From: Jeffrey Epstein <jeevacation@gmail.com>
To: "[redacted]" <[redacted]>
Cc: Martin Nowak <[redacted]>
Subject: Re: also neat, bugs smarter and better at code breaking (attached article)
Date: Wed, 30 Dec 2009 06:11:41 +0000

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terrific..

On Wed, Dec 30, 2009 at 1:09 AM, <[redacted]> wrote:

Code-Breaking Insects Steal Plants' Defensive Signals, Enabling Counterattack

Herbivorous insects that dine on crops use a form of molecular code-breaking to ready their defenses against a chemically protective shield employed by their dinner, say scientists at the University of Illinois at Urbana-Champaign.

"It's a cloak-and-dagger world out there in the fields," said co-author May Berenbaum, the head of the entomology department at Illinois.
When insects attack, many plants activate a cascading signal of jasmonate or salicylate, molecules that promote biosynthesis of toxic allelochemicals that can act both as poisons for herbivores and as attractants for natural enemies of the insects. By recognizing the signaling molecules, earworm caterpillars produce detoxifying enzymes, including cytochrome P450 proteins similar to those in the human liver that neutralize toxins.
"Jasmonic acid to the plant is like a Paul Revere running around shouting, "The British are coming, the British are coming," getting everybody in Boston to grab guns and call for reinforcements," Berenbaum said. "With this early warning signal, the caterpillars can activate their detox systems ahead of time for whatever the plant mobilizes."
In a series of experiments, entomology doctoral student Xianchun Li fed experimental diets containing jasmonate and salicylate to fifth instars -- the oldest caterpillar stage that causes the largest amount of crop damage. Examining the midgut and fatbody, where detoxifying chemicals are produced, Li found almost eightfold increases of P450 compared with caterpillars fed a control diet. At least one of the induced P450s is known to mediate the breakdown of specific toxins turned on in the plant by jasmonate.
The researchers found that the earwormsÕ ability to mount its own defenses begins with exposure to very low levels of jasmonate and salicylate. The exposure of earlier stage caterpillars to the molecules also triggers a response before they begin feasting. Exposure at the penultimate larval stage to these signaling molecules prepares the ultimate larval stage to handle elevated amounts of defense compounds produced by the plant in response to insect damage.
"Our data provide direct evidence that H. zea can intercept the plant defense signals elicited by its own feeding activity," the researchers wrote. Additionally, they noted, "the signal-eavesdropping capability provides H. zea with prophylactic protection against plant defenses at no additional cost to fitness in the absence of plant defenses."
There has been a lot of attention focused on how plants anticipate what insects are going to do, Berenbaum said. "This study shows that plants may have won some battles but the outcome of the war has not been determined. It's really an ongoing interaction."
The findings may have implications for pest-control strategies for the some 100 different plants the earworms feed on. Some researchers at other universities have proposed spraying plants with jasmonic acid to turn on plant defense systems before insects damage them. University of California researchers recently found that spraying the chemical on tomato plants indeed increased parasitism of beet army worms, prompting the idea that such a practice could reduce crop losses. "Pouring on jasmonic acid might not be ideal under some circumstances, if it turns out that jasmonic acid also cranks up insect detoxification systems," Berenbaum said.

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