

Varroa-Tolerant Bees Keep Hives Buzzing

An eight-legged, blood-sucking parasite known as the varroa mite ranks as one of the worst enemies of honey bees worldwide. About one-sixteenth inch in size, *Varroa jacobsoni* mites have attacked in nearly every state, killing bees needed for making honey and for pollinating an estimated \$8 to \$10 billion worth of crops.

Varroa mites feed on the blood of adult bees and developing young bees that are still soft, white pupae. Parasitized bees may have deformed wings and abdomens and a shorter life span than their unparasitized hivemates. What's more, varroa mites are thought to transmit at least a half-dozen bee viruses.

But honey bees that can tolerate attack by the mite may hold an important key to stopping today's devastating losses to this parasite.

ARS entomologist Eric H. Erickson and colleagues monitored mite infestations in research apiaries. The scientists populated the apiaries with survivors from hives that had not been treated with mite-controlling chemicals, or miticides.

"We rated a hive as varroa-tolerant if it had no more than 15 mites for every 100 adult bees," says Erickson, who heads the ARS Carl Hayden Bee Research Center in Tucson, Arizona. "Our experimental apiaries, which we kept miticide-free, usually scored better than this, often having fewer than 7 mites per 100 bees."

Erickson says the 4-year experiment provides additional evidence that beekeepers can produce and maintain varroa-tolerant strains from established stocks of our domesticated honey bee, *Apis mellifera*.

"Some beekeepers and breeders already do this successfully," he notes.

Russians to the Rescue

Hardy honey bees from the mite-infested Primorski region of Russia's Far East may also offer natural genetic resistance that could be bred into U.S.

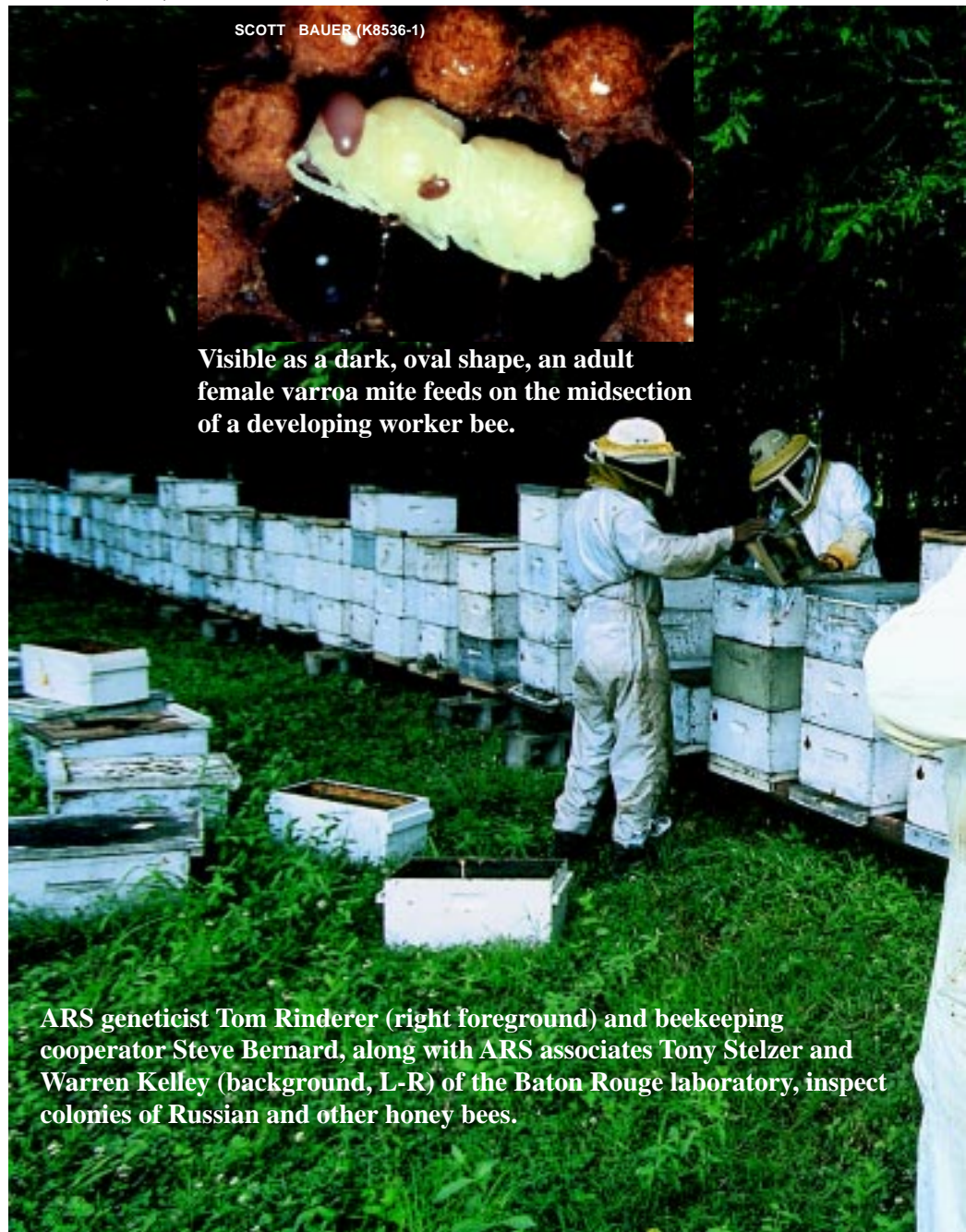
honey bees.

