

The African Advantage

In which immigrant Queen Bees are still arguably Mean Bees

"Christopher — ow! — Robin," called out the cloud.

"Yes?"

"I have just been thinking, and I have come to a very important decision. *These are the wrong sort of bees.*"

— A.A. Milne, *Winnie-the-Pooh*, 1926

By RICK WEISS



Illus. by Ernest H. Shepard from *Winnie-the-Pooh*, © 1926 E.P. Dutton, renewed 1954 by A.A. Milne. Reprinted by permission, Dutton Children's Books.

Suspended among the treetops from a blue balloon and disguised as a rain cloud, Pooh got pretty close to his honeycomb goal before reporting the bad news to Christopher Robin that "the bees are now definitely Suspicious."

Suspicious, for bees, means ready to sting. And nowadays, many beekeepers in South and Central America are finding their bees Suspicious with a capital S. Indeed, some beekeepers have concluded, like Pooh, that theirs are flat-out "the wrong sort of bees."

In many cases, they are right.

The problem is African honeybees. These easily agitated, aggressively stinging insects have gradually spread northward since their introduction into South America in 1956. Swarming roughshod over the countryside, they've been taking over hives inhabited by the more docile, local bees while stinging to death a few hundred people along the way.

With their killer reputations preceding them, the bees' imminent arrival in the United States has stirred considerable concern among entomologists, beekeepers and laypeople alike. But despite years of intensive study using sophisticated molecular tests, researchers have yet to agree on the degree of threat these bees pose to the U.S. beekeeping industry or to the general public.

Most important, insect geneticists have yet to determine the extent to which African honeybees are interbreeding with the more easily managed New World honeybees, most of which derive from European ancestors. Initially, entomologists reckoned that the African bee's irritable demeanor might get diluted after sufficient hybridization with its European cousins. Those hopes dwindled last year with the publication of two reports finding little genetic evidence of such interbreeding. New, unpublished research from U.S. Department of Agricul-

ture scientists contradicts those findings, but not everyone agrees that the USDA data reflect a broader genetic reality.

Now, with the first swarms of African bees expected to cross from Mexico into Texas within the next few months, entomologists are becoming increasingly agitated themselves. Faced with conflicting data painting very different pictures of critical genetic trends, they cannot reach a consensus on how to deal with the influx of expatriate insects.

"The USDA is pretty defensive about this," says H. Glenn Hall, an entomologist with the University of Florida in Gainesville. The federal agency has introduced large numbers of European bees into Mexico, with hopes of enhancing hybridization rates. And in an effort to buy time while hybridization occurs, USDA researchers have deployed bee traps in the countryside and "hit squads" in some cities to capture and kill African swarms moving through Mexico. While agency officials say their strategy has slowed the insects' advance, Hall contends they have little to show for their efforts.

Still, he says, "I'm not sure any effort would have worked. This is a major biological phenomenon. You're talking about trying to stop the tide with a bailing bucket."

The tide began its rise in southern Brazil, where Italian honeybees, although appreciated for their good temperament, have proved poor honey producers. In 1956, Brazilian scientists imported 46 South African queen bees as part of a program to breed a better bee—a placid but prolific producer well adapted to South American conditions. The program backfired when 26 queens escaped from the lab into the jungle. The rest is entomological history.

Three decades and 7,000 miles later, the progeny of the escapees are camped just

south of the U.S. border. The closest colonies spent this past winter about 150 miles south of Brownsville, Tex. And with African swarms capable of migrating up to 100 miles at a stretch, U.S. entomologists say they expect the first arrivals this year.

But what kind of bees, exactly, will the newcomers be?

"Originally, we anticipated there'd be a lot of interaction and the African bees would pick up European traits," says Orley R. Taylor, an entomologist at the University of Kansas in Lawrence. But Taylor, working with Deborah Roan Smith and Wesley M. Brown of the University of Michigan at Ann Arbor, has conducted genetic studies indicating that African queens, compared with European queens, seem either genetically dominant or ecologically better suited to take advantage of neotropical niches.

