Potential cure for captive amphibians with chytrid fungus

May 12 2014

Researchers at Vanderbilt University have identified an alternative to a sometimes toxic therapy that protects frogs in zoos from a deadly fungal infection that has been destroying the amphibian populations worldwide. Their research is published ahead of print in *Applied and Environmental Microbiology*.

The fungal disease, chytridiomycosis, has been decimating frogs all over the world. At present, nothing can help amphibians in the wild, but zoos currently rely on the often-toxic itraconazole to eradicate the disease from infected amphibians they wish to acquire.

To preserve the most at risk amphibians, zoos have been acquiring "founding populations" of species threatened by chytridiomycosis, which is caused by the fungus, *Batrachochytrium dendrobatidis*.

"Some species, such as the Panamanian Golden Frog, are nearly extinct in nature, and doing well only in zoos," says Louise Rollins-Smith, a researcher on the study. "Facilities which house multiple amphibian species need safe treatments to protect their valuable colonies."

Brian Gratwicke, a conservation biologist with the National Zoo, describes the difficulties zoos face in treating the creatures. The animals must go through 10 days of immersion in an itraconazole solution.

"Itraconazole is a fairly expensive drug, and depending on the species we treat we can see a very high mortality rate," says Gratwicke. "An

alternative treatment would be very helpful."

In the study, Rollins-Smith and colleagues, of Vanderbilt University, Nashville, TN, tested two potential alternatives, chloramphenicol, and amphotericin B. Although both drugs reduced B. dendrobatidis infection, neither could eradicate it. But amphotericin B had a critical advantage over chloramphenicol.

The investigators found that chloramphenicol can cause major changes in the community of microbes inhabiting amphibian skin, while amphotericin B does not, says Rollins-Smith.

Previous research has shown that altering or reducing the skin microbiome leaves amphibians more vulnerable to chytridiomycosis infection, she says. Whether by competing for space, or by providing antimicrobial compounds, the skin microbiome is probably protective.

Moreover, amphotericin B is much less toxic to frogs than is itraconazole.

Rollins-Smith suggests that a more benign cure for chytridiomycosis might involve treatment first with amphotericin B, followed by itraconazole, which would enable a lower, less toxic dosing with the latter.

"That makes sense," says Gratwicke. "It would also correspond with my field observations."

Chytridiomycosis is a skin disease. Clinical signs include reduced appetite, weight loss, lethargy, and loss of righting reflex. Death is thought to result from disruption of sodium and potassium ion transport in the skin, resulting in osmotic imbalance and asystolic cardiac arrest.

Gratwicke and others hope eventually to be able to cure chytridiomycosis with probiotic treatments that would add protective bacteria to the skin. But such efforts have yet to bear fruit. B. dendrobatidis was first identified as a threat to amphibians in 1998.

There are about 7,000 amphibian species in the world, including roughly 6,000 frogs, 600-700 salamanders, and about 200 caecilians, says Gratwicke. The International Union for Conservation of Nature lists 122 "missing" species of frog, on its "red list," most of which are likely extinct, including 90 for which chytridiomycosis is listed as the essential threat. Some salamanders and caecilians are also endangered. (Caecilians are legless borrowing creatures that look like the progeny of a mating between a snake and a worm).

More information: The manuscript can be found online. The final version of the article is scheduled for the July 2014 issue of *Applied and Environmental Microbiology*.

Provided by American Society for Microbiology