

Bees

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Varroa mites are fatal to honeybees and are part of the complex colony collapse problem. They feed on bee larvae and reproduce in the hive. In two years a Varroa mite infestation can kill an entire bee colony, according to WSU.

“It’s also the pathogens and viruses they vector — that’s really what’s killing the hives,” Cobey said. “Some bees are more resistant to those than others.”

Varroa mites were first found in the U.S. in 1986, and came from Europe and Russia, so the possibility of finding bee genes for resistance is greater in those overseas bee populations.

Preserving genetics

WSU is the only lab in the country with permits to import bee semen, and the only laboratory with the ability to freeze it, Hopkins said.

Viruses can still be transmitted through bee semen, but it’s less risky than transporting live bees — and simpler, Cobey said.

The three researchers share collecting duties. They have brought bee sperm from Italy, Slovenia, the Republic of Georgia and Kazakhstan.

Hopkins said they typically collect sperm from thousands of drones. It takes about 20 male honeybees to fill one straw containing 20 microliters. A microliter is one-millionth of a liter.

“We have 800 straws, or something like that,” Hopkins said.

The semen is cryo-preserved in liquid nitrogen at 320.8 degrees below zero Fahrenheit so it can be used whenever beekeepers want.

The researchers artificially inseminate a queen bee with the semen using special instruments.

This year, they inseminated about 100 queens, he said.

Cobey said the bee industry could now see the sorts of advancement possible in other industries, such as cattle, horses and chickens.

“We haven’t had that capability with honeybees,” she said. “It’s pretty exciting, pretty cutting-edge.”

Evolved traits

Honeybees are generally well-adapted to most climates, but subspecies of bees have evolved in different locations. For example, Hopkins said, a subspecies of bee lives in the Sahara Desert.

“You can’t take a hive of that subspecies and move it to the Alps or here — it’ll die in the winter,” Hopkins said. “It’s the same species, but it has evolved drastically different characteristics and behavior.”

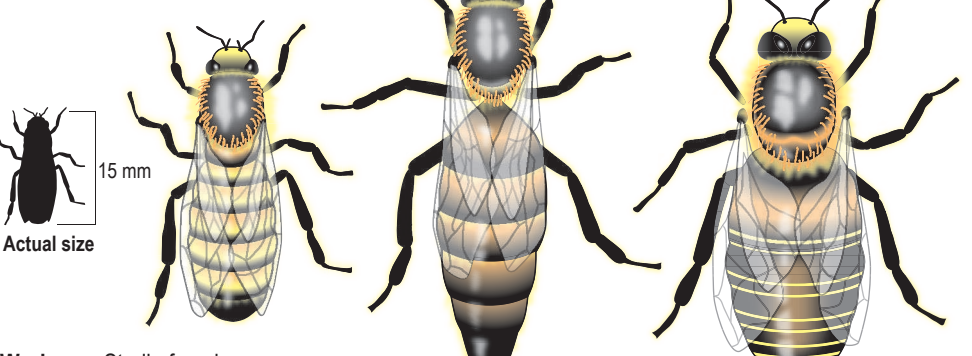
Most bees in the U.S. originate from Italy — well-suited for California, but not necessarily adapted in the Pacific Northwest for flying in the rain, Hopkins said.

Cold-weather bee races fly under more marginal conditions for pollination. Some bees have similar characteristics, but

Amazing honeybees

Members of the genus *Apis*, seven species of honeybees are recognized today. The best known is the Western honeybee and a colony can contain 60,000 or more. They are social insects with three distinct groups or castes: workers, drones and queens. While there is only one fertile queen, hundreds of drones and tens of thousands of workers make up a beehive.

Caste of characters



Worker — Sterile females, they develop from eggs the queen fertilizes. They exhibit a wider range of behaviors that include cleaning, brood care, defense and foraging.

Queen — Produced at the behest of the workers, queens are larger and can lay 2,000 eggs a day. They may live up to three years or more.

Drone — Developed from unfertilized eggs, drones have large sets of eyes to locate the queen during mating flights. They have no stingers.