"The Russian bees are the same species as our domesticated honey bee," says ARS geneticist Thomas E. Rinderer. "But we suspect that, over time, the constant mite challenge in that region led nature to favor survival of only the most mite-resistant bees." Rinderer heads the ARS Honey Bee Breeding, Genetics, and Physiology Research Unit in Baton Rouge, Louisiana.

In 1997, Rinderer brought some of the rugged Russian bees to an ARS quarantine facility on small, sun-baked Grand Terre Island off the coast of Louisiana. His studies there indicate that mite populations in some hives deliberately infested with the parasite decreased as much as one third, while mites in some research hives of domestic bees increased fivefold.

"If this resistance proves constant,"

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Visible as a dark, oval shape, an adult female varroa mite feeds on the midsection of a developing worker bee.

ARS geneticist Tom Rinderer (right foreground) and beekeeping cooperators Steve Bernard, along with ARS associates Tony Stelzer and Warren Kelley (background, L-R) of the Baton Rouge laboratory, inspect colonies of Russian and other honey bees.

says Rinderer, “beekeepers may in some cases be able to reduce, if not eliminate, miticide treatments by relying on the Russian bees.”

Rinderer has sent Russian bees to commercial bee colony suppliers in Iowa, Mississippi, and Louisiana to evaluate the insects for temperament, honey production, and pollination skills—traits beekeepers value. “If their reports to us are good and mite resistance continues

to be high,” says Rinderer, “the Russian bees could make their national debut next year.”

Widespread use of a miticide called fluvalinate, or Apistan, has “inadvertently contributed to the rise of mites resistant to this chemical,” says ARS environmental toxicologist Patti J. Elzen.

Recently, Elzen and colleagues in the ARS Beneficial Insects Research Unit at Weslaco, Texas, found fluvalinate resis-



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On Marsh Island, Louisiana, an isolated ARS research facility used for producing pure stocks of Russian bees, technician Gary Delatte prepares hives for transport.



tance in varroa mites collected from California, Wisconsin, Arkansas, and Florida. Based in part on the Weslaco research, Florida state officials this year were the first to seek and obtain a 1-year emergency exemption from the federal Environmental Protection Agency to allow use of an alternative chemical, coumaphos.

Still More Threats—and Treatments

Coumaphos also foils the small hive beetle, *Aethina tumida*. Last year, Florida beekeepers became the first in the United States to suffer major losses from this shiny-black, quarter-inch-long insect.

Varroa mites not felled by fluvalinate or coumaphos might someday be vanquished by natural compounds extracted from the smoke of burning citrus or other plants. As entomologist Frank A. Eischen at Weslaco has already shown, chemicals in some kinds of smoke can kill the mites—without harming the bees—or at least make the mites fall off the bees. [See “Smoking Out Bee Mites,” *Agricultural Research*, August 1997, p. 19.]

Now, Elzen and her husband Gary, an insect toxicologist, have captured smoke samples for analysis by Robert D.

Stipanovic and colleagues in the ARS Cotton Pathology Research Unit at Oxford, Mississippi. The scientists will use instruments called mass spectrometers to identify the smoke chemicals. Ideally, some of those extracts could be used in tomorrow's hives to quell the mites.

Varroa mites have been implicated in the spread of a pathogen known as Kashmir bee virus, but scientists don't yet know the mites' exact role.

"It's possible that the mites, after feeding on the blood of a sick bee, spread virus to the next healthy bee they attack," says entomologist Akey C.F. Hung, who is at the ARS Bee Research Laboratory in Beltsville, Maryland. "Or, if an otherwise healthy bee harbors a low level of the virus, perhaps an attack by varroa mites triggers the virus to multiply."

To discover more about the microbe's spread, Hung is scrutinizing samples of the virus' genetic material taken from sick and healthy bees and varroa mites.

"Although this virus—in association with varroa mites—could become a serious pathogen of bees," says Hung, "we don't yet know to what extent it occurs in American beehives. If we can find out how Kashmir bee virus is transmitted," he says, "we'll be better prepared to combat it, should it prove to be a problem here."—By **Marcia Wood** and **Ben Hardin**, ARS, and **Jill Lee**, formerly with ARS.

This research is part of Animal Pests and Parasites, an ARS National Program described on the World Wide Web at <http://www.nps.ars.usda.gov/programs/appvs.htm>.

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Beekeeping assistants Matt Wyble and Guy Foret and technician Gary Delatte (L-R) unload colonies of Russian honey bees on Marsh Island to obtain pure mated Russian queen bees. The island is far enough from land that no other honey bees are present.

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Beekeeper Steve Bernard and ARS entomologist Lilia de Guzman extract developing bees from a comb to check for mites.

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A family of varroa mites found at the bottom of a honey bee brood cell.