

'Its body looked like a warzone.' Air pollution could kill off critical honey bees in India

By **Harini Barath** | Aug. 10, 2020 , 3:10 PM

Bees feel the sting of air pollution more acutely than we do. A 3-year study in India finds that even mildly dirty air could kill 80% of giant Asian honey bees, a key pollinator in South Asia. Without such bees and other insects, domestic production of fruit, vegetables, nuts, and legumes could be at risk, the team says.

"This is an important and timely study," says Olli Loukola, a behavioral ecologist at the University of Oulu who was not involved with the work. The findings, he says, are the first to document the impact of air pollution on insects, and they emphasize just how far-ranging the effects of human-caused pollution can be. "I think we have to be more worried."

Air pollution **claimed more than 1 million Indian lives** in 2015, and Indian cities regularly dominate global "worst polluted" lists. But India isn't just home to humans. The giant Asian honey bee (*Apis dorsata*) is a major pollinator in many Indian landscapes, including cities, where their large nests are sometimes spotted hanging off tall buildings. Indeed, the insects are thought to be critical for India's huge fruit and vegetable production; the country produced more than \$3 billion of fresh fruit in 2016, and it's the world's second largest producer of vegetables.

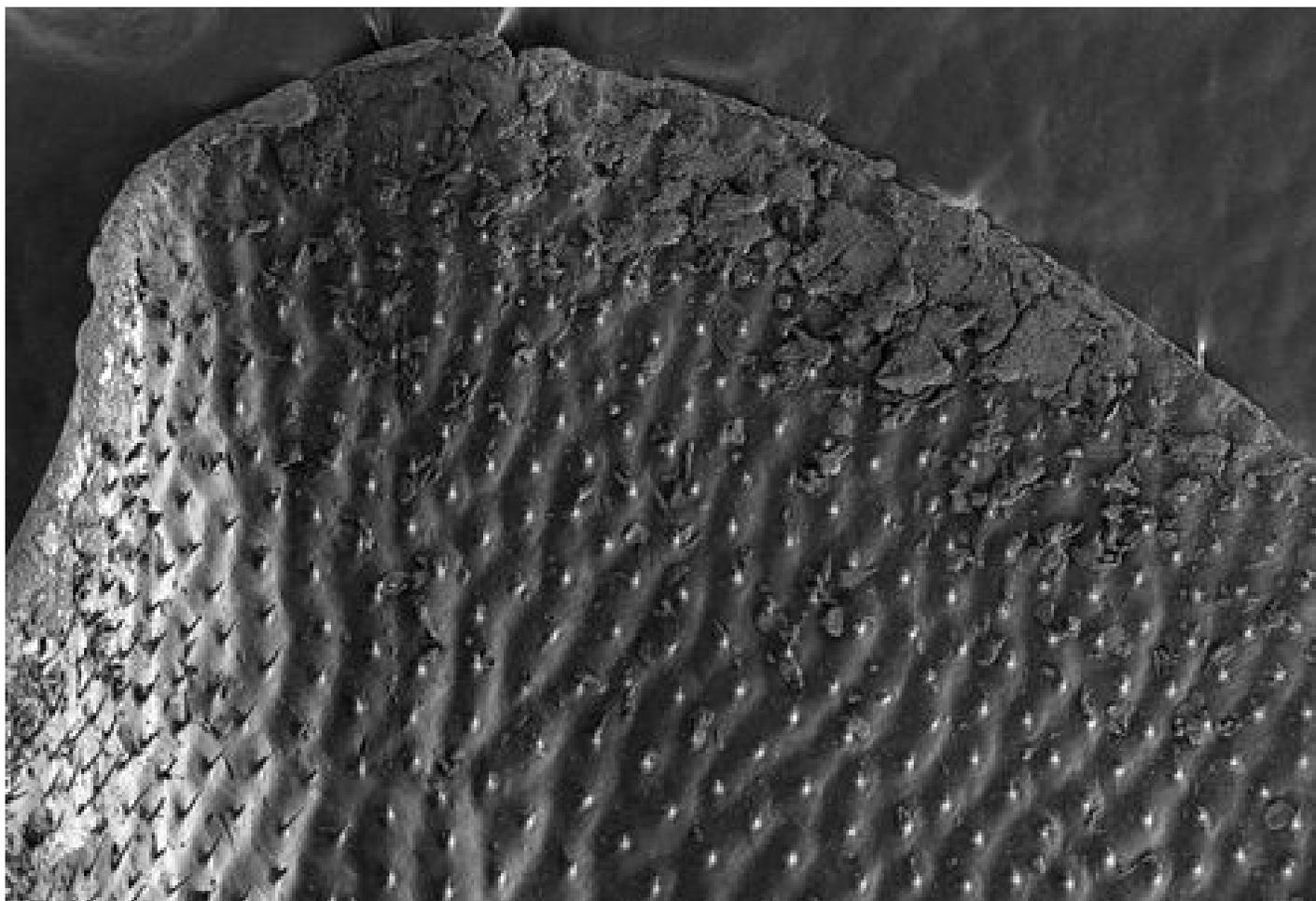
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About 4 years ago, ecologists at the National Centre for Biological Sciences, a research institute based in Bengaluru, India, began to wonder what impact India's massive pollution was having on these bees. Geetha Thimmegowda, a postdoc in Shannon Olsson's lab at the institute, collected honey bees in and around Bengaluru, **which has growing problems with air pollution**.

The researchers selected four sites across Bengaluru with air particulate levels smoke, soot, and dust ranging from healthy to dangerous. Thimmegowda netted the giant honey bees that visited yellow bell flowers, ubiquitous ornamentals that are a common source of nectar at every site. Working with collaborators, she assessed the physical condition of more than 1800 bees. "We examined their bodies inside and out," she says.



A giant Asian honey bee wing crusted with airborne dirt (upper edge) GEETHA THIMMEGOWDA

Early in the process, Thimmegowda compared specimens from two sites—one from the verdant campus where she works and another from Peenya, one of Asia’s largest industrial areas about 7 kilometers away—under a scanning electron microscope. Some of the bees from Peenya were in very bad shape, Olsson says. One “was covered with all sorts of crud and particles,” she says. “Its body looked like a warzone.”

Overall, bees collected at more polluted sites were far more likely to be flecked with particulate matter containing toxic heavy metals such as arsenic and lead, the team reports today in the *Proceedings of the National Academy of Sciences*. **Four out of five bees collected from the most polluted areas died within 1 day of collection**—twice as many as those collected from the campus areas. In addition, bees covered in toxic dust visited flowers only half as many times as their campus cousins, potentially reducing the chances of successful pollination.

Bees that lived in polluted areas also tended to have irregular heartbeats (a sign of poor cardiac health) and lower levels of blood cells (a sign of a compromised immune system). Air pollution also caused increased expression of genes linked to immunity and stress, which in turn could shorten their life span, the researchers say. Lab-reared fruit flies exposed to the same toxic air for 10 days exhibited similar symptoms.

The study is the first to provide comprehensive evidence that insects are especially sensitive to particulate matter in the air, Loukola says. And that could be bad news for crops that depend heavily on pollinators. By one estimate, **53% of mangoes would disappear** without insect pollinators, which would cost India about \$86 million in exports alone.