

Climbing for Chytrid: An Aerial Pursuit for Answers in Honduras

By Jonathan E. Kolby

Cusuco National Park (Cusuco) is a biological gem, situated in the Sierra Merendón of northwestern Honduras, close to the border with Guatemala. The park is quite small, approximately 200 square kilometers, but presents a beautiful mosaic of montane cloud forest, tree fern gullies, and crystal clear rivers and waterfalls. Cusuco is biologically rich, providing habitat for as many as 100 species of reptiles and amphibians, some of which are endemic to the park. I began studying the herpetofauna of Cusuco in 2006 to conduct biodiversity surveys with the British organization Operation Wallacea. During my first field season, I was unaware that some of the IUCN critically endangered amphibian species in this park were said to be experiencing enigmatic decline and it was not until 2007 that I reviewed these assessments and decided to return to conduct the first survey for the presence of amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (hereafter “chytrid”).

The results were alarming, revealing the widespread presence of chytrid throughout the park, and an especially high prevalence of infection in the critically endangered species reported to be in decline (*Duellmanohyla soralia*, *Plectrohyla dasypus*, *Ptychohyla hypomykter*) (Kolby et al. 2010). Compelled but not satisfied with these findings, I wanted to know if there might be places within an exposed forest where amphibians might be protected from chytrid. How about bromeliads? These unique epiphytic plants can collect a considerable volume of rainwater and seemed like the perfect natural refugia; they could protect amphibians from chytrid both physically (by distance away and height above terrestrial water bodies) and chemically (elevated acidity).

So up into the trees it was! In 2009, a colleague (Merlijn Jocque) and I participated in a training course to become certified tree climbers to pursue this arboreal endeavor. We returned to Honduras that summer and conducted an extensive arboreal investigation for the presence of chytrid in amphibians collected from bromeliads. One of two bromeliad treefrog species present in Cusuco, *Bromeliohyla bromeliacia*, became the target of this new study. Not only do adult frogs take refuge in the bromeliads by day, but the eggs are also deposited within the plants' water-holding leaf axils where the larvae are able to survive even when very little water remains. After completing two rewarding months of field work and scaling over a dozen trees, I emerged with moldy clothes, a broken tooth, and disheartening results. Almost one-

third of all bromeliad frogs sampled tested positive for chytrid, regardless of bromeliad height, distance from water, and the stark contrast between river and bromeliad water conditions. Not only was this worrying for the sake of the bromeliad frogs, but for all amphibians which are not directly associated with

terrestrial water bodies, as these bodies are widely considered to be the environmental reservoirs for infectious chytrid zoospores.

So how can bromeliad frogs and their tadpoles which rarely enter the splash zone of streams and rivers, infrequently wander to the ground, and are unlikely to engage in physical contact with species emerging from contaminated rivers still become infected with chytrid? Might chytrid have been introduced into these bromeliads by drops of contaminated water carried by flying insects, on the feet or feathers of waterbirds, or possibly even by wind-dispersed rain during tropical storms? A few more trips into the trees will hopefully begin to answer some of these questions and reveal some of the missing puzzle pieces. As of now, your guess is as good as mine, but one

thing is certain; all amphibians should be considered vulnerable to chytrid exposure, not just those with terrestrial aquatic life stages. Until we develop a more comprehensive understanding of the range of dispersal pathways exploited by chytrid, all bodies of freshwater should be considered potential sources of chytrid infection, whether it be a puddle of rainwater on the forest floor, a water pocket in a bromeliad 50 meters up a tree, or a raging river. As demonstrated here in Cusuco, even isolated bodies of ephemeral water some distance away from rivers and high within the rainforest canopy cannot provide amphibians safe haven from this devastating epidemic.

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References

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Adult bromeliad frog (*Bromeliohyla bromeliacia*). Photo: J. E. Kolby



Other species threatened by chytrid in Cusuco include the IUCN critically endangered *Plectrohyla dasyopus* (top) and *Plectrohyla exquisita* (middle), both of which are endemic to the park. Cloud forest habitat within Cusuco National Park, Honduras (bottom). Arboreal sampling for chytrid in Cusuco (right). Photos: J. E. Kolby