion of flowers near honeybee apiaries – about 19 per cent – harboured these viruses, whereas all the flowers we collected in sites where there wasn't a honeybee apiary nearby were all negative for the viruses.

HOW DOES THAT SPILLOVER HAPPEN?

We don't really know what the mode of transmission might be. We don't know whether it's through salivary secretions or through faeces, but those are the two most probable methods.

When bees forage on flowers, you can think of a flower like a dirty doorknob during flu season, right? In the disease ecology world, we call it a 'fomite', sort of an inanimate object that might harbour a pathogen. Imagine a honeybee landing on a flower. What they're doing on that flower is walking around on it, getting pollen on their bodies, sticking their tongues in the flowers and drinking up the nectar. Once they get pollen, they sort of coat it in salivary secretions and then stick it to the sides of their bodies. Then they'll travel to the next flower and do the same thing. Some of those pollen grains that they might have put saliva on fall off their bodies onto that flower, and also during that process, they will often defecate and leave behind faeces.

It's funny, we look onto our beautiful gardens and we see bees pollinating plants and we're not thinking about all these gross faeces and salivary secretions that can be left behind by bees. But that's how we think this is occurring. Another bee will land on that flower and they're basically feeding from the same waterhole, right? They can then possibly pick up viruses through the salivary secretions or the faeces left behind.

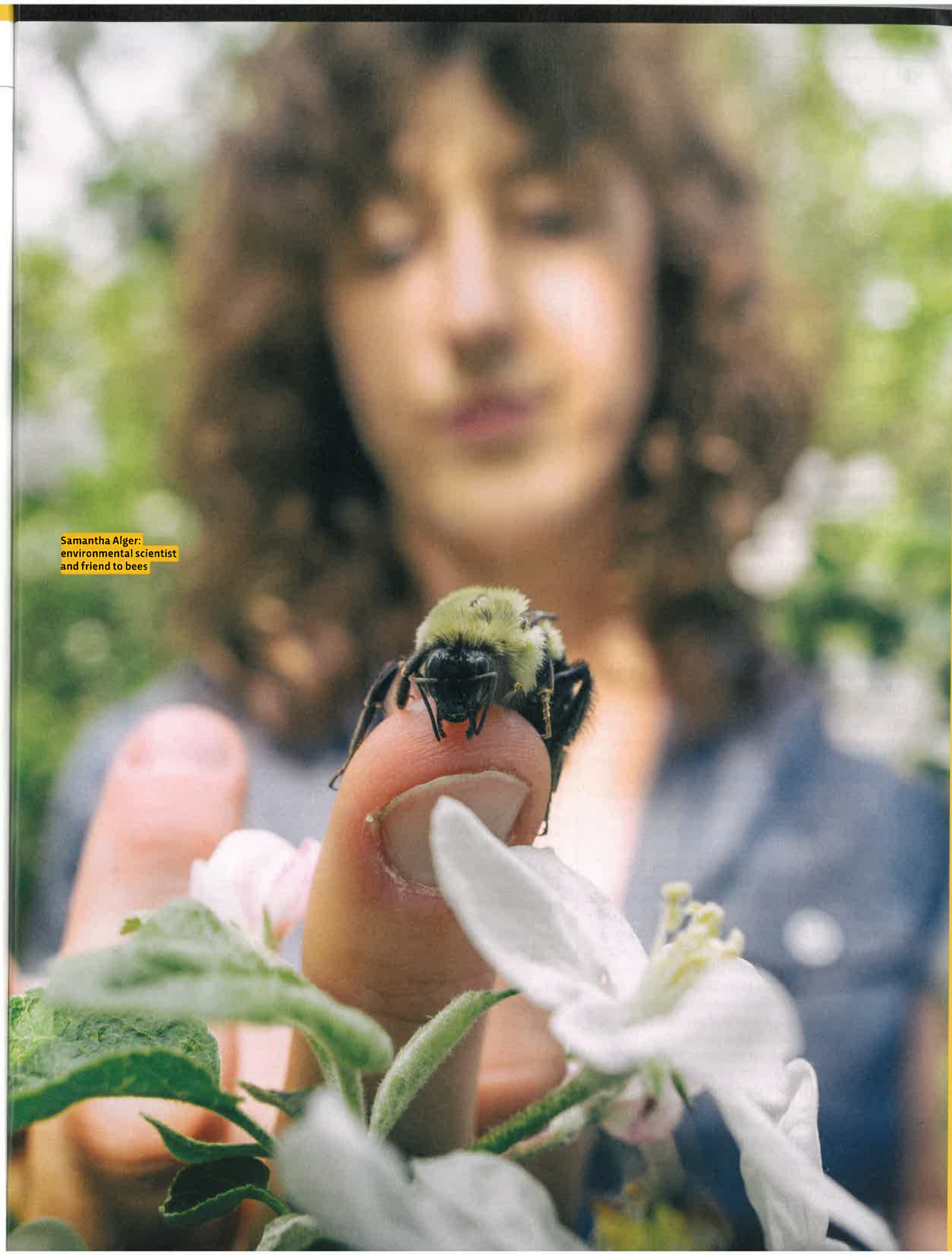
WHERE DO THESE VIRUSES COME FROM?

Viruses have been around for a long time. They really only became a big problem in honeybees ●

**SAMANTHA ALGER**

Samantha is a researcher in the plant and soil science department at the University of Vermont. She also works as an environmental scientist and pollinator specialist at an engineering consulting firm called VHB. At VHB, Samantha helps US departments of transportation and other big organisations change management practices to reduce how often they mow roadside areas or vast areas of land, cutting their costs and improving local pollinators' habitat.

