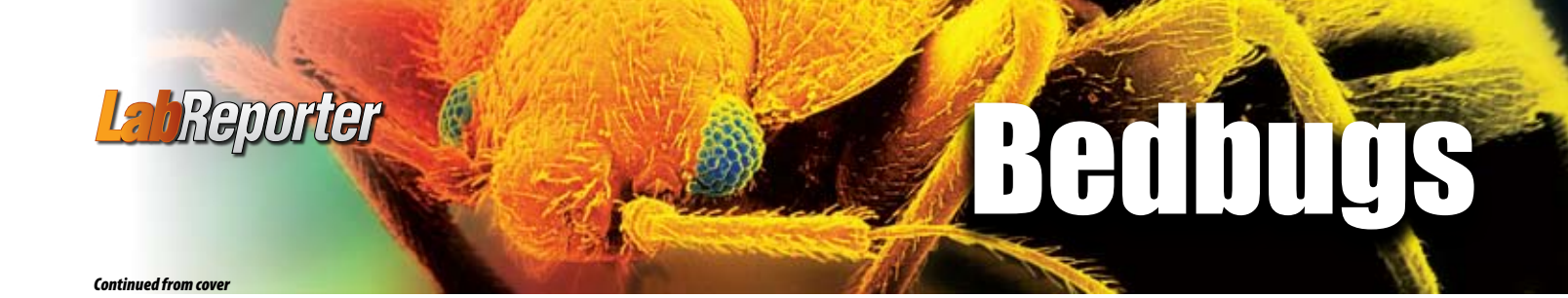

Bedbugs

Continued from cover

A group of entomologists at Ohio State University has conducted the first genetic study of bedbugs with the hope of identifying how the tiny insect is pesticide-resistant and uncovering new control methods to decrease their ever-increasing numbers.

Bedbugs, or *Cimex lectularius*, have been around for centuries. In the 1940s exterminators widely used DDT to control the population; however, since DDT is no longer used, the number of bedbugs has soared in the past decade by 100 to 500 percent in North America, Europe, east Asia and Australia, according to a published report in the Public Library of Science journal *PLoS ONE* and covered by **www.msnbc.com**. These bloodsucking bugs do not transmit any serious diseases, but they can leave a rash and an itchy bump. Once they are finished with their meal, they hide in dark crevices for up to six months, digesting their meal – making them extremely difficult to remove.

Several hypotheses have been proposed to understand the increased numbers, including a rise in international travel, more people exchanging used, bug-infested furniture and clothing, using more specific and selective control tactics as opposed to broad-spectrum insecticides, and pesticide resistance within the insect. According to the **msnbc.com** article, most cases seem to come from multi-unit apartment complexes.

Research Findings

Omprakash Mittapalli, corresponding author of the study and assistant professor of entomology with the university's Ohio Agricultural Research and Development Center in Wooster said, "The common assumption today is that pesticide resistance in bedbugs results from point mutations in certain genes. However, the role of detoxification and antioxidant enzymes in pesticide resistance of bedbugs is poorly understood. Enzymes such as Cytochrome P450s and glutathione S-transferases (GSTs) have been shown in other insects to act as detoxification agents, allowing the insects to get rid of toxic compounds such as insecticides and not be killed by them. Our study looked closely at those groups of enzymes in bedbugs."

According to a *Science Daily* article that covered Mittapalli's findings, the researchers examined the RNA of "both laboratory-reared bedbugs that are susceptible to insecticides (the Harlan strain) and pesticide-exposed bedbugs collected from a Columbus, OH apartment in 2009 and 2010."

Their analysis identified 35,646 expressed sequence tags (ESTs), which aid in gene discovery and sequencing work, 17 times more information than had previously been recorded. Researchers expect the new findings will advance additional genetic studies of the insect.

In addition to the bedbug genes, the researchers also examined and compared the genes of other pests, discovering that the bedbug is closely related to lice and aphids. However, they identified 44 genes that are specific to the bedbug, and with more research, it could be these genes that might be involved in the resistance.

Mittapalli and his team did discover differences in gene expression between a normal lab strain of bedbug, which hadn't been exposed to insecticides, and a pesticide-resistant strain from the apartment in Ohio. "From the database we created, we profiled the transcript level for a cytochrome P450 (CYP9) and a GST (Delta-epsilon) in different developmental stages (early-stage nymphs, late-stage nymphs and adults) of pesticide-susceptible and pesticide-exposed bedbugs," Mittapalli said. "We found higher transcript levels for CYP9 in all developmental stages in pesticide-exposed populations compared to pesticide-susceptible populations. We also found higher transcript levels of Delta-epsilon in the late-instar nymphs of pesticide-exposed bedbug populations."

The Future of the Resistance

Further studies, including gene silencing, are still needed; however, this study revealed that bedbugs are "much more complex than we thought, according to Mittapalli. "The insecticides being used right now are based on the idea that resistance in bedbugs is caused by point mutations in genes. But we are finding out that the mode of resistance could be attributed to a combination of changes in the bug's genetic makeup (such as mutations) as well as transcriptomic adjustments leading to differential gene expression. Pinpointing such defense mechanisms and the associated genes could lead to the development of novel methods of control that are more effective."

Facts about Bedbugs

- Bedbugs are small bloodsucking insects that feed on humans and other warm-blooded animals
- Bedbugs often hide in mattresses but they can also survive in furniture, behind wall coverings and pictures/paintings; they will crawl and nest inside tiny crevices anywhere indoors, as long as there is a source of food (blood)
- While bedbugs do not transmit any pathogens or diseases, their bites usually result in swollen red, itchy welts
- Bedbugs are typically nocturnal insects
- There are other types of bedbugs including the bat bug, the chimney swift bug and the swallow bug; all of which survive on blood feeding; however, the secondary parasites thrive on either bats or birds as their primary victims
- Small reddish or brownish spots on one's linens are often the first sign of an infestation; another sign is swelling at the bite site
- Bedbugs are not necessarily a sign of unkempt/dirty homes or buildings
- A female bedbug can lay as many as 500 eggs during her lifetime
- Bedbugs are less than a quarter inch in length, flat and oval-shaped — a bit like a sunflower seed
- Bedbugs can go up to a year without a blood meal
- A bedbug's saliva features an anesthetic to numb the pain as it bites; it also contains anti-coagulant to keep the blood of its meal host flowing

By: Gwen Myslinski

Sources

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