CREATING A BUZZ

MAES ENTOMOLOGIST ZACH HUANG HAS INVENTED A HONEY OF AN IDEA: A CHEMICAL-FREE, INEXPENSIVE WAY TO CONTROL DEADLY VARROA MITES IN BEE COLONIES. MEET THE SPARTAN™ MITEZAPPER.

The steady hum of bees buzzing around fragrant fruit trees in full flower is music to the ears of Michigan growers. Many of Michigan's fruit and vegetable crops, valued at more than $400 million, depend on pollination from a healthy honeybee population. Honey and beeswax add another $5 million to the state's economy each year.

But honeybees around the world are under attack from a deadly

PHOTO: ZACHARY HUANG

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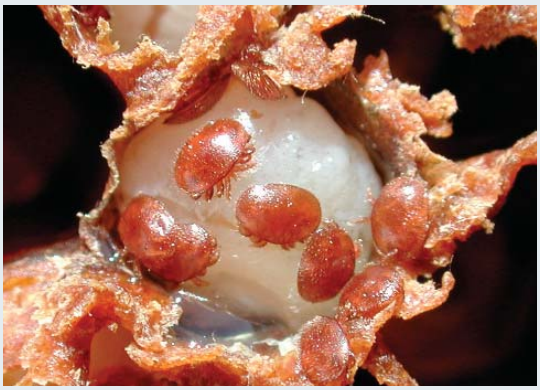
Honeybees around the world are being attacked by deadly Varroa mites. In the two photos at the far right, the red dots on the bee drone larvae are mites. The larva in the lower photo is dead. In the photo at the immediate right, mites have invaded a brood cell at the MSU apiary.



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parasite smaller than a grain of rice. Varroa mites, which invaded the United States from the eastern hemisphere in 1987, can kill an entire bee colony within 1 to 2 years if left untreated. In 1995, Michigan had about 92,000 bee colonies, with roughly 30,000 bees in each colony. In 2003, the number of colonies had dropped to 65,000, according to statistics from the U.S. Department of Agriculture.

As the number of Varroa mites in an infested bee colony increases, the colony weakens — there are fewer bee offspring and more deformed bees. The mites wiped out nearly 50 percent of the U.S. commercial honeybee population during the winter of 2004.

"These mites are a big, big problem for agriculture," said MAES entomologist Zachary Huang. "In California, almond growers need about 1.5 million colonies to pollinate their trees during a 3-week window in late February and early March. They were in a panic situation in 2005 — there just weren't enough bees. The price for pollination in 2006 will go up to $150 per hive — normally it's about $60."

Chemicals are available to kill the mites, but they're expensive, and the mites have become resistant to them. Beekeepers also worry about the chemicals contaminating the honey or the beeswax, which will cause it to be rejected for retail sale. And beekeepers who want to serve the organic market are restricted from using any type of chemical pesticide to control the mites.

Clearly, innovative thinking was needed to develop new ways to control the Varroa mite.

Huang became engrossed in all things honeybee while pursuing his doctorate at the University of Guelph in Ontario, Canada. He had received a scholarship to attend, but the only entomology scholarship available was one that specialized in honeybees. Huang hadn't even tasted honey at the time, but he decided to enroll in the program. The bees fascinated him and he decided to stick with them.

As the Varroa mite began ravaging bee colonies, Huang began considering ways to control the pests without using chemicals.

Varroa mites suck the blood of worker bees, riding around on their bellies as they tend to developing baby bees (known as brood) in the honeycomb cells. When a female mite is ready to reproduce, she jumps from the belly down into a brood cell just before it's capped with wax and immerses herself in the food for the immature bee. The mites are more attracted to cells containing drone larvae than worker larvae. Because the cell is then capped, mama mite has a cozy, safe home in which to bear her offspring. When they're old enough, the young mites attach themselves to the developing bee and feed on its blood. When the young bees emerge from the brood cells, they release the mother mite and her grown offspring. These mites then attach themselves to the bellies of worker bees and start the process all over again.

PHOTO: ZACHARY HUANG

MAES entomologist Zach Huang *(right)* is an avid bee photographer as well as a researcher. His Spartan Mitezapper doesn't use chemicals to control the Varroa mite. When bees forage for food *(left and below)*, they transfer pollen from one flower to another, ensuring plentiful fruit and vegetable crops.

PHOTO: JOYCE WANG

PHOTO: ZACHARY HUANG

Huang first thought about freezing the mites with liquid nitrogen but thought the liquid might clog easily as it moved through a radiator-like structure in the drone frames. Then he flipped his thinking and considered heat.

"I knew that in Europe, some beekeepers actually baked their frames at about 140 degrees F (40 degrees C)," Huang said. "But it's not practical for beekeepers with a large number of colonies. The frames are heavy and large. You have to have a big oven and a way to move the frames in and out."

But what if Huang could somehow heat up the frame quickly and easily? Perhaps with electricity? Bingo! The Spartan Mitezapper was born.

Looking like a large circuit board, wires from either side of the Spartan Mitezapper are attached to a 12-volt battery for about 4 minutes. The Mitezapper generates enough heat to kill both the mites and the drone larvae (which aren't important to a colony's survival) but not the worker bees. Beekeepers also can regulate the amount of heat the Mitezapper puts out so only the mites die.

In laboratory tests and in actual colonies, the Spartan Mitezapper killed 100 percent of Varroa mites in combs. It doesn't interfere with bee management practices — the Mitezapper has the same dimensions as a regular frame and can even go into a honey extractor, if needed.

"We have filed a patent on it," Huang said. "People are interested in licensing it, but it's not available commercially just yet."

The Spartan Mitezapper offers beekeepers both economic and environmental benefits.

At a cost of $12 per colony per year, chemicals to control the Varroa mite can cost Michigan beekeepers almost $800,000 per year. The Spartan Mitezapper costs much less per colony. Beekeeping has tight profit margins, so keeping costs down is important. Using the Mitezapper also ensures that beekeepers conform to USDA certified organic standards.

"The mite pesticides have been known to harm the bees," Huang explained. "They affect mating and sperm production, which decreases the production of the colony."

As manufacturers consider producing his Mitezapper, Huang continues to study the mites. Working with Ke Dong, MAES toxicologist, Huang is working to understand how the mites become resistant to chemicals and if these mechanisms can be controlled.

"When we're able to fully understand how the mite's resistance mechanisms work, we can develop ways to minimize insecticide resistance," Huang said.

When combined with the Mitezapper, Huang's research might mean a brighter future for Michigan honeybees.

::: Jamie DePolo