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# Hops, Bees

Posted by steven.reynolds | April 6, 2011

## WSU Gets Hopping to Fight Plant Diseases Threatening U.S. Hop Production

Some of the world's most sought after hops, the ingredient that flavors and preserves America's favorite brew, are grown in the Pacific Northwest. But a threat to commercial hop production could stop the industry dead in its tracks. Informed beer drinkers everywhere are thus raising a toast to Washington State University, the home of a new federal program providing the industry with the research needed to stop the threat.

The headquarters for the National Clean Plant Network for Hops (NCPN-Hops) is WSU's Irrigated Agriculture Research and Extension Center in Prosser. The focus of the program is identifying and eliminating diseases caused by virus-like agents, especially hop stunt disease.

Hop stunt disease does just what its name implies: it stunts plant growth, resulting in smaller yields and a stunted bottom line. That has an economic impact on the Pacific Northwest where commercial hop production is concentrated. The U.S. hop industry supplies one-third of the world's annual hops crop. Over 80 percent of each year's harvest is exported to more than



The acids used to flavor beer are found in the centers of these hop cones.

60 countries. Pacific Northwest commercial growers produce an annual farm-gate value exceeding \$200 million.

“We first spotted hop stunt disease in 2004,” said WSU plant pathologist Ken Eastwell. “By 2005, there was evidence that the disease was being spread when new plants were propagated from hop stunt–infected hops.”



Hop plants undergoing heat therapy to remove viruses.

Hops producers needed to know that the hops being planted in their hop yards were not infected with the disease. So they turned to WSU, which also runs virus elimination programs for fruit trees and grapevines. All the WSU clean plant programs are funded through the U.S. Department of Agriculture’s National Clean Plant Network.

The NCPN–Hops’ focus is on identifying and eliminating hop stunt and other yield–robbing viruses. Data gathered from WSU’s hop research plots indicates hop stunt not only reduces yield, but also the alpha and beta acids found in hop

cones. These acids are the sought–after flavor components that give beer its refreshing bitterness.

So far the NCPN–Hops program has produced 22 virus–free selections of the most economically important hops. Those plants are being propagated and distributed to eager hop growers. The program continues to work on cleaning up several other varieties and expects to release at least five selections every year.

–Terri Reddout, Program Coordinator, National Clean Plant Network for Fruit Trees and Hops

*More information about WSU’s collaborative effort to increase the economic sustainability of specialty crop production in the United States is available at <http://bit.ly/gkO1Rt>.*

## Entomology Grad Student’s Research Sheds New Light on Bee Health

New research is the first to demonstrate the sub–lethal effects of pesticide residue exposure on an insect largely responsible for a third of the human diet. Judy Wu, a former entomology graduate student at Washington State University and current Ph.D. student at the University of Minnesota, found that

low levels of pesticides build up in honey bee brood comb wax and cause serious consequences for developing worker bees and the adult worker bee's lifespan. The brood comb is the breeding quarters of a hive and the place where food is stored.

Bees are economically critical because of their pollination services, so colony health is a high priority in entomological research. While honey is also valuable, it doesn't compare to the contribution bees make as pollinators.

The pesticides involved in Wu's study include those used by beekeepers, growers and homeowners and included miticides, insecticides, fungicides and herbicides. The accumulation occurs because beekeepers reuse their combs to save on the expense of replacement.

Wu surmises that the pesticide residue contamination in the brood comb and its effects may be a potential contributing factor to losses associated with colony collapse disorder (CCD), a term coined in 2007 to describe the mysterious phenomenon that results in the disappearance of worker bees from hives. In recent years, the number of hives that beekeepers think should be healthy, but which are not, has significantly increased.



Judy Wu. Photo courtesy University of Minnesota.



The brood comb is the beeswax structure in which a queen bee lays eggs. It is the part of the beehive where a new brood is raised by the colony. Photo: USDA/ARS.

Professor Steve Sheppard, chair of the Department of Entomology at WSU and a widely respected authority on bees, said that CCD has a lot of possible causes. However, he is confident that while sub-lethal pesticide effects alone do not explain the disorder, Wu's research shows that low levels of pesticide accumulation cause abnormal honey bee development.

Some of the consequences to honey bees that Wu found were delayed larval development and a shortened adult life span, which can indirectly result in premature shifts in hive roles and foraging activity.

If a bee's life span is shortened, it dramatically

changes the dynamic of a hive. According to Sheppard, foragers are the bees that provide pollination and bring food back to a hive. "A bee's life span as a forager is on average only the last eight days of its life," he said. "This research shows that if raised with pesticide residues in the brood comb, an individual's foraging life span is shortened by four days, a 50 percent cut."

If there is not a sufficient number of foragers in the colony, the colony makes up the deficit by using younger bees that are not physiologically ready. The result is a negative cascade effect on the entire hive all the way down to the larval bees because individual nurse bees must prematurely move toward foraging behavior and stop feeding larvae, Sheppard said.

In addition, according to Wu's study, longer development time for bees may provide a reproductive advantage for Varroa destructor mites. Varroa mites are parasites that live in hives and prey on honey bees. The extended bee developmental period enables these mites to produce more offspring that devastate hives.

–Kacie McPartland, WSU CAHNRS news writing intern

### *But is honey safe to eat?*

*Steve Sheppard told On Solid Ground that the problems seen in honey bee brood combs are unlikely to occur with honey storage combs so the honey people eat is unlikely to become contaminated. This is because honey combs are 1) only used for the brief period during the year when bees are making honey from blooming plants; 2) the pesticides are generally highly lipid soluble, meaning they easily migrate into wax, but are poorly soluble in aqueous solutions such as honey; and 3) honey combs are not used to rear broods.*

*Wu's research was recently published in the peer-reviewed online journal PLoS One, and adds to the growing collection of professional literature on honey bees and pesticide residue contamination. Read Wu's research paper at <http://bit.ly/i3g31E>.*

*Learn more about entomology research at WSU by visiting <http://bit.ly/OrVNa>.*

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