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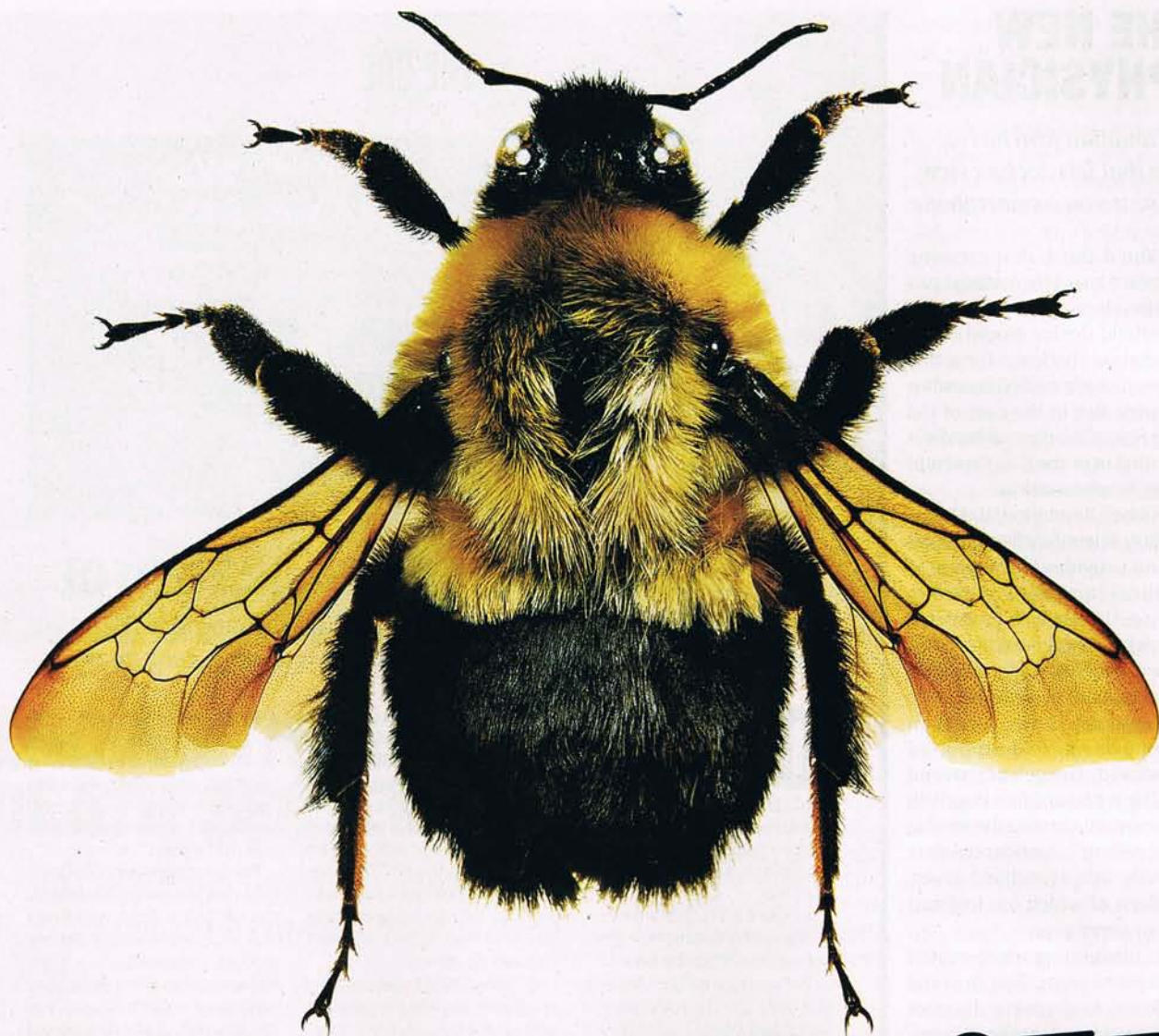
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# Buzz Kill

*Bees are disappearing, putting a third of our food supply at risk. Inside the \$15-billion race to save one of nature's hardest workers*

BY RACHEL MENDLESON. PHOTOGRAPHS BY NATASHA V AND KELLY SHIMODA

**On a hot, sunny morning** in late July, beekeeper David Hackenberg parks his truck on the path of uneven terrain that separates the pumpkin from the broccoli on a sprawling central Pennsylvania farm. From a distance, it's tough to tell that the white wooden boxes, resting on the ground a few metres away,

are teeming with hundreds of thousands of honeybees. Up close, however, it's an altogether different story. As Hackenberg, clad in cowboy boots and jeans, slips on his well-worn bee veil and steps out of the truck, legions of black-and-yellow insects zoom in every direction. Countless others

cling to the man-made hives, forming solid clumps of tiny wings and eyes. It's barely 10 a.m., but the bees' workday, he says, is just about over. The golden petals of the pumpkin flowers they were brought here to pollinate, open for only a few hours each morning, are already starting to tighten up like fists.