The researchers examined mitochondrial DNA from 66 honeybee colonies in Brazil, Venezuela and Mexico. Since mitochondrial DNA is inherited only from the mother, analyzing it in captured workers provides an indication of the relative mating success of European and African queens. In the May 18, 1989 *NATURE*, the team published its surprising results: 97 percent of the workers tested positive for African mitochondrial DNA. The researchers concluded that "mitochondrial genomes of a small number of African females have rapidly colonized most of a continent."

In the same issue of *NATURE*, Hall and K. Muralidharan of the University of Florida reported that all 19 wild swarms they captured and analyzed in Mexico had African mitochondrial DNA. The finding further clarified the nature of the African bees' expansion, showing that it has resulted mostly from African maternal lineages spreading as swarms, rather than from African drones inseminating European queens.

Those two papers shocked entomologists and beekeepers in North America, where no one had expected the African matriarchies to make their way so far north without a little more genetic mixing and matching.

"It's very surprising that the African bees in Mexico do seem to be offspring of an unbroken chain of African bees," says P. Kirk Visscher, a bee geneticist at the University of California, Riverside. However, he adds, "just how much this really tells us, I don't know."

The problem, explains entomologist Robert E. Page of the University of California, Davis, is that population dynamics over continental expanses cannot be deduced from a few spotty studies at random locations. The *NATURE* papers were "significant," Page says, but he calls the authors' interpretation "overstated."

For example, he says, in some parts of Central America and Mexico, African bees may have had very little contact with European bees, but significant contact and hybridization may be occurring in other areas. Moreover, bees with differing genetic backgrounds may show varying survival rates in particular environments. "There's no reason to think that what's going on with African bees should

be uniform throughout their range," says entomologist Richard Nowogrodzki of the CBORD Group in Ithaca, N.Y.

In fact, recent studies by Walter S. Sheppard of the USDA's Agricultural Research Service in Beltsville, Md., and Thomas Rinderer of the USDA's honeybee research lab in Baton Rouge, La., provide good evidence for interbreeding. In two studies submitted for publication — one performed in Argentina and the other comparing honeybee species from around the world — the researchers used mitochondrial DNA analyses to prove that African males in the wild have been mating and producing offspring with European females, and vice versa.

The finding counters a suggestion by Taylor that metabolic differences between European and African bees may be significant enough to prevent their respective DNAs from functioning well in combination. Says Rinderer: "We conclude that hybridization does occur to a large extent and there's no fundamental [genetic] incompatibility."

Taylor argues that even if African and European bees do interbreed, the offspring — or the offspring's offspring — may not survive as well as those of purer African strains. "The pattern indicates that at first there's a puff of hybridization, then the [gene] frequencies drift back more toward African," he says. This suggests that the hybrids ultimately do not compete well in nature.

"The African bees seem to pick up European characteristics, then lose them because of natural selection, genetic dilution or lack of European input," Taylor concludes. In this way, the African bee seems to genetically "reconstitute itself," he says. Indeed, he adds, his studies of wild bees captured more than 400 miles north of Mexico's southern border — in an area that has one of the highest concentrations of European hives in all of Mexico — indicate "they're showing more African traits than they did farther south."

Hall concurs. "In Venezuela, in Honduras, in Costa Rica, in Mexico, it's the same story," he says. "The evidence to me is indisputable. We conclude that European maternal lines aren't making it."

Scientists on both sides of the issue acknowledge they still know too little about bee genetics to back up some of their sweeping predictions. "The story is far more complex than we had anticipated," Taylor concedes. He points, for example, to recent research by Hall suggesting that some genetic markers that researchers use to differentiate between African and European bees may be more common to both types of bees than was previously assumed.

Moreover, says USDA's Sheppard, "none of these [genetic] markers is necessarily linked to behavior. In the long run,

we're going to have to define African and domestic bees in terms of what we're trying to control, such as behavior and honey production."

