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An Army of Ant Genomes

by Sara Reardon on 31 January 2011, 3:01 PM | Permanent Link | 0 Comments

Whether you think of them as paragons of industry or picnic-crashing pests, ants are an inseparable part of our lives. Apparently, researchers think so, too; two scientific journals are crawling with newly sequenced ant genomes, providing information about everything from how ant social systems work to how to keep them out of our kitchens. Three papers published in the *Proceedings of the National Academy of Sciences* today describe the genome sequences of the fire ant, Argentine ant, and harvester ant, and a fourth, to be published in *PLoS Genetics* next month, will describe the leaf ant.

ENLARGE IMAGE

Swarm of information. Researchers have sequenced the genomes of the fire ant (*top*), harvester ant (*lower left*), and Argentine ant (*lower right*), revealing how genetics influence ant society and evolution.

Credit: (top, fire ant) Johnny N. Dell/Bugwood.org; (bottom left, red harvester, and bottom right, Argentine ant) www.alexanderwild.com

These four ant species are interesting for their relevance to human society, says biologist Christopher Smith of San Francisco State University in California, who contributed to three of the four genome sequences. The fire ant and Argentine ant are invasive species in the United States that disrupt ecosystems and harm crops, and the fire ant's sting can cause anaphylactic shock in both humans and livestock. Companies and governments have long searched for ways to control the pests without using environmentally toxic pesticides, and Smith says that the genomes will help reveal how to use the ants' natural behavior, particularly their reliance on odors, against them.

"Ants live in a little chemical world," says evolutionary biologist Neil Tsutsui of the University of California, Berkeley, who led the Argentinean ant study. They use their sense of taste and smell for everything from trail navigation to socialization. The researchers identified a surprisingly large number of genes used for recognizing these chemical signals. The Argentine ant, for example, has 367 genes for odor receptors—twice as many as the honeybee. Identifying the biological chemicals that ants use to recognize their friends and enemies, Tsutsui says, might make it possible to spray a nest with these naturally occurring chemicals and trick the ants into thinking that they've been invaded. That could provoke a civil war, eliminating the need to kill the insects with pesticides.

Another way to control ant pests, Smith says, would be to interfere with their strict caste system of workers and a queen. The harvester and fire ant genomes revealed for the first time that ants have genes similar to those that honeybees use to produce a "royal jelly" that they feed to one privileged larva, designating her as a queen.

Finding a way to destroy this jelly would keep the ants from reproducing.

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The genomes also revealed that adding or removing chemical tags called methyl groups to or from a handful of genes to turn them off or on determines an ant's fate in the social ladder. In bees, royal jelly and other environmental factors play a role in making these "epigenetic" modifications, and it is likely that the same holds true in ants. Some of the genes that appear to be controlled this way include the genes for wings and reproduction—perks that only a fat, long-lived queen would get. "This is why I'm so excited about ants," says Smith. "They take one genome and read it in different ways to create different forms."

Sifting through the masses of data in the ant genomes will be no picnic, but the researchers have a good head start, thanks to the low cost, speed, and high quality of the genome-sequencing technology they used.

The papers are "a landmark event," says entomologist Gene Robinson of the University of Illinois, Urbana-Champaign, who led the group that sequenced the honeybee genome. "It's the beginning of an era where we'll be seeing many genomes from related species coming out together."

The researchers next plan to compare the various ant genomes to study how the invasive species have diverged from their native counterparts and whether pesticides like DDT could have accelerated ant evolution.

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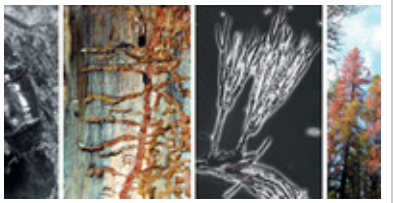

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