

Living the high life is risky business for toads under threat from fungus

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Male midwife toads carry the eggs until the tadpoles hatch

(PhysOrg.com) -- Midwife toads that live in the mountains are highly likely to die from a serious fungal infection, called chytridiomycosis, whereas their infected relatives in the lowlands are not, according to new research published today in *Ecology Letters*.

The authors of the study, from Imperial College London, the Zoological Society of London and the BiodivERsA project RACE, say their findings suggest conservationists may be able to limit the impact of the disease in the mountains by ensuring tourists do not transfer it between lakes.

During the five year study, the researchers found that no midwife [toads](#)

at low altitudes died as a result of [fungal infection](#), whereas up to 100 per cent of those at high altitudes died. The mortality rate of toads at high altitudes fluctuated over the five years.

The fungus *Batrachochytrium dendrobatidis* (Bd), also known as chytrid fungus, grows in the skin of amphibians, causing a disease called chytridiomycosis. The fungus has caused many species of [frog](#) and toad to become extinct and human activity has spread the fungus across the world, affecting an estimated 50 per cent of [amphibian](#) species.

Although infection usually is invisible to the naked eye, it can cause skin discolouration and ulceration and lead to convulsions. Previous research shows that infection kills amphibians by causing [heart failure](#). The fungus is particularly prevalent in Australia and the Americas, where its spread is well studied. However, little was known about Bd in Europe before today's study.

In the new study, the researchers found no dead toads at low altitudes. However, in mountain regions up to 100 per cent of infected toads died of the fungus infection, and the disease is known to have caused the extinction of some of the populations in the region. The authors of the study, which was funded by the Natural Environment Research Council and BiodivERsA, say this means it is vital for conservationists to ensure that the fungus does not spread to new mountain ranges, as it could be devastating to the toad populations living there.

In the new research, the scientists studied the spread of Bd in midwife toads (*Alytes obstetricians*) living on the Iberian Peninsula, which includes Spain and Portugal. Midwife toads are common in Europe and are a vital part of the ecosystem, providing predators with food and preying on insect pests. The new study shows that the disease is spread patchily across much of the area but in some locations, such as the Pyrenees, the disease is found in clusters, where it is threatening local

toad populations. Although the researchers found no link between the presence of infection and climate, they did show that the disease is much more dangerous for toads living at high altitudes. Although no midwife toads died at low altitudes in the region covered by this study, the disease has been fatal to other amphibian species in lowland areas around the world.

Dr Matthew Fisher, corresponding author of the study from the Department of Infectious Disease Epidemiology at Imperial College London, said: "Chytridiomycosis is a serious problem for amphibians all over the world and the disease is causing extinctions at a shocking rate. At the moment, we have no prevention or cure for Bd infection in the wild so we need to act fast to stop it from spreading to otherwise healthy populations.

"We identified infected midwife toads across the Iberian Peninsula, but the infection was much more likely to be fatal in toads that live at high altitudes, such as in mountain ranges. These areas are often tourist hotspots, and if people are walking along footpaths and visiting different lakes, they may be spreading the infection unwittingly.

"In order to limit the devastation this fungus could potentially cause, we need to invest money and expertise in stopping it from spreading. Simple measures, such as disinfecting tourists' boots when they cross infected areas, and providing them with uninfected sources of water so they don't spread fungal spores between lakes may be effective ways of tackling this problem. We are also concerned that stocking high-altitude lakes with artificially-reared fish may be introducing the disease to uninfected areas, and would like to see further research to investigate whether this is occurring," added Dr Fisher.

For today's study, the researchers took skin swabs of 3016 tadpole and adult midwife toads from 126 locations across the Iberian Peninsula

between 2003 and 2008. They analysed the samples in the laboratory, using a sensitive molecular technique called polymerase chain reaction (PCR) and found Bd infection at 31 of the sites.

The researchers looked at the genetic fingerprints of the fungi causing a cluster of infections and deaths in the Pyrenees and found they were all identical. This suggests that the disease was introduced to the area relatively recently.

The researchers then used mathematical models to determine whether environmental factors, such as minimum and maximum temperatures, rainfall and altitude affected the probability of infection or the risk of fatality. The results showed no link between environmental factors and probability of infection, but infected toads living at high altitude were more likely to die as a result of their infection than those living at lower altitudes.

The authors of the study say the increase in risk of mortality could be because the toads are less able to fight off infection in the mountains, where temperatures are colder, or that the fungus is better adapted to cold environments. The researchers now plan to investigate this further.

More information: "Factors driving pathogenicity vs. prevalence of amphibian panzootic chytridiomycosis in Iberia" *Ecology Letters*, Monday 25 January 2010.

Provided by Imperial College London

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