Issue #2 "What's Bugging You?" December 2013

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There's been a lot of buzz about *Honeybees* lately - concerning a mysterious malady called Colony Collapse Disorder, or CCD. This ailment, first noticed around 2006, causes a sudden loss of a colony's worker bees, with very few dead bees found near the hive. The queen and the young remain and there are reserves of honey and pollen; however, a colony can't survive without the worker bees and eventually dies. Estimates of losses to CCD since 2006 average about 30% per year.

Many challenges face honeybees in modern times including insect pests, parasites, viruses, fungi, pesticides, loss of floral diversity, and poor management. All of these have been investigated as the cause of CCD, but there is no clear correlation between CCD and any one of these problems. The media has focused on pesticide impacts as a possible cause but, again, there is no evidence of any one pesticide being the cause of CCD. It's possible that a combination of factors may lead to the syndrome, or something as yet unknown is the cause.

Why do we care what happens to bees?
Most flowering plants need insects, birds or bats to pollinate them and honeybees are the major pollinator for most crop plants. Tree fruits, melons, tomatoes, alfalfa, and more are fertilized by honeybees. The almond industry is completely dependent on honeybees. Tehama County requires over 18,000 hives to pollinate the almond orchards. Many of these are imported. (See the Apiary section of this website for further information.)

Honey, wax and pollination services are plenty of reasons to care about bees.

What are the major pests of honeybees?
Varroa Mite – These are external parasites of bee larvae and adults. They pierce the bee and feed on their juices. In the process they can infect the bee with viruses such as the deformed wing virus. This disease makes the bee unable to fly. Varroa mites and the diseases they carry can kill off a bee colony, if untreated. Control is attempted through miticides, but Varroa mite quickly develops resistance, and the chemicals themselves may pose problems for the hive.

A varroa mite on the back of a honeybee

Small Hive Beetle – This insect, originally from South Africa, first showed up in Florida in 1998. Since then it has spread to many states including California. The adult beetle is about half a centimeter long. The larvae do the most damage, tunneling through the honeycomb, contaminating the honey, which gives off a rotten orange smell. Tehama County inspects incoming shipments and requires treatment of infested hives.

Small Hive Beetles on a honeycomb

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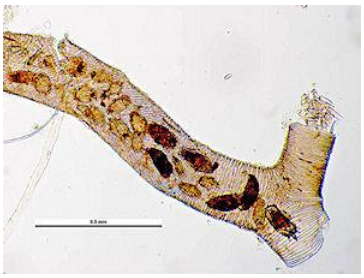
Nosema – a single-celled protozoan that causes the disease nosemosis. It infects the guts of bees and causes premature death of workers and queens. Other symptoms vary and are hard to characterize. Sometimes infected bees show dysentery symptoms, and infected colonies may have high numbers of dead or dying bees in front of the hive. These symptoms can be caused by other diseases or problems as well. Originally known from Asia, two species of Nosema have been found in the Western honeybee since 2005. Treatment is with antibiotics and disinfection. A possible correlation between Nosema and CCD is still unclear.

Other Pests & Problems

Tracheal mites, tiny mites that infest the airways of bees,



Wax moths, that feed on and destroy the bees' honeycombs,

American foulbrood, a bacterial disease that kills the larvae.

Healthy bee brood – few empty cells

Diseased brood – empty cells, dead larvae

Many of these pests come from other parts of the world where they infest other kinds of bees. The global movement of honeybees has resulted in the introduction of pests that honeybees are sometimes not able to withstand. Colony Collapse Disorder is not the only killer of honeybees. Many of the pests infesting hives have caused population crashes in various parts of the world. It also helps to put CCD in perspective to remember that population crashes happen over time as well. Significant bee disappearances happened in the 1880s, the 1920s and the 1960s. Promising lines of research are focusing on developing honeybee resistance to pests through breeding and genetics.

Honeybees and Pesticides

What role, if any, pesticides play in CCD, is hotly debated to this day. The controversy centers on a group of insecticides called neonicotinoids.

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These are compounds based on the structure of nicotine, a nerve poison. They were developed to replace organophosphate and carbamate pesticides, which have toxicity to people animals and birds. Neonicotinoids are more specific to insect nervous systems and less toxic to people and animals.

Some neonicotinoids have systemic activity meaning that they can be applied to plant tissue or at the roots, taken up by the plant and distributed throughout, making the plant poisonous to insects feeding on it. This directed approach results in reduction of the risk of pesticide drift from spraying. Reduced toxicity, drift and impacts on beneficial insects made the neonicotinoids look like a great breakthrough in pest management.

The systemic properties of neonicotinoids are applied in two ways; seed treatment and soil drench for trees. Seeds coated with neonicotinoids take up the insecticide when they sprout and are protected through the season. Trees and shrubs treated once can retain the insecticide up to a year.

Neonicotinoid seed treatments are much used on crops like corn, grain and soybeans. A large beekill incident occurred in Germany in 2008 when it was discovered that the equipment used to plant the treated seed blew large clouds of the pesticide into the air, killing 50 – 100% of nearby hives. Similar incidents happened in Canada in 2012.

The European Union has issued a two-year moratorium on neonicotinoids while it assesses the ongoing decline in honeybee populations. Canada and the U.S. are taking the other approach, calling for more research first before banning neonicotinoids.

The agricultural industry meanwhile has responded with improvements to equipment to minimize the production of pesticide dust, and also with improved stickers to keep the coating from coming off the seed. Neonicotinoids are a powerful tool in the fight against pests, improving yields in many crops as much as 15%.

The final piece of the puzzle of neonicotinoids and honeybees concerns the sub-lethal, chronic effects. The long-lasting, systemic nature of neonicotinoids results in the presence of insecticide in the nectar and pollen produced by treated plants. Even if acute poisonings are prevented by better application methods and timing (while plants not flowering, bees not present), small doses are still delivered to bees in many unintended ways. Studies have shown effects such as impaired immune system, reproduction, and the ability to forage and navigate.

The pesticide industry counters that these lab studies do not reproduce effects in the field and are not representative of what actually happens to bees. It is also stated that no direct connection between neonicotinoids and CCD has been demonstrated.

The USDA is the lead agency dealing with CCD. They developed a Colony Collapse Disorder Action Plan in 2007 to guide efforts to understand the causes of CCD and refine research goals. The EPA as well has responded with changes to pesticide labels to provide greater protection for bees. In March 2013 several groups sued the EPA to ban neonicotinoids.

Research (and debate) continues, and will for the foreseeable future. There have been calls for improvements to the risk assessment process used by EPA to determine toxicity of pesticides, to include chronic and cumulative effects of pesticides on bees. This is where we stand today. For further information on CCD, honeybees and pollinators see these references:

"Status of Pollinators in North America" available online at
www.nap.edu/catalogue/11761.html
Project Apis m
The Xerces Society
Agricultural Research Service USDA at
www.ars.usda.gov
National Pesticide Information Center, at
www.npic.orst.edu/envir/ccd.html