Parasitic bat flies offer window into lives of hosts

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The buffy flower bat (*Erophylla sezekorni*). Credit: M. Brock Fenton

A new study on a Bahamian bat makes the case for using the species' unusual parasites to reveal details about the species' populations on the archipelago. Using parasites to glean information about their hosts isn't a new concept, but typically scientists have focused only on parasites that exhibit tight links with individual hosts in a species over tens of thousands of years. The new research, published today in the *Journal of*

Parasitology, provides evidence for extending this concept based on information provided by blood-feeding bat flies that spend a large percentage of their lives independent of their hosts and switch among host individuals of the same species.

"For many years, parasites like lice have been used to learn more about their hosts. They never leave their host individuals, and that makes for a really good model," said lead author Kelly Speer, a comparative biology Ph.D. candidate in the American Museum of Natural History's Richard Gilder Graduate School. "But we've found that we can also use micropredator parasites—like bat flies—to give us details about their hosts, as long as the parasites are host-specific and use their host to be dispersed."

The study focused on the buffy flower bat (Erophylla sezekorni), a Caribbean species that the researchers selected because of its ability to cross a narrow ocean channel in the Bahamas. This channel is thought to be a geographic barrier for other bats in the area, and physical barriers can lead to different populations of the same species—and over long periods of time, because the separate populations are unable to mate, two different species altogether. To learn more about the buffy flower bat's Bahamian populations, the researchers examined the parasitic flies (Trichobius frequens) that live on the bats on both sides of the ocean channel.

"It can be really difficult to measure the connectivity between populations of bats because they are highly mobile, and they are often too small for GPS trackers," said study co-author David Reed, from the Florida Museum of Natural History. "To get around this, researchers generally rely on genetic estimates of gene flow as a proxy for measuring how well connected two populations are. The problem with this is that certain types of dispersal aren't reflected in genome of the bat, or are reflected but result in very low genetic signal. In this study, we found

that bat flies can act as an alternate way to get at this information."

These particular bat flies, which are part of the group that includes tsetse flies—known for transmitting trypanosomiasis, or sleeping sickness, in humans—have a unique life cycle. Unlike most flies, which lay their eggs and leave them to develop on their own, female bat flies nurture their larvae internally, even feeding the larvae with "milk" glands inside of their bodies. Once the larvae are mature, the female flies deposit them in a bat's roost, shortly after which they form a puparium, similar to a cocoon, develop into an adult, and find a host to feed upon. T. frequens only feed on the blood of the buffy flower bat, moving among individual bats. Female flies leave their host every 10 days to deposit larvae.

The researchers looked at the genetics of the buffy flower bats and their associated flies on four islands in the Bahamas, two on each side of the ocean channel. They found evidence for a single population of the bats, but two populations of its flies. The results indicate that the ocean channel is likely not a universal barrier for bats.

"There is a lot more connectivity than we expected longterm across this barrier in both the host and the parasite," Speer said.

However, the results also indicate that there has been very little, if any, dispersal of the bats over the last two generations, or about two years. This finding was not evident from the host genetics alone and only became clear with genetics from the flies. Ultimately, the study suggests that something besides the ocean channel might be stymieng the bats' gene flow.

"Changes in roost and foraging habitat availability could be playing the largest role here," said coauthor Nancy Albury, from the National Museum of The Bahamas. "In the northern islands we surveyed, many of

these bats roost in abandoned buildings, and in the southern islands, many of the caves are being filled with trash. As the population in the Bahamas continues to increase and tension builds between the natural habitat and altered habitat for human use, it's important to know what the baseline is for this bat and this parasite."

More information: Kelly A. Speer et al. A Fly on the Cave Wall: Parasite Genetics Reveal Fine-Scale Dispersal Patterns of Bats, *Journal of Parasitology* (2019). DOI: 10.1645/19-20

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