Richard L. Hellmich, a colleague of Rinderer's in Baton Rouge, says his research suggests that if beekeepers check hives annually to make sure African queens haven't dethroned their European counterparts, and maintain about 90 percent control over matings by swamping the area with European drones during the mating season, "then you're okay" in terms of retaining hive manageability. Although these tactics will cost money, a bit of African "blood" might even enhance honey production in European colonies without necessarily adding aggressiveness, Hellmich speculates.

Some data offer hope for such a trend. After an initial drop in Brazilian honey production due to hive takeovers by African bees, honey output has begun to increase again — although some of that trend is probably due to recent increases in the number of citrus groves there. Perhaps most encouraging, human deaths due to mass stings by African bees have become less commonplace in recent years, especially in the insects' northern range. Stinging deaths have dropped from an average of 75 per year in Venezuela during the bees' first five years there to only eight deaths in Mexico since the bees crossed its border in 1985, says USDA's Rinderer.

Those numbers probably reflect both a mellowing among African bees and an increased human effort to avoid antagonizing them, Rinderer says. He and others hypothesize that in temperate regions, the meanest tropical bees will find themselves at an ecological disadvantage, and that a hybrid zone, perhaps a few hundred miles wide, may ultimately stretch across the southern United States. A similar hybridization zone seems to exist in Argentina, he says.

Hall agrees that African bees will have an increasingly difficult time as they cross the border and move northward through the United States. But in parts of the U.S. South, African bees "are probably going to become well established and they're going to cause a lot of problems," he contends. Hall maintains that honey prices probably won't change, in part because much of the honey in the United States is imported from such places as China. "But the economics of pollination will escalate," he says.

Managed bees are critical to agriculture in the United States, where roving beekeepers transport their hives around the countryside to pollinate an estimated \$10 billion worth of crops each year. If African bees start taking over hives in the South and traveling beekeepers encounter increased hassles and costs in controlling their bees, "food prices will prob-

What's in a name?

When it comes to pinning a name on the short-tempered honeybees now making their way north through Mexico, entomologists are united in their disdain for the term "killer bees." But they have trouble agreeing on a more suitable moniker.

USDA bee specialists go with "Africanized bees," a name hinting of the hybridization that they say is occurring between native, bees of European descent in South and Central America and their imported African cousins, which arrived in Brazil in 1956. But others, citing genetic evidence for African dominance, say the term is misleading.

"The very word 'Africanized' implies the bees are European and that because of some input from African bees they've become Africanized," says H. Glenn Hall, an entomologist at the University of Florida in Gainesville. But most of the bees that he and his colleagues examined in Brazil, Venezuela and Mexico show African maternal lineage, with little evidence of interbreeding. "If anything," he says, "we should call them Europeanized."

Hall contends the name needs to be changed to reflect the finding that the current generation of these bees is essentially African.

But until further genetic studies yield conclusive results, the terminology will no doubt remain somewhat bee-fuddling.

— R. Weiss

Continued on p.332

interesting ways to incorporate it into the diet. Over the past two years she has been developing new recipes, in part to keep former study participants on the barley bandwagon.

One commercially available source of barley for baking and cooking is a beer-brewing byproduct known as malted barley. Though malting removes the beta-glucan, it doesn't erase barley's cholesterol-fighting potential, says food scientist Frank E. Weber of the Miller Brewing Co. in Milwaukee. That's because malting and beer brewing concentrate the oily tocotrienol, he explains. Weber reports data from a pair of month-long studies involving a total of 73 people with elevated serum cholesterol, indicating that daily consumption of as little as 3 to 5 tablespoons of malted barley can lower serum cholesterol by as much as 15 percent.

