Research could lead to protective probiotics for frogs

July 30 2015

In research that could lead to protective probiotics to fight the "chytrid" fungus that has been decimating amphibian populations worldwide, Jenifer Walke, PhD, a postdoctoral researcher at Virginia Tech University, Blacksburg, and her collaborators have grown bacterial species from the skin microbiome of four species of amphibians. The research appears July 10 in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology.

In the study, the investigators swabbed the four species, all of which inhabit Virginia. They grew, or cultured what bacteria they could from the swabs, and sequenced those cultures. They also sequenced all of the bacteria inhabiting the skin of each amphibian using next-generation sequencing. Next, they compared the cultured bacterial sequences to species which data suggests are dominant on amphibian skin.

Most of the bacteria that could be grown, or "cultured," were dominant species, although some rare species were culturable. "Dominant bacteria might be likely to contribute important functions, such as disease resistance, to their host," said Walke. "At least some species are known to produce antifungals, and we consider these to be strong candidates for amphibian probiotics."

While the investigators were unable to culture some presumptive dominant species, Walke suggests that merely tweaking culturing conditions might make it possible to grow some of these species.

The investigators were able to grow less than ten percent of the bacterial species in the amphibian skin microbiome. Moreover, "we found that amphibian species have distinct microbial communities, and this pattern held for both the cultured and the sequenced bacteria," said Walke.

"The research is important because many amphibians play critical roles in ecosystems, for example, controlling populations of harmful insects, including those that carry human diseases, such as malaria," said Walke. "Additionally, what we are learning about the role of microbes in amphibian disease resistance has applications to other species, such as white-nose syndrome in bats, and fungal disease in snakes, many of which control rodents that carry human diseases.

Amphibians include frogs, toads, salamanders, newts, and caecilians. The latter are limbless burrowing creatures of the southern hemisphere, and are not (yet) known to be infected with chytrid fungus. That fungus, *Batrachochytrium dendrobatidis*, is currently known to infect nearly 300 species of amphibians, and has caused around 100 extinctions, according to one estimate.

B. dendrobatidis' spread is driven largely by commercial trade in amphibians, 100 million of which are shipped annually. And now a new species of chytrid fungus is killing salamanders in Europe. "There is great concern that this species is going to arrive in America and decimate the amazingly diverse salamander communities in the eastern US," said Walke.

A total of around 6,000 species of amphibians are known, roughly one third of which are threatened or have become extinct, said Walke. The fungus was discovered in 1997, but amphibians were being decimated as early as the 1970s. Multiple factors that act synergistically—all due to human activity—threaten amphibians, including habitat destruction, infectious diseases, pollution, pesticides, climate change, invasive

species, and over-harvesting for the food and pet trades. In mountainous areas, *B. dendrobatidis* is the single greatest threat to amphibians.

Walke said that the benefits of the research will go beyond species preservation. It will contribute to the ability to culture diverse bacterial species, which will aid in disease control generally, as well as developing renewable energy, decontaminating pollutants, and improving understanding of evolution.

More information: This article can be found online at aem.asm.org/cgi/reprint/AEM.01 … f&siteid=asmjournals

Provided by American Society for Microbiology