Banana-preserving bacteria show promise against bat-killing fungus

Since White Nose Syndrome began decimating bat colonies in New England in 2006, most of the news coming out of bat caves in the U.S. hasn't been good. To date, as many as 6 million bats in 26 states have died as a result of infection. But a new trial pitting a particular soil bacterium against White Nose is providing a glimmer of hope in the fight to slow the disease's devastating march across the country.

White Nose Syndrome is caused by a fungus called *Pseudogymnoascus destructans*, which thrives in the cold, damp conditions often found in caves and crevices where bats hibernate during winter. As the fungus grows on bats' faces, wings and bodies, it inhibits the creatures' ability to mitigate dehydration and maintain body temperature during hibernation. In infected hibernacula, mortality rates typically range between about 80 and 100 percent.

In the past few years, a number of groups have been searching for biological or chemical agents that might combat the fungus without further harming bats or damaging the often delicate ecology of caves. A potential breakthrough recently put to the test began, oddly enough, with bananas.

Sybill Amelon of the U.S. Forest Service releases one of the bats treated for White Nose Syndrome back into the wild in May.
Credit: Katie Gillies, Bat Conservation International

"Originally, we were looking for bacteria that would help delay the ripening of fruits and vegetables," says Chris Cornelison, a microbiologist at Georgia State University and the lead researcher behind the new efforts to counter White Nose Syndrome. In experimental trials, Cornelison and colleagues noticed that bananas exposed to the bacterium *Rhodococcus rhodochrous*, which occurs naturally in soils, had a lower fungal burden than untreated bananas.

"I had seen news reports about White Nose Syndrome, and the idea came to me that if *Rhodococcus* could prevent mold from growing on bananas, maybe it could also prevent mold from growing on bats," he says.

After testing to ensure that the *Rhodococcus* bacterium wasn't harmful to bats, Cornelison, along with Sybill Amelon and Daniel Lindner, both with the U.S. Forest Service, captured roughly 150 infected bats from cave sites in Missouri and Kentucky last fall as the animals returned to their hibernacula. In the treatment, the bats — after entering hibernation on their own — were hung in small mesh bags inside picnic basket-sized coolers containing bacteria-filled petri dishes for 48 hours.

"One of the best features of this bacterium is that the bats don't need to come into direct contact with it to be treated," Cornelison says. That's because *Rhodococcus* produces a vapor of organic compounds, which disperse into the air and appear to inhibit growth of *P. destructans*.

After treatment, the hibernating experimental bats were returned to their caves and held inside protective mesh bags so that they could be monitored throughout the winter. Then, in

A tri-colored bat afflicted with White Nose Syndrome hibernates in a cave in Cumberland Gap National Historic Park.
Credit: National Park Service

April, the animals were brought back to the lab and assessed for body mass index, fungal burden and damage to the wings. Most of the infected bats had still sustained damage from the fungus, Cornelison says. But "some that survived were heavily infected before treatment and probably would have died without treatment."

Many of the bats needed time to recover from the wing damage, but on May 19, about half of the animals treated for White Nose — mostly little brown bats, plus a few northern long-eared bats — were successfully released at the Mark Twain Cave Complex in Hannibal, Mo.

"It's jumping the gun to call this a cure, but it's very promising," says Katie Gillies, director of the Imperiled Species Program at Bat Conservation International, who was not directly involved in the new research (although Bat Conservation International provided funding to support the work). "This work shows that our efforts to combat White Nose are not in vain. The bat world has been bleak for a few years, so we're very grateful and excited to get some positive news."

Cornelison told EARTH in June that he and his colleagues plan to publish the results of their lab trials in PLOS ONE this month, and that they are still working to analyze results of field trials completed in April. “We’re aware there is a lot of interest in these data, and we’re very engaged in trying to get the data out as soon as possible.”

