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# A Paradigm-Shifting DISCOVERY

Paul Stamets Asks: Can Fungi Save Bees?

By Shykyo Mithuna of Host Defense  
with Hannah Apricot Eckberg of PMNA

Paul Stamets has been a mycologist for over 40 years. With a Doctorate of Science, he is an author of 6 books, a TED speaker (with over 6 million views), a passionate innovator, and founder of the Host Defense Organic Mushrooms company and founder and Director of Research at Fungi Perfecti, LLC. Paul has discovered many species of mushrooms, created cutting edge cultivation techniques, and invented insecticides based on mushrooms. The recognitions he has received for his research are numerous, including being named an Invention Ambassador by the largest and most prestigious scientific organization in the world

– the American Association for the Advancement of Science.

Known around the world for his cutting edge research on the health benefits of mushrooms, Paul Stamets has led in showing the incredible connection the fungi world has to the rest of nature. On October 16, 2014, he made a groundbreaking announcement during his plenary talk at the Bioneers conference in California.

Paul's big announcement stemmed from his application of permaculture principles: through careful, protracted observation, he connected many dots in Mother Nature's masterpiece that we call life. The big discovery: honey bees were

eating mycelium nectar which in turn boosted their immune system and helped with detoxification! In other words, bees were using mushrooms to combat Colony Collapse Disorder!

With over 1/3 of our diet and billions of dollars in agriculture dependent on pollinating insects, the cataclysmic decline in bees and other sensitive species has put their survival and our food security at great risk. In just one year, from April 2015 to April 2016, beekeepers across America lost 44% of their honeybee colonies, according to the latest survey conducted by the Bee Informed Partnership. Over the last 30 years, some areas of Western North America may have lost up to 90% of the Western Bumble Bee (*Bombus occidentalis*). The cause of this drastic die-off is the result of a myriad of influences: infections from bacterial and viral pathogens, attack on young bees by parasitic mites, pesticides, herbicides, and fungicides used in conventional farming, and poor nutrition provided by commercial beekeepers. Commonly called Colony Collapse Disorder (CCD), the causes are complex, yet a symptom of our conventional agricultural system being out of balance with the functional systems of nature. Electromagnetic energy from cellphones and other microwaves are also suspected of impairing the health of this keystone species. Without pollinators – a great unraveling in the fabric of nature will occur.

The announcement by Stamets was perhaps the first real sign of hope for the quest to save the bees. If

"I have never seen such strong antiviral activity against bee viruses as I have seen with Stamets' extracts," said Jay Evans, Ph.D., Agricultural Research Service, US Dept. of Agriculture.

**ABOVE:** One morning while working in the garden, Paul was astonished to see that his bees had moved the wood chips away to expose the underlying mushroom mycelia and were sipping the droplets of nectar exuded from the mycelium.

mushrooms can provide the medicine needed to boost the bee's health and provide an ability to fight the stressors of CCD, can this discovery lead to a rebound in the drastic decline in their population?

A healthy forest ecosystem offers creatures, such as bees, all the aspects they need for survival. The woody debris and decomposing material, traditionally found in a forest, provides home and fodder for many animals and insects, including bats, birds, mammals, and bees. The mycelium system is a key component to breaking down woody material and restoring destroyed forest areas. However, today's traditional forest management focuses on the removal of such understory habitat at best, or worse yet, the complete desolation of the system through clear-cutting practices.

Paul's careful observations also led to understanding how animals, such as bears, play a crucial role in this orchestra. When the mighty claw of a bear scratches a tree in the forest, it provides an opening for the reproductive spores of mycelium to land and ultimately grow into a mushroom. Cavities are created and entice not only bees, but attract woodpeckers, squirrels, and owls which use these hollows as refuges. Fungi start a succession of habitat which evolves to support many downstream communities. Ultimately, this process leads to the creation of soil through decomposition and provides habitat, food, and we now see, medicine for animals and plants.

It was in his own backyard that Paul first observed bees had moved wood chips in order to sip on the nectar that was dripping from mycelium of a King Stropharia, aka the Garden Giant, mushroom. Though there were many flowers in the garden, Paul observed a steady

line of bees heading straight to the mushroom pile. This observation continued for 40 days.

He thought about how certain polypores mushrooms have been effective for a variety of health applications in humans. Could these same compounds help regulate immunity and detoxification pathways to protect bees against pesticides and other harmful environmental contaminants? The discovery of the use of mycelium by bees led to a partnership with Washington State University (WSU) to conduct detailed research on Paul's theory. Dr. Steve Sheppard, known for his work on the evolution and genetics of honeybees and Chair of the Department of Entomology at WSU, is leading the research. Together, the two have formed a research initiative called BeeFriendly™, "We are studying mycological solutions that increase longevity, reduce mite and viral burden, and improve immunity of honey bees," says Stamets.

