

HEALTH

Israelis discover cure for bee colony collapse-associated virus

By Rachel Neiman September 22, 2008

It is a real-life nightmare scenario that makes any horror movie pale by comparison. The honeybees are in trouble and, by extension, so is the human race. Last winter, over 36 percent of the US bee colonies collapsed, affecting honey production, but more significantly, affecting the one-third of all food production that requires pollination - from fruits and nuts, to the dairy and beef cows that feed on alfalfa.

Now, an Israeli-US company Beeologics is taking rapid measures to bring to market a proprietary anti-viral agent that promises to alleviate the effects of the virus strongly associated with Colony Collapse Disorder (CCD), with full-scale FDA trials commencing next month.

So far 60,000 hives are committed and Beeologics aims to have 100,000 hives enlisted in the trial which will run in several locations in the US from October to February. The season is critical, Eyal Ben-Chanoch, CEO of Beeologics, tells ISRAEL21c, because the bee keeping industry cycle follows the seasons of the bees which strengthen in spring, and summer and naturally weaken during fall and winter.

Vanishing bees

CCD is characterized by the mysterious and inexplicable loss of worker bees in managed honeybee colonies. There is often still honey in the hive, and a few immature bees, but the adult bees have vanished. It was first noticed as a problem in the winter of 2006/7, when beekeepers began reporting losses of 30 to 90 percent of their hives, according to the US Department of Agriculture (USDA).

Since then, the crisis has grown. Last winter, a survey by the US Department of Agriculture/Agricultural Research Services (USDA-ARS) and Apiary inspectors showed that 36% of America's 2.4 million hives were lost to CCD. The survey covered almost 20% of America's 1,500 commercial beekeepers, and suggested an increase of 11% over the losses of 2007, and 40% over the losses of 2006. Similar losses are being reported in Italy, Spain, Greece, the UK, and other countries across Europe.

There is much at stake. "Today it's not about honey but about pollination," says Ben-Chanoch. Pollination using managed honeybees is a critical element in modern agriculture; more than 130 crops in the US require pollination, with an annual crop value of \$15 billion.

The cause of CCD is still unclear. Some are convinced it is connected to the Varroa bee mite, others suspect a single cell parasite, or a virus. Some even blame pesticides or cellphones. None of these suspected causes bear up to close scrutiny, according to Ben-Chanoch.

"So far, there is no solution because no one has even come to an agreement as to what the problem is," adds Nitzan Paldi, chief technology officer of Beeologics.

One virus strongly associated with CCD, however, is Israeli Acute Paralysis Virus (IAPV). Identified by Hebrew University of Jerusalem plant virologist Prof. Ilan Sela in 2004, the virus causes honeybees to suffer from shivering wings, followed by paralysis and death

outside the hive. In 2007, the journal *Science* published research by a prestigious team of US scientists and researchers that found a significant connection between IAPV and CCD in honeybees.

A contagious virus

At Beeologics, scientists are convinced that IAPV is the primary cause of CCD. "If you look how the disease spreads, it's very reminiscent of flu. Flu also starts in the fall and hits hard in the winter, the same is true of this bee virus," explains Paldi. "It's very contagious like a flu. In our opinion, we have something that's interacting very strongly with the environment to cause CCD. It could be interacting with pesticides, with improper nutrition, general stress - but that's not what's killing the bees. What's killing them is a virus and we believe that virus is IAPV."

Using the *Science* article as validation, in the summer of 2007, the company's founding research team - Sela, biochemist Dr. Eitan Glick and doctoral student Eyal Maori - began work to develop an affordable cure for the virus.

They turned to a longtime collaborator, plant virologist Dr. Gal Yarden who was previously CEO of publicly traded Bio-Oz Biotechnologies and to Paldi, an expert in bee pollination and an experienced entrepreneur. Beeologics was founded as a commercial entity in October last year with the help of Ben-Chanoch, an Israeli-American serial entrepreneur based in Florida.

Beeologics' solution, Remebee, utilizes a mechanism called RNA interference (RNAi, also known as gene silencing) a mechanism that inhibits or hinders gene expression. "The technology is based on naturally occurring biological agents. Conceptually, we're introducing the factor that prompts the silencing response," Paldi tells ISRAEL21c. "We didn't invent gene silencing. However, as far as we know we are among the first to use it commercially on non-humans."

According to the company, the patent-pending Remebee provides protection from IAPV and other bee viruses. The technology is potentially applicable to all bee viruses, precludes the possibility of virus breaking resistance, is non-toxic and leaves no residues in either honeybees or their honey.

Successful trials

Initial trials on 100 hives were conducted in Florida from March to June. The trials were designed, managed and monitored by Dr. Jamie Ellis from the Entomology department at the University of Florida, with collaboration of the USDA-ARS in Fort Pierce, Florida and the Florida Department of Agriculture, Apiary Inspection Service.

Remebee is delivered to the colony via regular feeding processes. Laboratory and field trials demonstrated that feeding IAPV specific RNA prior to virus inoculation dramatically improved bee-to-brood ratio and honey yield compared with bees inoculated with IAPV only.

Beeologics has now applied for FDA approval for Remebee and has partnered with all major US and international institutions working on the CCD problem, including leading US beekeepers Dave Mendez and Dave Hackenberg, the man who alerted the media to CCD after losing 90% of his bees in 2006.

"Hackenberg provided us the hives and the bees for the trials in Pennsylvania as did Mendez in Florida," says Ben-Chanoch. "It was a great sacrifice because these beekeepers were already hurting -- these hives were planned for revenue generation and the replacement cost for this size of fully populated hive is substantial."

The company is also in the process of establishing European partnerships, following successful presentations this summer before the World Health Organization and major bee conferences.

Ben-Chanoch hopes that Remebee will just be the start for Beeologics. The businessman who founded GreenOvation Labs, a Florida-based business accelerator for innovative biotech technologies in 2007, hopes the company will become the 'go to' company for bee health.

While it's primary focus is Remebee and solving the current CCD crisis, Beeologics' wider focus is developing a full line of products for bee health, starting with RemebeePro, a multi-viral agent; and RemebeePlus, a feeding supplement based on natural ingredients.

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