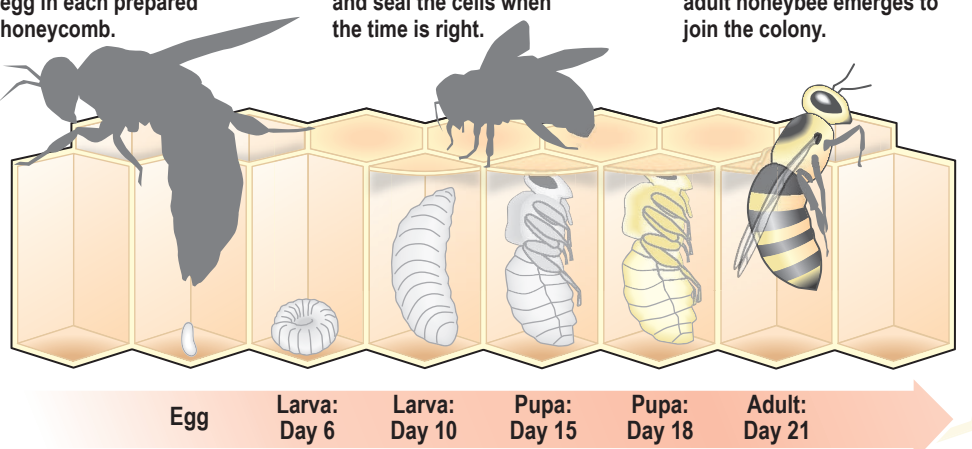
From egg to adult

Workers typically take 21 days to develop while queens take only 16. Drones take the longest at 24 days but all are fully developed adults when they emerge from the honeycomb.

The queen lays a single egg in each prepared honeycomb.

Workers feed the larvae and seal the cells when the time is right.

At 21 days a fully developed adult honeybee emerges to join the colony.

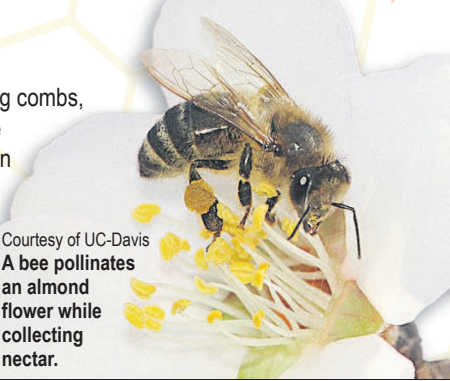


Stage	Day
Egg	
Larva	Day 6
Larva	Day 10
Pupa	Day 15
Pupa	Day 18
Adult	Day 21

A bee’s life

From the moment a worker is born it’s put to work building combs, nursing the brood and cleaning the hive. As they become harderier they move on to guard duty. Older workers, known as field bees, forage for nectar, pollen, water and other plant resins used for hive construction. Workers born early in the season live about 6 weeks while those born late will overwinter until the following spring.

Sources: www.gpnc.org; www.orkin.com; www.britannica.com
Alan Kenaga/Capital Press



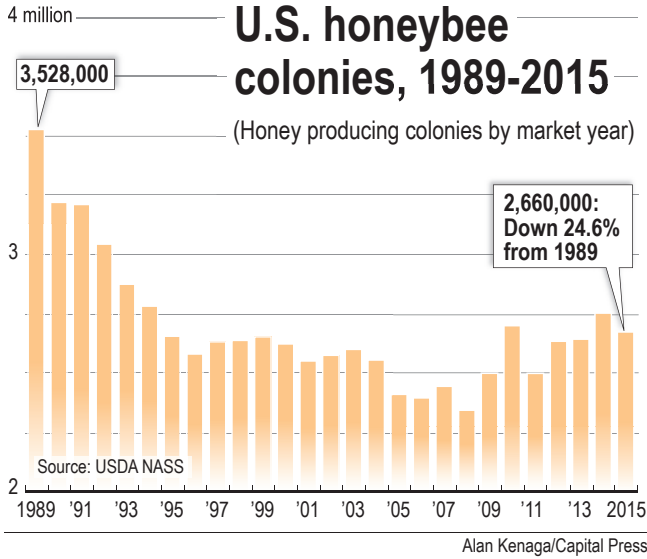
others won’t forage in rainy weather, increasing the chances of a lost or smaller crop.

“If you have marginal, drizzly weather, they will be out there,” Cobey said. “They seem to fly longer hours. ... These are used to a long, hard winter, hunkered down. Cover them with snow and they’re happy.”

Better queens

Ray Olivarez, owner of Olivarez Honeybees in Orland, Calif., said Cobey inseminated his Carniolan stock — a subspecies of the Western honeybee — with “pure” stock maintained at WSU to keep breeder mother traits consistent to breed type, characteristics and to infuse “some new blood.”