Over the last year, 300 sets of bees were fed Host Defense® mushroom extracts developed by Stamets via their feed water. The mycelium based mushroom extracts, especially Reishi and Chaga, reduced the bee's viral burden by more than 99%. The university oversaw tests of mycelial extracts from Amadou (*Fomes fomentarius*) and Red Reishi (*Ganoderma resinaceum*), which showed reductions of the Deformed Wing Virus and the Lake Sinai Virus in the bees. The most recent test results show more than a 1000x reduction in Deformed Wing Virus in the bees given extracts of the mushroom Amadou!

Dr. Sheppard states, "Our research goal is to help improve honeybee health, and the results look promising! With regard to Host Defense® Chaga and Reishi extracts,

as an entomologist with over 39 years of experience studying bees, I am unaware of any reports of materials that extend the life of worker bees more than this."

Dozens more experiments are underway at WSU, including research on whether certain species of mycopesticide fungi can kill the parasitic Varroa mites that decimate beehives around the world. "We take bees from colonies with high Varroa destructor mite levels and set up numerous test environments with fungi. We are finding that the fungi product is killing mites without harming bees. It's certainly encouraging," says Dr. Sheppard.

On October 25th, 2016, Paul

"I think I have found something fundamental to the foundation of nature – that the mycelial networks in forestlands influence the immunological health of its inhabitants – of people, bears, birds, swine, and bees. "

- Paul Stamets



**RIGHT:** The WSU research team enclosed a queen in a small plastic cage on a string and tied this around Paul's neck. The queen emitted pheromones that alerted her workers to swarm and cover her, and he became covered by the colony. It was the experience of a lifetime for Paul as the bees continued to buzz and vibrate to keep the queen and colony warm. It seemed a fitting "thank you" to the man who has dedicated his life to helping people, planet...and now bees!



was awarded a new U.S. patent “Integrative fungal solutions for protecting bees.” Paul stated “My discovery was an epiphany in slow motion, taking me nearly 30 years for this idea to dawn within me. I think I have found something fundamental to the foundation of nature – that the mycelial networks in forestlands influence the immunological health of its inhabitants – of people, bears, birds, swine, and bees.”

He continues, “This is a paradigm-shifting discovery – scalable, using native forest fungi, particularly polypores. Most importantly this breakthrough is ecologically rational. My hope is to open source this patent for the Commons – provided I can afford to do so. To be sustainable, we must be profitable, so we can afford to be charitable. We are at an ‘all hands on deck moment’ in history. We are at a time critical period in history and need to muster an EcoRevolution to save the natural biomes. Thankfully, many great scientists are supporting me. And the permaculture movement is a perfect for bringing this life saving mycotechnology to the forefront. I am honored to be the messenger of this information. Deep inside, I feel there is a spiritual element at play here.”

An important part of BeeFriendly™ is a PR campaign reaching out to farmers, beekeepers,

bee associations, filmmakers, and natural product customers and retailers to increase awareness of this research. Through these efforts and the support of natural product retailers, the Host Defense's® “Give Bees A Chance” initiative donated over \$50,000 to the research at WSU. During the fall of 2016 and winter of 2017, full-scale field tests will measure the survival of treated vs. untreated bee colonies, in diverse locations and conditions.

This process of connecting the dots through decades of research has led to perhaps the most important discovery ever in the quest to repair the mass destruction on the pollinator world. It gives hope for the survival of the bees, and the future of our own food security.

“The path to the future is the path of the mycelium,” shares the inspirational Paul Stamets.

Tax-deductible donations can be made directly to WSU at [BeeFriendlyInitiative.org](http://BeeFriendlyInitiative.org).

Fungi.com offers more of Paul's research and a place to order Host Defense® mushroom supplements.

See his Bioneers talk on our website.  
[www.permaculturemag.org](http://www.permaculturemag.org)

## THE SCIENCE BEHIND THE BEE/MUSHROOM CONNECTION

- Bees use honey and pollen-based bee bread as food, which contain fungal constituents, including p-coumaric acid that activates the bee's Cytochrome P450 pathway. Cytochrome P450 enzymes are the most important enzymes for detoxification, and are used by humans, bees, and other animals. (Without the presence of fungi, honey and bee bread lack this important chemical.)
- Bees have approximately 47 genes that control Cytochrome P450 detoxification enzymes that are “turned on” by p-coumaric acid. Without it, toxins accumulate, making bees sick.
- Fungal compounds found in decomposing wood are the source of p-coumaric acid for bees in the wild.
- Other experiments are looking at how certain mushrooms directly combat the Varroa mite as a natural fungicide, in turn, protecting vulnerable young bees from the destructive parasites.



**LEFT:** At WSU's honey bee lab, Steve Sheppard shows Paul a close-up of a petri dish with tracheal mite-infected bees for microscopic viewing.

**RIGHT:** Reishi liquid is fed to bees. Reishi reduced viruses in bees by 75%. In research so far, Birch Polypore, Reishi & Chaga liquids show the most immune-supportive activity.