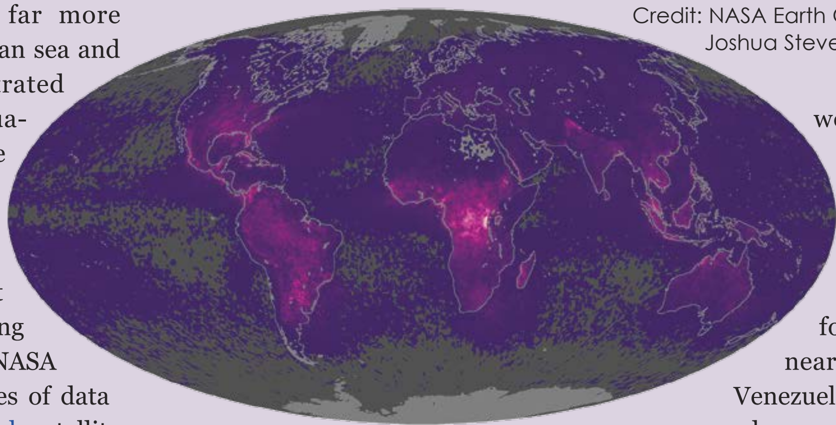
Because of the hands-off procedure of the *Rhodococcus* treatment, the technique could prove to be a far more logistically feasible way to treat wild bats than applying a topical treatment, Cornelison says. “Applying medicine directly to a whole colony of hibernating bats would be terribly inefficient, at best.”

But, he notes, more work will need to be done before the new treatment can be applied to bat colonies across the country. “Before we encourage resource managers to start spraying this bacterium into caves, we need to fully characterize the potential for nontarget effects to bats and cave environments,” he says.

Cornelison says he hopes that other research groups will come up with additional tactics against White Nose Syndrome. “It’s unlikely that *Rhodococcus* will stop White Nose Syndrome by itself,” he says. “We’re going to need an integrated disease-management strategy with a number of control tools that can be applied together if we’re going to get the upper hand on this disease.”

Mary Caperton Morton

Map shows where lightning zaps most



Credit: NASA Earth Observatory/ Joshua Stevens

Lightning strikes far more often over land than sea and is more concentrated closer to the equator — both testaments to the greater atmospheric instability over those parts of the planet. These are just two observations evident from a global map of lightning strikes produced recently by NASA based on nearly two decades of data from the OrbView-1/Microlab satellite and the Tropical Rainfall Measuring Mission satellite. The new map color-codes Earth by the average number of lightning flashes seen annually per square kilometer — brighter colors mean more lightning — and refines earlier efforts based on fewer data. So where on Earth does lightning strike most? That would be in eastern Democratic Republic of Congo, which is struck roughly 150 times per square kilometer each year, followed by the area near Lake Maracaibo in Venezuela. If you look closely, you can also see the contributions of certain orographic features like the Himalayas and the Rockies on lightning-strike patterns.

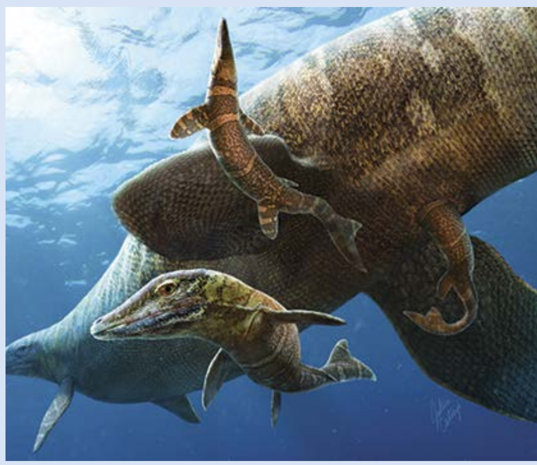
Timothy Oleson

Ancient marine reptiles born alive and ready to hunt

Mosasaurs, giant marine reptiles found in all the world’s oceans during the Late Cretaceous, may have reached up to 18 meters in length, and they were fearsome predators. Little is known, however, about newborn, or neonate, mosasaurs because very few have been found. Now, new research describing a rare fossil find from Kansas reveals that mosasaurs likely gave birth to live young that were born swimming and able to survive alongside the adults.

Because so few newborn mosasaur fossils have been discovered relative to adults, and because there is a known bias against preservation of newborn animals in Mesozoic terrestrial settings, it was previously thought that the animals might have climbed ashore and traveled inland to lay eggs, much like sea turtles do today. However, in the new study, published in the journal Palaeontology, Daniel Field, a doctoral student at Yale University, and his colleagues describe a neonate mosasaur fossil jawbone preserved in chalk originally deposited in a marine setting far from any landmass. This implies that adult mosasaurs likely gave birth to full-fledged swimmers in the open ocean, Field and his colleagues noted.

Lucas Joel



An artist’s interpretation of an adult mosasaur giving birth to live young.
Credit: Julius T. Csotonyi