It enabled Olivarez to replace older, failing breeder queens with reliable queen mothers for production. He hopes to see continued improvement of breeder stock with better tolerance of Varroa mites and disease, as well as



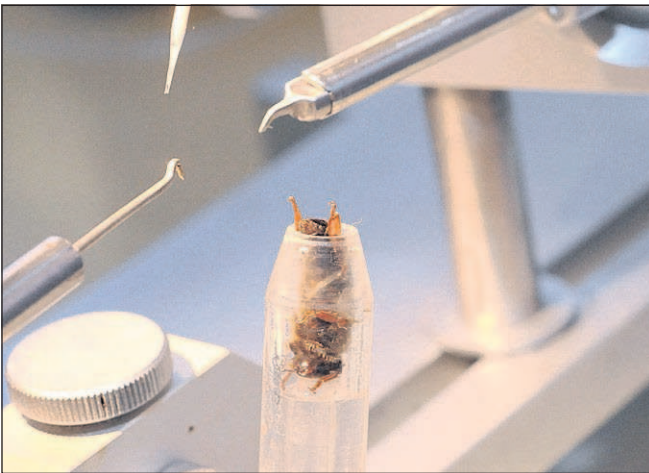
keep key traits such as honey production, brood production and gentleness.

“I believe we have quite a bit of diversity in the United States as it sits right now, but once we realize we are not in that situation, it is too late,” Olivarez said. “We need to be proactive in this area.”

Garry Reeves, a beekeeper

in Moores Hill, Ind., purchases breeder queens through Cobey to breed “some of the best production queens east of the Mississippi.”

“As a beekeeper and queen breeder, we are always looking for something better,” Reeves said. “I need breeder queens that will produce daughters that are hygienic in



Kathy Keatley Garvey/University of California-Davis

A queen bee is instrumentally inseminated. Washington State University research associate Susan Cobey and a team of researchers are importing bee semen to inseminate “starter” queen bees for queen bee producers to develop for sale, and improve the U.S. honeybee gene pool.



Matthew Weaver/Capital Press

Samples of bee semen are frozen in Washington State University’s bee sperm bank Aug. 30 on the Pullman campus. The ability to freeze bee semen makes possible WSU’s program to import bee germplasm from outside the U.S. and improve the genetic diversity in the U.S. bee population.

nature that help control my mites, viruses, (are) gentle and produce honey and overwinter well.”

Reeves said he noticed a difference after the first year. After the second, he realized it wasn’t a fluke.

“The bees were much more gentle, overwintering success had picked up and (they made) more honey,” he said.

Reeves had used breeder queens from other universities and private individuals. Before working with Cobey and WSU, he had lost 40 percent of his 120 hives. In 2013, his losses were 8 percent, in 2014 6.4 percent and 2015 6.6 percent, well below the national average, he said.

“I can only hope that more people will start using good quality queens,” he said.

A safety net

Hopkins recently attended the first meeting of the USDA National Animal Germplasm Program’s honeybee committee to discuss which species are important to preserve.

A bee subspecies might possess a key trait, such as adaptability or Varroa resistance, so it’s important to maintain them for current or future breeding, Hopkins said.

“It’s like a safety net, because there’s other problems in the pipeline,” he said, noting that tropilaelaps mites haven’t been found in the U.S. yet, but are supposed to be “even more devastating” than Varroa mites.

“Hopefully it never makes it here, but inevitably in this kind of a global system, diseases seem to get spread everywhere. And those are just

the ones we know about.”

What’s next?

The university is preparing queen bees for overwintering at its Pullman, Wash., campus. Researchers will monitor them for foraging behaviors or hygienic behavior to see if they possess the desired characteristics. Some will go to California in February to be assessed for almond pollination.

The next queen bees will be delivered to commercial queen bee producers in February or March. Many producers are waiting in line for the bees, Hopkins said.

Without WSU’s work, honeybees would have to travel farther to places such as California and Washington state to meet the demand for fruit and nut tree pollination, Cobey said. The U.S. even imported bees from Australia for several years to help with early-season almond pollination, she said.

“The cost of producing bees for pollination and keeping bees healthy would greatly increase, along with increasing the cost of producing food,” she said.