Though the odd pumpkin can sprout without the help of honeybees, they are what makes planting a large acreage of this crop—as well as scores of others, from blueberries and apples to almonds and canola—worthwhile. The tireless efforts of these little workhorses ensure that by September, a single acre of thick green vines will have produced enough swollen orange gourds to fill a semi.

But this essential service now comes at a premium. Since 2006, a massive wave of honeybee deaths has plagued the beekeeping industry, pushing costs ever upward. In the case of pumpkins, the per-hive rental price has nearly doubled since then, from about \$50 to \$90—which, for farmers such as this one, who need one hive for each of his 600 acres, is not insignificant. But Hackenberg says growers now realize honeybee losses are a reality that can't be bargained away. "They don't even argue with me about the price anymore," he says.

To the rest of us, the fact that some pumpkin grower in Pennsylvania has acquiesced to paying more for bees may not seem like a big deal. But what it signals is the beginning of a chain of events that, if left unchecked, could have dramatic global economic implications. In the past few decades, commercially managed honeybees have become so thoroughly entrenched in our agricultural economy that "without them," says Mike Kelley of the Central California Almond Growers Association, "we're pretty much lost." In Canada, the total value of honeybee pollination is estimated at \$1.7 billion annually; south of the border, it's thought to be worth more than eight times as much.

This staggering contribution explains why when honeybees began to abandon their hives en masse several years ago, the world sat up and took notice. Credited with being the first to stumble upon the mysterious disappearing act, now known as Colony Collapse Disorder (CCD), Hackenberg jokes that he's been asked about his unwitting discovery so often, he ought to keep a recording on hand. But his emotion is still palpable as he recalls sensing something amiss with 400 colonies he was picking up from Florida in mid-November 2006. "I started jerking covers off, picking boxes up on end, and they were empty," he says. "People say I'm never lost for words, but you can ask my son [who was operating the forklift at the time]. I couldn't talk."

Nearly four years later, the scourge shows no signs of letting up. Though there is a lack of consensus about the cause and reach of CCD, it has become clear that it is only one of many factors taking a toll on honeybees, which continue to die in record numbers. We're only now beginning to



**Beekeeper David Hackenberg was among the first to witness Colony Collapse Disorder**

see the ripple effects of this tiny yet vital cog in our agricultural framework coming loose. Suddenly, the worst-case scenario—that we may one day find ourselves priced out of the fruits and vegetables we've come to take for granted—no longer seems so far-fetched. "It's basic supply and demand," says Almuhanad Melhim, a research associate at the University of Guelph who studies beekeeping economics. "If the cost of production increases, it's going to translate at the end to higher prices." Now, scientists, governments and industry are coming together to preserve one of nature's most significant money-makers. It's a tenuous coalition with a daunting task: to change the very way big agriculture does business.

**I**n many ways, the honeybee crisis can be understood as a balance sheet that no longer adds up. Though European honeybees (*Apis mellifera*) have been managed for millennia, the commodification of their primary function—transferring the pollen from one flowering plant to another—is a very modern phenomenon. The first known instance of pollination for hire occurred in a New Jersey apple orchard in 1909, but it wasn't until the 1980s, when disease virtually wiped out wild honeybees in North America and Europe, and urban sprawl greatly reduced native bee populations, that the practice became commonplace.

The sheer number of honeybees that have since been woven into the fabric of food production is astounding. According

to a paper published last year in the *Journal of Invertebrate Pathology*, nearly half of the 115 leading global food commodities now rely on this insect to set fruit or seeds. (This doesn't include big staples like corn and wheat, which are pollinated by the wind.) In Canada, about 380,000 hives—more than half the country's stock—are used to pollinate canola seed alone. Meanwhile, every February, half of the commercially managed hives in the U.S. are trucked to central California for what Reese Halter, author of *The Incomparable Honeybee*, referred to in an interview as "the biggest bee orgy on Planet Earth." In a few short weeks, some 1.5 million hives pollinate about 800,000 acres of almonds—80% of the world's supply.