JOSHUA BROWN



Samantha Alger:
environmental scientist
and friend to bees

● with the introduction of the *Varroa* mite to North America, Europe and elsewhere. That mite came from Asia and transmits the viruses directly to the haemolymph – the blood – of the bee. Then the viruses are able to propagate quickly and cause symptoms in the honeybees, whereas previously, honeybees might eat a virus and it would go through its digestive tract and it might not actually be able to get into the bee's system at large and cause issues.

IF THE VARROA MITE CAME FROM ASIA, HOW DID IT COME TO BE PREVALENT IN HONEYBEE POPULATIONS ELSEWHERE?

It's a topic of a lot of research, but we don't really know where exactly it started and how it spread so quickly, except that it's just a really, really good parasite of honeybees. I think it was introduced to the US in the late 1980s [it arrived in the UK in the early 1990s], and since then we've come up with a slew of different chemical treatments, conventional, organic. There are different cultural practices that beekeepers employ to keep the mites at bay.

Those methods have been developed over time, and in some ways they're working, but we're never going to eradicate *Varroa* mites. They're here, and it's just a matter of managing. But there is another mite, the *Tropilaelaps* mite, that's in Asia. There are scientists studying it and it also looks to be spreading. There's a concern because the *Tropilaelaps* mite could actually out-compete the *Varroa* mite. With what we've learnt with the spread and the issues that the *Varroa* mite has caused, we're hopefully taking precautions now. There are researchers studying *Tropilaelaps* in its environment and trying to formulate mite-management strategies before it spreads.

WHEN WE THINK OF SAVING THE BEES, WE OFTEN THINK OF HONEYBEES. SHOULD WE FOCUS OUR EFFORTS ON OTHER TYPES OF BEES?

I think we should definitely broaden our efforts onto other bees. The public and conservation initiatives have focused so much on honeybees because people know what a beekeeper looks like and people know how bees are kept in this incredible comb in this hexagonal structure. It's all very charismatic and people understand it. Whereas if you talk about a solitary bee that nests underground in these little, tiny holes, it's difficult for people to feel like they're connected to that and to try to make changes based on this bee. But if all of the effort is focused on the honeybee, then we're missing the vast majority of species in the world. There are 20,000 species of bees. If we're finding that honeybees are causing problems for other bees, either through the spread of disease or through maybe competition on flowers, that's a difficult thing to show people.



1. Honeybees are used worldwide for pollination and honey, but they can transmit deadly viruses to wild bee species, which are also important pollinators and a vital part of the ecosystem

2. 'Messy' land is a hugely important habitat for insects like wild bees

3. Samantha collecting bumblebees as part of her research



JOSHUA BROWN X3

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IT'S A REAL SHAME THAT BECAUSE SOLITARY BEES AND BUMBLEBEES DON'T SEEM TO OFFER ANY BENEFIT TO HUMANS, WE'RE NOT AS WORRIED ABOUT THEM...

Well, I wouldn't say they don't offer benefits to humans. They are fantastic pollinators of crops. It's just a matter of making sure there's the habitat to support them.

In Vermont here, we're pretty rural, we have farming communities structured in such a way that the farms tend to be pretty small and we have a lot of wild habitat between farms. Research by my colleagues at UVM found that blueberry growers produced way more blueberries when they had wild habitat around their farms, and that their blueberries were supported by other bees. So, they're fantastic pollinators. It's just a matter of being able to support them around our crops to take advantage of that free pollination service.

It's not that they're not doing anything for us; they are. It's just that people don't associate with them. They don't have that childhood curiosity or interest with other bees, because they hadn't been introduced to them at such a young age as they had been to honeybees.

WHAT CAN WE DO TO HELP WILD BEES?


There's two big things. One would be to do whatever you can to create pollinator habitat. Bees like really messy, messy fields. You know? We're talking about snag, like trees that have died that are still standing, and they have holes in them. We humans don't like to look at those and we like to take them down. But that's incredible bee habitat. Messy brush piles or areas where there are clumps of grass that bumblebees can nest down into and burrow into, not that beautiful cut grass that might be cut at an angle: that's basically a desert for bees – all things that we view as not aesthetically pleasing. We need to change our mentality of what we think is beautiful. We need to think that even if we have a messy lawn, we're supporting bees, and that's a beautiful thing.

The other big thing is to avoid using pesticides and chemicals on our home gardens. Homeowners are not necessarily trained how to use pesticides, how or when to apply them. It's not really the quantity of these chemicals being used, it's the way that they're being misused.

It's funny, I think being in this position of a bee researcher and an advocate for bee conservation, a lot of people come up to me and say, “I'm thinking about becoming a beekeeper because I want to help save the bees. I want to do my part, so I'm going to become a beekeeper.” And you know, based on our discussion, you can see why that's such a disconnect. It's like wanting to do something for bird conservation, and then saying you're going to become a chicken farmer.

It's great that you want to take on that hobby, but beekeeping is a lot of work. It's a lot of effort. You have to do a lot of things to keep your bees pathogen-free, and if you're not willing to put in the effort, you actually could be causing harm to your own bees, to maybe your neighbour's bees, and now to the pollinator community at large if your pathogens are spilling over. **SF**

DISCOVER MORE

 You can listen to our full interview with Samantha in an upcoming episode of the Science Focus podcast sciencefocus.com/science-focus-podcast