Hopkins said WSU’s research will make the future more secure for honeybees. He’s seen photos from China and Japan of workers pollinating fruit trees with paintbrushes.

“I guess that’s the picture I imagine without bees,” he said. “Production standards are going to have to be much, much lower, because there’s no way people or anything else can do pollination. You’re never going to get the production you see today.”

Merger

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rising food demand.

“This type of change enables more innovation and delivers better products to the farm even faster,” Fraley said. “Farmers are best served when companies invest more in new technologies and accelerate the pace of their (research and development), which in turn spurs robust competition.”

Blome noted that Monsanto has a greater presence in North America while Bayer’s business is greater outside of North America.

“Monsanto is a perfect match to Bayer’s agricultural business combining complementary skills with limited geographic overlap,” Blome said.

Grassley pointed to lower crop prices and higher seed prices, saying farmers are under “tremendous pressure” as the agriculture economy has slowed in the last couple of years.

The Iowa senator said antitrust regulators should closely watch consolidation of the agricultural biotech industry



Pablo Martinez Monsivais/Associated Press

Bayer CropScience North America President and CSO Jim Blome, left, talks with Monsanto Company Executive Vice President & Chief Technology Officer Dr. Robb Fraley in Washington, Tuesday, Sept. 20, 2016, prior to testifying before the Senate Judiciary Committee hearing on a proposed \$66 billion merger of American seed and weed-killer company Monsanto and German medicine and farm chemical maker Bayer.

and coordinate oversight between agencies. He said the Federal Trade Commission is currently reviewing another merger between Syngenta AG and the China National Chemical Corp. and the Justice Department is looking at the merger of Dow Chemical and DuPont.

“The innovations of the companies in this room today have helped the world reach productivity levels which ease fears over meeting the long-

term demands of our growing global population,” Grassley said. “However, when does the size of companies and concentration in the market reach the tipping point, so much that a market becomes anti-competitive?”

Executives from Syngenta, Dow AgroSciences and DuPont similarly defended their own merger plans at the hearing, saying that combined resources would help spur better innovations. Grassley

said that the China National Chemical Corp. declined to testify.

Republican Sens. Thom Tillis of North Carolina and Orrin Hatch of Utah said the companies are facing too many government regulations and that is one reason for the mergers.

“No one this side of the dais should be surprised that they have to go through this to survive,” Tillis said.

Democrats were less supportive. “You have to look at it from the consumer’s point of view, and whether that is good policy,” said Illinois Sen. Dick Durbin.

Farm groups testified that they are worried about the consequences.

Roger Johnson, head of the National Farmers Union, said that the mergers would mean that three companies would have more than 80 percent of U.S. corn seed sales and 70 percent of the global pesticide market.

“These mergers will result in fewer choices for farmers, higher prices, and less innovation,” he said.

Bayer and Monsanto both own a variety of well-known

products. Bayer sells crop protection chemicals used to kill weeds, insects and plant fungal diseases and also makes popular pharmaceutical products such as Bayer aspirin, Claritin allergy medicine and Alka Seltzer. Bayer also owns Dr. Scholl’s foot products and Coppertone sunscreen.

Monsanto sells seeds for fruits, vegetables, corn, soybeans, cotton and other crops, plus heavily advertised Roundup weed killer. The company is a leading producer of genetically modified seeds engineered to resist drought and herbicides, among other things. Activists who oppose those so-called genetically modified organisms, or GMOs, have created a grassroots effort to vilify the company, even holding marches on city streets to protest Monsanto by name.

Bayer and Monsanto executives so far have not said if the Monsanto name will change. They say the combined company’s seeds and North American business will still have a headquarters at Monsanto’s St. Louis base.

Pack

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“The department is continuing to monitor the situation. The wolf removal action is ongoing, but we recognize full pack removal will be extremely challenging, given the rugged and heavily timbered landscape in the area and the wolves’ extensive range,” Martorello wrote.

This is the third time Washington has shot wolves since the animals crossed over from Idaho. Wildlife managers shot seven wolves in 2012 and one in 2014. All the shootings have occurred in northeastern Washington, where most of the state’s wolves are concentrated.

Some environmental groups have expressed outrage over plans to remove the entire pack and are calling for changes in WDFW’s policy.

WDFW adopted the policy this year after meeting for more than a year with an advisory group that includes ranchers, hunters, animal-rights advocates and environmentalists.