In the first study, 4 tablespoons of malted-barley bran daily lowered serum cholesterol an average of 6 percent. In the second study, participants ate a low-fat diet along with a daily dose of either 3 tablespoons of malted-barley bran or the oil derived from 4 tablespoons of the bran. Their cholesterol levels dropped an average of 10 percent, Weber says.

Moreover, the cholesterol-lowering effect of bran flour made from malted

barley "is more persistent than oat bran's," he asserts. "You can stop taking [malted] barley bran and tocotrienol, and eight weeks later your cholesterol is still lower [than before the supplementation began]."

"Beta-glucan has proven cholesterol-lowering effects," says James Anderson, who pioneered oat bran's use in the dietary management of high cholesterol at the Veterans Administration Medical Center in Lexington, Ky. However, he adds, beta-glucan and tocotrienol are not panaceas. Some people with high cholesterol show little or no response to them. And among those who do respond, he points out, "we seldom see a [diet-induced] blood cholesterol reduction of greater than 20 percent. I think that's sort of the limit of its potency." Patients who need more dramatic reductions to bring their serum cholesterol into the healthy range "probably need a more powerful drug," Anderson says.

What about people whose serum cholesterol is already in the healthy range? Dietary changes may not lower it much, if at all, these researchers observe. But beta-glucan's benefits extend to another front. The National Cancer Institute recommends eating at least 20 to 30 grams of fiber daily — about twice what most U.S. adults now consume. And beta-glucan, whatever its source, could help many people fill that fiber gap. □

Continued from p.329

ably go way up," Hall predicts.

USDA scientists tend to downplay such dire scenarios. So far, they note, government brigades using hormone-drenched traps have captured and then killed more than 13,700 northward-moving African swarms in Mexico. Taylor and other critics say that number is minuscule compared with the more than 2 million managed hives in Mexico and the large, uncensused population of wild bees. But USDA officials maintain the delaying tactic has worked, and they say the bees' impact in the United States will be greatly reduced with expanded trapping of intruding swarms, periodic requeening using certified European queens, and mass releases of European drones.

Ultimately, everyone agrees, the final picture will depend on just how much hybridization really occurs, how well the hybrids will compete in temperate environments and how hybridization will influence bee behavior.

"It's obvious to me that hybridization is occurring in some transition zones," says USDA's Sheppard. That observation leads him to believe that the bees will not pose such an extreme problem by the time they become a permanent part of the U.S. landscape. "But am I right about that? I'll know in 25 years, at the end of my career." □

NEW WORLD, NEW MIND:

Moving Toward Conscious Evolution

By Robert Ornstein and Paul Ehrlich

Culturally and biologically, humankind has evolved further and faster than any other species on earth. In the process we have also changed the planet more in the past ten thousand years than all its inhabitants did in the first four million. **New World, New Mind** is an investigation into what we have done to our planet . . . and a warning about the consequences of progress. Unless we consciously evolve to fit our advanced society, we will destroy all that we have created. According to Ornstein and Ehrlich, we function today with a mind-set fit for the eighteenth century, while playing with the "toys" of the twenty-first. Why, for instance, on a planet that has an exploding human population, a deteriorating environment and steadily dwindling resources, have we spent more time, energy and genius building arsenals to destroy our enemies rather than working to save ourselves? Why does the world respond to an infrequent airline hijacking and virtually ignore the daily killings on our streets?

S&S, 1989, 302 pages, 9½" x 6½", paperback, \$9.95

Science News Books NewWorld
1719 N St., NW, Washington, DC 20036

Please send _____ copy(ies) of *New World, New Mind*. I include a check payable to Science News Books for \$9.95 plus \$2.00 postage and handling (total \$11.95) for each copy. Domestic orders only.

Name _____

Address _____

City _____ State _____ Zip _____

Daytime Phone # (_____) _____

(used only for problems with order) RB1239

We need to develop a new mind — a new set of thought processes, reactions, perceptions and impulses — for our new world. Ornstein and Ehrlich present an invaluable study of where our society is going and what we can do to keep up with it.

— from the publisher