

One large organic shade-grown coffee, please -- with extra bats

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A big-eared bat of the genus *Micronycteris*. Bats of this genus are found in Mexican coffee plantations, where they glean insects from foliage and help limit pest populations. Credit: Merlin D. Tuttle, Bat Conservation International

If you get a chance to sip some shade-grown Mexican organic coffee, please pause a moment to thank the bats that helped make it possible. At Mexican organic coffee plantations, where pesticides are banned, bats and birds work night and day to control insect pests that might otherwise munch the crop.

Until now, the birds got nearly all the credit. But a new study from University of Michigan researchers shows that during the summer wet season, bats devour more bugs than the birds at Finca Irlanda, a 740-acre organic coffee plantation in Chiapas, Mexico.

And they often do it using a "perch and wait" hunting technique that is proving to be far more

common than bat researchers had believed. A report on the study appears in Friday's edition of the journal *Science*.

At a time when bat populations are declining worldwide, this new-found benefit to organic coffee farmers is another example of how these much-maligned mammals provide ecological services that go largely unnoticed. In addition to aiding agriculture, bats pollinate wild plants, disperse fruit seeds, and gorge on pesky mosquitoes by the ton.

"Bats are impacting ecological systems in all kinds of ways, and I just want them to get the credit they deserve," said Kimberly Williams-Guille, a tropical ecologist and a postdoctoral fellow at the U-M School of Natural Resources and Environment.

The bat's role in controlling coffee-eating insects has been overlooked for two reasons, Williams-Guille said. The first involves a flaw in the design of "exclosure" experiments used to study the impacts of various animals on coffee plants.

In previous experiments, the exclosures---simply net-covered wood-and-plastic frameworks---were placed over coffee bushes around-the-clock. After several days, scientists counted the insects on the protected plants and compared the tally to totals from nearby unprotected plants. The protected plants usually had higher pest counts, and birds generally received the credit.

But because the netting remained in place day and night, bats also had been excluded, Williams-Guille said. And their impact went unnoticed.

To determine the relative contributions of birds and bats at the Finca Irlanda plantation, Williams-Guille and her U-M colleagues established four types of exclosures: birds-only excluded during the day, bats-only excluded at night, both excluded day and night, and control plants with no netting.

They found that during the summer wet season, the bat-only exclosures resulted in an 84 percent increase in the density of insects, spiders, harvestmen and mites---exceeding the impact of birds.

Williams-Guille?n's co-authors on the *Science* paper are Ivette Perfecto of the U-M School of Natural Resources and Environment and John Vandermeer of the U-M Department of Ecology and Evolutionary Biology.

The second reason the bat's contribution to coffee-plantation pest control had been overlooked has to do with hunting techniques.

Bats are well known for a foraging strategy called aerial hawking, which involves fluttering through the night sky, zeroing in on prey using echolocation, and gulping countless flying bugs. A bat can eat half its body weight in a single night using this technique.

But many of the bats at the Chiapas plantation---about 45 species have been recorded there so far---rely largely on an approach called foliage gleaning. They patiently "perch and wait" in the tree canopy above the coffee bushes, inverted and clutching a branch with their feet, sometimes for hours at a stretch. Their large, pointy ears listen intently for the sounds of insects chewing, crawling across leaves, or chirping.

Then they swoop down and snatch the bug off the leaf or stem.

"People had believed that all the bats were flying around in mid-air and taking mosquitoes and moths," Williams-Guille?n said. "And if that's all they were going for, then you wouldn't expect them to have an effect on insects that were just hanging around on the plants," such as katydids and leaf-eating beetles.

"But it turns out that foraging modes in bats are much more diverse than people had thought," she said. More than 200 species of insects feed on, or can otherwise damage, coffee plants.

Source: University of Michigan

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