

With climate change, US could face risk from Chagas disease

March 15 2012



A close look at kissing bugs revealed to University of Vermont biologist Lori Stevens that a surprising number of them feast on people. Her new study, published by the US Centers for Disease Control, shows that the bugs might bring a little-known -- but dangerous -- tropical disease north into the US. Credit: Joshua Brown, 2012

In the spring of 1835, Charles Darwin was bitten in Argentina by a "great wingless black bug," he wrote in his diary.

"It is most disgusting to feel soft wingless insects, about an inch long, crawling over one's body," Darwin wrote, "before sucking they are quite thin, but afterwards round & bloated with blood."

In all likelihood, Darwin's nighttime visitor was a member of Reduviid family of insects — the so-called [kissing bugs](#) because of their habit of

biting people around the mouth while they sleep.

From this attack, some infectious disease experts have speculated, the famed naturalist might have contracted [Chagas disease](#), a parasite-borne illness carried by kissing bugs, that today afflicts millions of people in Central and South America. Darwin's bite may have led, ultimately, to his death from heart problems.

This hypothesis has been contested for decades, but if Darwin had experienced this bug attack in the United States, no one would have made such a speculation, since Chagas disease is almost unheard of in the U.S.

That could change, new research shows.

Lori Stevens, a biologist at the University of Vermont, and her colleagues, found that 38 percent of the kissing bugs they collected in Arizona and California contained human blood.

This upends the previous understanding of insect experts and doctors that the eleven species of kissing bugs that occur in the US don't regularly feed on people.

"This finding was totally unexpected," says Dr. Stephen Klotz, head of the infectious diseases department at the University of Arizona medical school and a co-author on the study.

And more than 50 percent of the bugs the research team collected also carried *Trypanosoma cruzi*, the parasite that causes Chagas disease.

Their study is reported in the March 14 online edition of the journal [Emerging Infectious Diseases](#).

"The basic message is that the bug is out there, and it's feeding on humans, and carries the parasite," says Stevens, "so there may be greater potential for humans to have the disease in the United States than previously thought."

So far, little of that potential has been realized. Only seven cases of Chagas disease transmitted by kissing bugs have been documented in the United States.

"We think the actual transmission is higher than the seven cases we have identified," says Patricia Dorn, an expert on Chagas disease at Loyola University and co-author on the new study, "but, even with these findings, we think the transmission of Chagas — of the *T. cruzi* parasite — is still very low in the US."

But with a warming climate that rate might rise.

Dorn and Klotz both emphasize that risk of severe allergic reactions to the bug's saliva is currently a greater problem than contracting Chagas disease. The team hopes their new work will "raise awareness among physicians and health care workers," Dorn says, about the risks of both allergic reactions and Chagas disease from kissing bugs.

"Chagas is a cryptic disease. It doesn't announce itself," says UVM's Lori Stevens. The parasite can trigger an acute phase of the disease that may have no symptoms or may include fever, swelling of one eye, swelling around the bite and general ill feelings. In other words, it can look like many other minor illnesses.

Then the disease often goes into remission, only to appear years later as much more serious illness, including life-threatening digestive and heart problems. Some eight to ten million people in Mexico, Central America and South America have Chagas disease — making it the "most

infectious parasitical disease in the Americas," Stevens says. But it is one of world's most neglected tropical diseases, mostly affecting the rural poor, and little studied compared to other major diseases.

It's not fully clear why Chagas disease hasn't established itself in the United States. "There are two leading theories," Klotz says. One is that housing stock in Central America is different than in the United States. There, thatched roofs, stick and mud construction and dirt floors provide good habitat for local kissing bug species. In contrast, U.S. houses tend to have concrete basements, screened doors and windows, and tighter construction.

The other reason may have to do with the bathroom behavior of different species of kissing bugs. "We like to joke the bugs have better manners in the U.S.," says Dorn. The primary method of transmitting the disease is through the insect's feces. The species that have made Chagas endemic to Central and South America tend to defecate while they are having their blood meal.

This fecal matter can then enter the bite wound or mucus membranes easily, transmitting *T. cruzi* parasite to the blood stream. In contrast, North American species "tend to feed, leave the host, and then defecate later," says Dorn, lowering the risk of transmission.

But could those more-dangerous kissing bug species move north as the climate warms?

"Absolutely," says Dorn.

"We know the bugs are already across the bottom two-thirds of the U.S., so the bugs are here, the parasites are here. Very likely with climate change they will shift further north and the range of some species will extend," she says.

This problem may be compounded by increasing numbers of houses in the U.S. being built in remote areas — such as the mountainous areas around southwest cities like Tucson and San Diego — "places inhabited by packrats, for example, that are the natural hosts of these bugs," says Klotz.

"The bugs are attracted by the lights at night," Klotz says. "They'll crawl under a door and once they are there, they are such incredible parasitical bugs — they'll come find you or your pets."

But prevention is fairly easy, Stevens says. "If you're camping, make sure you close in spaces at night," she says. "In Vermont, it's not such a big deal, but in Arizona, if you sleep with the windows open, you need to put screens in. If you take precautions to keep the bugs out, you can prevent getting the infection quite easily," she says.

Stevens and her team were able to make these findings with a novel technique for identifying DNA from any vertebrate animal, including human, — that they found in the bugs' abdomens.

First Klotz and others collected the bugs. Then Dorn, and her students at Loyola, chopped off the distal end of their abdomens and extracted all the types of DNA, she says. Then they amplified "the parasite DNA out of the whole mess of DNA -- including the bug's, what they've been feeding on and the parasite's," Dorn says.

This allowed the team to know which of the insects were carrying the parasite.

Then this total-DNA package was shipped to Vermont, where Stevens, a professor in the biology department, and her students, developed a new technique to amplify and clone the DNA of the insect's blood meals.

"If the bug fed on humans three months ago, the DNA is pretty degraded by the time you try to detect it," says Dorn. But with a novel application of certain primers, the UVM team was able to detect any vertebrate DNA present in the bug's abdomen -- even short strands of human DNA, including one case where they were able to show that one of the bugs had fed on two different humans.

The method is expensive and labor intensive, which is why the new study only presents results from thirteen insects, but the method "may be especially useful for detecting unpredicted blood meal sources and multiple blood meals," the researchers write.

Now the team would like to look at a larger sample of kissing bugs from more areas of the United States.

"Chagas isn't going to spread fast," says Stevens, "but it could spread. Finding out how prevalent it is now would be a good idea."

Provided by University of Vermont

Citation: With climate change, US could face risk from Chagas disease (2012, March 15)
retrieved 24 April 2024 from

<https://medicalxpress.com/news/2012-03-climate-chagas-disease.html>

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