

Lethal fungus that causes white-nose syndrome may have an Achilles' heel

Date: January 2, 2018

Source: USDA Forest Service - Northern Research Station

Summary: In the course of genomic analyses of the fungus behind white-nose-syndrome, a devastating disease that has killed millions of bats in North America, US Forest Service scientists discovered something very surprising: brief exposure to UV-light kills *Pseudogymnoascus destructans*.

FULL STORY



Scientists with the USDA Forest Service and the University of New Hampshire have found what may be an Achilles' heel in the fungus that causes white-nose syndrome: UV-light. White-nose syndrome has killed millions of bats in North America over the past decade.

Credit: Daniel Lindner, USDA Forest Service

The fungus behind white-nose syndrome, a disease that has ravaged bat populations in North America, may have an Achilles' heel: UV light. White-nose syndrome has spread steadily for the past decade and is caused by the fungus *Pseudogymnoascus destructans*, known as *P. destructans* or *Pd*.

In the course of genomic analyses of *P. destructans*, a team of scientists from the U.S. Forest Service, U.S. Department of Agriculture and the University of New Hampshire found that the fungus is highly sensitive to UV light. *P. destructans* can only infect bats during hibernation because it has a strict temperature growth range of about 39-68 degrees Fahrenheit. However, treating bats for the disease during hibernation is challenging, so any weakness of the fungus may be good news to managers trying to develop treatment strategies.

In a study published on Jan. 2 in the journal *Nature Communications* titled "Extreme sensitivity to ultra-violet light in the fungal pathogen causing white-nose syndrome of bats," the research team suggests that *P. destructans* is likely a true fungal pathogen of bats that evolved alongside bat species in Europe and Asia for millions of years, allowing Eurasian bats to develop defenses against it. In the course of comparing *P. destructans* to six closely

related non-pathogenic fungi, researchers discovered that *P. destructans* is unable to repair DNA damage caused by UV light, which could lead to novel treatments for the disease. The study was funded by the U.S. Fish and Wildlife Service.

"This research has tremendous implications for bats and people," said Tony Ferguson, Director of the Forest Service's Northern Research Station and the Forest Products Laboratory. "Bats play a key role in the health of forests as well as the production of food in the United States, and developing an array of tools with which we can treat bats for white-nose syndrome is important to preserving these very important species."

The research team generated annotated genomes for *P. destructans* as well as six non-pathogenic *Pseudogymnoascus* species in an effort to gain insight into the origins and adaptations of the fungal pathogen of WNS. Using comparative genomics, the research team noticed that *P. destructans* lacked a key DNA repair enzyme, prompting them to expose the fungi to DNA damaging agents, including different wavelengths and intensities of UV light. They found that a low dose exposure of UV-C light resulted in about 15 percent survival of *P. destructans* while a moderate dose exposure resulted in less than 1 percent survival. These values translate to only a few seconds of exposure from a hand-held UV-C light source.

"It is unusual that *P. destructans* appears to be unable to repair damage caused by UV-light," said Jon Palmer, a research botanist in the Northern Research Station's lab in Madison, Wis., and the lead author of the study. "Most organisms that have been found in the absence of light maintain the ability to repair DNA caused by UV light radiation. We are very hopeful that the fungus' extreme vulnerability to UV light can be exploited to manage the disease and save bats."

Research on potential treatment using UV light is under way. Daniel Lindner, a research plant pathologist with the Northern Research Station in Madison and the corresponding author on the study, is leading follow-up research to determine if UV-light can be used as a treatment for bats suffering from white-nose syndrome. The study will measure the survival of little brown bats during hibernation after being treated with UV-light compared to control groups. The researchers are also exploring whether there are any non-target effects by measuring changes in the bat skin microbiome (both fungal and bacterial communities). The study, which is funded by a grant from the National Fish and Wildlife Foundation, Bats for the Future Fund began late last year.

Co-authors on the study include Kevin P. Drees and Jeffery T. Foster of the University of New Hampshire.

Story Source:

Materials provided by **USDA Forest Service - Northern Research Station**. Note: Content may be edited for style and length.

Journal Reference:

1. Jonathan M. Palmer, Kevin P. Drees, Jeffery T. Foster, Daniel L. Lindner. **Extreme sensitivity to ultraviolet light in the fungal pathogen causing white-nose syndrome of bats**. *Nature Communications*, 2018; 9 (1)
DOI: 10.1038/s41467-017-02441-z

Cite This Page:

MLA

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USDA Forest Service - Northern Research Station. "Lethal fungus that causes white-nose syndrome may have an Achilles' heel." ScienceDaily. ScienceDaily, 2 January 2018.

<www.sciencedaily.com/releases/2018/01/180102153209.htm>.

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