Pesticides not sole cause of declining bee numbers

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(PhysOrg.com) -- Despite a growing worldwide clamor to ban pesticides linked to honey bee deaths, multiple factors contribute to the declining honey bee population, not just one class of insecticides, says Extension Apiculturist and noted honey bee expert Eric Mussen of the UC Davis Department of Entomology.

Speaking on honey bee health at the 51st annual meeting of the international Society of Toxicology and ToxExpo, held recently in San Francisco, Mussen said "no specific culprit" causes colony collapse disorder (CCD), a mysterious malady characterized by adult bees abandoning the hive, leaving behind the queen, her brood, and honey and pollen stores.

Multiple factors affecting colony health include "pathogens, parasites, pesticides and malnutrition," he told the society, which is comprised of 7,500 scientists from academia, government, and industry from various countries around the globe.

"Pesticide residues have been found in beeswax, stored pollens and adult bees," Mussen said in his abstract. Bee scientists are "also looking at the synergistic interactions among pesticides, including adjuvants mixed into the pesticides and investigating everything from bacteria, fungi, viruses, malnutrition, transportation of migratory bees, impact of pollen from genetically modified plants, and effects of exposure to irradiation."

"None of these factors explains why 25 percent of beekeepers continue

to lose 40 to 100 percent of their colonies annually," Mussen declared.

Banned in some European countries is the class of insecticides known as neonicotinoids, which act on the central nervous system of insects, Mussen said, but scientific studies show that despite the ban, the bee population continues to suffer significant annual losses.

Neonicotinoids, or systematic pesticides, are applied as seed or soil treatments, and also directly to the foliage of vegetable, orchard, field, turf and ornamental crops.

According to Mussen, colony losses are not new. Prior to the arrival of tracheal (Acarapis woodi) in 1984 and varroa (Varroa destructor) mites in 1987, annual colony losses averaged around 5 to 10 percent, he said. "To control mites, most beekeepers place acaricides in their hives. Since then, queen longevity, colony health and vigor have declined in many operations and colony losses increased to about 15 to 20 percent."

CCD, so-named in 2006, first surfaced in 2004 when approximately 25 percent of the nation's beekeepers noted that apparently healthy colonies very quickly lost all adult bees, except the queen and a few newly emerged workers that soon perished, Mussen said.

"All stages of brood were present, and stores of honey and pollens were abundant," he said. "In the few remaining adult bee specimens, titers of the fungus (Nosema ceranae) and one or more RNA viruses were very high. While appearing similar to losses induced by extremely heavy varroa mite infestations, neither bees with shriveled wings nor copious varroa fecal spots were observed."

The resulting media attention prompted governmental agencies to provide extra funding for honey bee research. "That research provided a greater insight into the parameters of honey bee health," he said.

The honey bee's immune system is "meager" compared to that of a fruit fly or mosquito, he said.

Mussen, in a recent talk at a UC Cooperative Extension seminar in Woodland, advocated that the bee toxicity tests conducted by the Environmental Protection Agency (EPA) and the California Department of Pesticide Regulation (DPR) "be of a longer time frame." Current regulations "specify that they be completed in 96 hours, which is too short of a time period to see what happens to the bees."

"Sublethal effects are not required, chronic exposure to sublethal effects is not required and synergism is not studied," he said.

"Synergies easily could be the biggest problem," Mussen said. "Coumaphos (an acaricide used for mite control) knocks the daylight out of queens when it's in the pollen. "Fluvalinate (synthetic pyrethoid commonly used to control varroa mites) synergizes Coumaphos, and vice versa."

Mussen cautioned that adjuvants can be toxic. "Adjuvants seem to make non-toxic fungicides toxic to honey bee brood, especially the organosilicone 'superspreaders,'" he said. "The superspreader can penetrate the waxy cuticle of leaves, such as Eucalyptus leaves. And the waxy cuticle is the No. 1 bee protection."

Also at the Cooperative Extension seminar, Mussen called for greater genetic diversity in the honey bee and a loosening of the "genetic bottleneck" in the United States. "Unlike dogs and horses, there are no pedigree bees and no papers, he said. "There are few true breeding lines, but they include the New World Carniolans (developed by bee breeder-geneticist Susan Cobey of UC Davis), Russians, Minnesota Hygienic, and the Varroa Sensitive Hygiene."

"Most breeders simply select from last season's best performing stock," he said. They breed for certain company traits, such as color, gentleness and brood pattern."

Mussen pointed out that in 1922 the United States closed the door to live bees entering our country due to fears of an incoming pest, the tracheal mite.

The tracheal mite eventually found its way to the United States in 1984, he said. "We couldn't prevent it from coming in forever. It killed half of our nation's bees in five years as it expanded across the country. Then the varroa mite arrived in 1987, and killed half of the remaining colonies in five years as it expanded across the country. This one practically killed all of our feral colonies in 1995-1996. It made a really big dent in our gene pool."

Mussen described the varroa mite as "Beekeeping Enemy No.1." Mite feeding lowers the pupal blood protein, resulting in underweight bees and a shortened life span, he said. It suppresses the honey bee immune system. And third, the mite is a vector for RNA virus diseases.

Of the viral diseases affecting the honey bee, RNA viruses are the most prevalent. "We have 20 known and named viruses, and more are coming," Mussen said. Some of the viral diseases are shared with bumble bees, wasps, ants, other native bees and other unrelated species of insects.

Asked what the average person can do to help the bees, Mussen said that a wide mix of pollen is essential for honey bee nutrition, and "they're not getting that any more. Plant bee-attractive plants. Each colony needs the equivalent of one acre of bloom every day to survive."

What about the role of genetically modified plants in bee health, he was

asked. "They don't appear to be a problem. One modified corn variety seemed to affect honey bees in lab studies, but it's not being grown anymore. The honey bees don't care if it's genetically modified or not."

As for viruses, "The harder we look, the more we find," Mussen said.

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