

Diseases can rapidly evolve to become more—or less—virulent, according to songbird study

May 28 2013

A novel disease in songbirds has rapidly evolved to become more harmful to its host on at least two separate occasions in just two decades, according to a new study. The research provides a real-life model to help understand how diseases that threaten humans can be expected to change in virulence as they emerge.

"Everybody who's had the flu has probably wondered at some point, 'Why do I feel so bad?'" said Dana Hawley of Virginia Tech, the lead author of the study to be published in *PLOS Biology* on May 28, 2013. "That's what we're studying: Why do pathogens cause harm to the very hosts they depend on? And why are some life-threatening, while others only give you the sniffles?"

Disease virulence is something of a paradox. In order to spread, [viruses and bacteria](#) have to reproduce in great numbers. But as their numbers increase inside a host's body, the host gets more and more ill. So a highly [virulent disease](#) runs the risk of killing or debilitating its hosts before they get a chance to pass the bug along. It finds the right balance through evolution, and the new study shows it can happen in just a few years.

Hawley and her coauthors studied House Finch [eye disease](#), a form of [conjunctivitis](#), or pinkeye, caused by the bacteria *Mycoplasma gallisepticum*. It first appeared around Washington, D.C., in the 1990s. The House Finch is native to the Southwest but has spread to towns and

backyards across North America. The bacteria is not harmful to humans, which makes it a good model for studying the evolution of dangerous diseases such as [SARS](#), [Ebola](#), and [avian flu](#).

"There's an expectation that a very virulent disease like this one will become milder over time, to improve its ability to spread. Otherwise, it just kills the host and that's the end of it for the organism," said André Dhondt, director of Bird Population Studies at the [Cornell Lab of Ornithology](#) and a coauthor of the study. "House Finch eye disease gave us an opportunity to test this—and we were surprised to see it actually become worse rather than milder."

The researchers used frozen bacterial samples taken from sick birds in California and the Eastern Seaboard at five dates between 1994 and 2010, as the pathogen was evolving and spreading. The samples came from an archive maintained by coauthor David Ley of North Carolina State University, who first isolated and identified the causative organism. The team experimentally infected wild-caught House Finches, allowing them to measure how sick the birds got with each sample. They kept the birds in cages as they fell ill and then recovered (none of the birds died from the disease).

Contrary to expectations, they found that in both regions the disease had evolved to become more virulent over time. Birds exposed to later disease strains developed more swollen eyes that took longer to heal. In another intriguing finding, it was a less-virulent strain that spread westward across the continent. Once established in California, the bacteria again began evolving higher [virulence](#).

In evolutionary terms, some strains of the bacteria were better adapted to spreading across the continent, while others were more suited to becoming established in one spot. "For the disease to disperse westward, a sick bird has to fly a little farther, and survive for longer, to pass on the

infection. That will select for strains that make the birds less sick," Hawley said. "But when it gets established in a new location, there are lots of other potential hosts, especially around bird feeders. It can evolve toward being a nastier illness because it's getting transmitted more quickly."

House Finch eye disease was first observed in 1994 when bird watchers reported birds with weepy, inflamed eyes to Project FeederWatch, a citizen science study run by the Cornell Lab. Though the disease does not kill birds directly, it weakens them and makes them easy targets for predators. The [disease](#) quickly spread south along the Eastern Seaboard, north and west across the Great Plains, and down the West Coast. By 1998 the House Finch population in the eastern United States had dropped by half—a loss of an estimated 40 million [birds](#).

More information: Bird watchers can do their part to help House Finches and other backyard birds by washing their feeders in a 10 percent bleach solution twice a month. More tips for bird feeder maintenance can be found at www.allaboutbirds.org/clean-feeders

Provided by Cornell University

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