Rising input costs and competition from the global marketplace have had a lot to do with the increasing need for bees. Since New Brunswick blueberry grower David Hatt first got into business in the mid-1980s, he says, his average per-acre production has more than doubled. "Now, if I don't have 2,000 pounds to the acre, I'm losing," he says. But more blueberries means exponentially more hives. "The more you open fields up and the more densely populated the fields get, there's fewer wild pollinators around," he says. "In order to get higher production, you definitely have to put honeybees in."





In Canada, the value of honeybee pollination is roughly \$1.7 billion per year. In the U.S., it's eight times as much



There has long been reason, however, to suspect that honeybees might one day have a difficult time keeping up with this demand. According to a recent study, over the past 50 years, there has been a 300% increase in crops that require animal pollination, yet global populations of managed honeybees have risen by only 45%. In the U.S., managed honey-producing colonies have tumbled by nearly two-thirds since peaking at 5.9 million in 1947. As University of Georgia entomologist Keith Delaplane put it during a recent presentation on the issue, "This defines the pollination dilemma: more work to be done, fewer workers to do it."

As with any other commodity, the ebb and flow of honeybees is directly tied to the bottom line. In the *Invertebrate Pathology* paper, Pennsylvania State University entomologist Dennis vanEngelsdorp notes that, in the U.S., there is a threshold of profitability (measured in the price of honey) that must be exceeded to trigger an increase in hive numbers—which, significantly, "has only been surpassed 16 times in the last 66 years." More than anything, what this shows is that beekeeping is very much on the margins. And after widespread honeybee losses, which have hovered at around 30% in the U.S. and Canada since 2006 (the most recent Canadian figures have yet to be released), the most immediate concern around meeting our pollination needs is one of dollars and cents. "To be honest," says Melhim, "we're talking about the disappearing of beekeepers more than we're talking about [the disappearing of] honeybees." As smaller operations fold, fewer commercial beekeepers are managing more colonies—

and shouldering more financial risk. "It's not very sustainable," says Jeff Pettis, head of the Beltsville, Md., Bee Research Laboratory of the U.S. Department of Agriculture (USDA). "We've got to find another way."

**I**f there were a simple solution to the bee problem, odds are Penn State would already have found it. One of the first institutions to begin seriously looking into the mysterious honeybee disappearances—Hackenberg called experts there when his bees started vanishing—Penn State has since become a sort of ground zero for CCD research. On top of nearly \$8 million in grants, almost a million dollars in private donations has poured in since 2007, much of it from those with a vested interest in saving the bees. (Häagen-Dasz, which credits bee pollination for half the flavours in its ice cream, has given the institution \$325,000 through its "Häagen-Dasz loves Honey Bees" campaign.)

Though early findings suggested that a single pathogen, called Israeli Acute Paralysis Virus (IAPV), may be responsible, hope of discovering a silver bullet has since faded away. Rather, says Penn State entomologist Diana Cox-Foster, CCD now appears to be the "cumulative effect" of one or more different

viruses, as well as a host of other stresses, including pesticides and poor nutrition. The disappearances themselves, meanwhile, are now understood as an act of altruism: "If an individual is sick," she says, "it will remove itself from a colony and go off to die." And IAPV and other viruses, previously thought to be exclusive to honeybees, have been identified in bumblebees, wasps and other orders of pollinators, suggesting these pathogens are contaminating the pollen of plants. "It means that it is not just our managed workhorses—it's also our native bees that are necessary for our environment that are potentially at risk here," she says.

The good news, however, is that the buzz about bees hasn't touched only Penn State. In July, the institution's recently established Center for Pollinator Research held a pioneering international conference on pollinator issues—an event that drew nearly 200 scientists, government officials and industry representatives. Welcoming his colleagues to what he called "the golden age of bee research," Swiss entomologist Peter Neumann urged them to take advantage of funding while it lasts.

Even with available funding, those leading the charge have their work cut out for them. Though the research into CCD and other ills plaguing honeybees is still ramping up (in Canada, where there have been no documented cases of CCD, experts have recently identified a virulent external

parasitic mite known as the varroa destructor as the primary cause of losses), the proposed fixes demand co-operation across sectors. "It's something every aspect of our agriculture [sector] has to consider if we want to have bees out there," says Paul Kelly, manager of the Honey Bee Research Centre at the University of Guelph. That, concedes R. Thomas Van Arsdall, who lobbies in Washington on behalf of the Pollinator Partnership, is the biggest challenge. "Everybody has a stake in it," he says. "The question is, what do you do about it, and how do you find solutions that don't result in gridlock?"

Under the current system, especially south of the border, where honeybees are trucked from one crop to the next, often feeding on large monoculture farms for weeks at a time, researchers have found that bees often aren't getting the nutrition they need. Silly though it may sound, honeybees are generalist foragers and require a variety

of pollens and nectars for a balanced diet. To address this concern, growers are being encouraged to increase crop diversity and leave hedgerows fallow. Meanwhile, when natural food sources are limited, beekeepers have begun feeding their charges a regimen of protein and sugar water. According to Florida-based beekeeper David Mendes, the adjustment, however pricey, "has made a huge difference in the health of my bees."

To take some of the stress off struggling honeybee populations, experts are also looking at ways to increase the role of native bees—of which there are an estimated 5,000 species in North America and 20,000 worldwide. "In a small-scale agriculture, native bees will serve as an insurance policy," says Laurence Packer, a wild-bee expert at York University who has developed the uncanny ability to grasp a bee between his forefinger and thumb in such a way that he neither kills it nor gets stung. "They can pick up some of that slack as long as the same things that are affecting the honeybees aren't affecting them." To encourage habitats where both honey and native bees can flourish, a pilot program, launched last year in California, offers a "Bee Friendly Farming" certification, which comes with stickers that growers can use to identify produce as such.

Many leading experts now suspect low-level pesticide exposure, especially the systemic variety found in an increasing number of crops currently blanketing farmland in the U.S. and Canada, as another underlying cause of CCD. In scanning the beehives for toxicity, researchers at Penn State identified up to 39 different pesticides per sample—a particularly disturbing finding considering the fact that mixing pesticides has been shown to raise the danger level significantly. In a poignant presentation, a researcher from the University of Nebraska compared the effect of multiple chemicals in bees to the drug interactions that can occur in humans, arguing that there's reason to suspect that pesticides may be reacting in harmful ways with each other, as well as with certain pollens and bee diseases.

All of which has been more than enough to prompt American beekeepers to take a vocal and passionate stand on the pesticide issue. (The call-in question period at the conference was all but hijacked by one unrelenting beekeeper who took the opportunity to grill a government regulator about his lack of action against chemical manufacturers.) But the suggestion that pesticides—products of a \$27-billion industry that's also vital to the success of farming—are killing bees has wide-reaching economic implications, making it tough to tackle. There is, however, evidence that the players are prepared to sit at the table: Bayer CropScience and Syngenta

helped sponsor the conference; during break time, representatives from chemical companies could often be found in the hall, engaging in conversation with beekeepers.

If efforts to protect pollinators are successful, it will be due, in large part, to the compelling economic argument. "The money speaks louder than the biology," says Van Arsdall, who successfully lobbied to include pollinator protection provisions in the 2008 Farm Bill. "Without the economics, we wouldn't have a chance." As a recent comparison in the U.K. found, it would cost the country \$2,570 million per year to fill the bee void with human pollinators (a practice already underway in one region of China, where workers pollinate pear trees by hand), compared with \$45 million per year to protect the natural order. But there may be other solutions, too. Earlier this year, the USDA announced that it had developed a self-pollinating almond tree that produces nuts that are just as tasty as those that are bee-pollinated—evidence, perhaps, of the imperative to keep the wheels of the agricultural economy turning, with or without the bees.

**T**he plight of the honeybee has captured the public imagination in a way that science rarely does—which Guelph's Paul Kelly describes as "the silver lining with the problems we're having." In New York City, hobbyists recently won their battle to remove honeybees from the "venomous insects" list, clearing the way for rooftop hives. Meanwhile, the White House has installed bee hives in its garden, and apiculturist classes everywhere are on the rise. There appears to be a popular acknowledgment of the urgency of the issue. Douglas Coupland's most recent novel, *Generation A*, envisions a world "in the near future" when "bees are extinct." "People can identify closely with bees," says the USDA's Jeff Pettis. "There's an attachment that the general public feels."

Despite his self-effacing nature, it's clear that Hackenberg takes a certain amount of cautious pride in having raised the profile of pollinator decline. "People tell me I've done more for the bee industry than anyone has in years. Well, I don't know about that," he says with a laugh. "I'm just a vocal s.o.b., basically." But while he continues to forward the cause, the 61-year-old's primary concern remains his bees, which, for the time being, appear to be doing quite well. As he opens one flourishing hive, bees literally spill out; he pulls out one of the frames to reveal a nice, healthy brood pattern and thick stores of honey. "You've gotta be optimistic in this business," he says. "Because if you ain't, you give up." ■

