Researchers find bats use curled leaves for sound amplification

October 16 2013, by Bob Yirka

Spix's Disk-winged Bat (Thyroptera tricolor). Credit: antonsrkn/Flickr

(Phys.org) —A pair of researchers, one from Universidad de Costa Rica, the other North Dakota State University has found that a type of bat that

hides from predators inside a curled leaf plants, gains acoustic advantages from doing so. In their paper published in the journal *Proceedings of the Royal Society B: Biological Sciences*, Gloriana Chaverri and Erin Gillam describe recording experiments they conducted with the types of plants the bats hide in and found that the plant served as both megaphone and ear horn.

Prior experiments by researchers studying Spix's disc-winged bats (*Thyroptera tricolor*) have found that the tiny creatures oftentimes have difficulty differentiating calls from family members and others in their group. This is important because the bats are social—they form clans that stay together for years. Intrigued, Chaverri and Gillam wondered if the sound problems might be due to the environment in which the bats live when they are not flying—in the curled leaves of *Calathea* and *Heliconia* type plants that grow outside their caves (in South America). To find out, they collected several plant specimens and brought them into their lab. There they affixed tiny microphones and speakers that played bat calls in and around the plants to study their acoustic properties. In doing so, they discovered that the curled plants caused several changes to the sound around them.

Most impressively, they found that sound emitted outside of the plant becomes condensed as it makes its way inside the funnel shaped leaves—by the time it reaches the bottom the sound on average was increased by ten decibels. This means that those hiding inside the leaves can hear calls from their family members who are much farther away than if they were not in the leaf. The researchers found that the leaves also worked as a megaphone, increasing the volume of sounds emitted from inside the leaves by 1 to 2 decibels (by focusing the sound as it leaves). They also found that because different sound frequencies were impacted in different ways by the shape of the leaves, bat calls heard inside would be nearly impossible for the hiding bats to distinguish between family, friend or stranger.

More information: Sound amplification by means of a horn-like roosting structure in Spix's disc-winged bat, *Proc. R. Soc. B*. Published 16 October 2013 DOI: 10.1098/rspb.2013.2362

Abstract

While sound is a signal modality widely used by many animals, it is very susceptible to attenuation, hampering effective long-distance communication. A strategy to minimize sound attenuation that has been historically used by humans is to use acoustic horns; to date, no other animal is known to use a similar structure to increase sound intensity. Here, we describe how the use of a roosting structure that resembles an acoustic horn (the tapered tubes that form when new leaves of plants such as Heliconia or Calathea species start to unfurl) increases sound amplification of the incoming and outgoing social calls used by Spix's disc-winged bat (Thyroptera tricolor) to locate roosts and group members. Our results indicate that incoming calls are significantly amplified as a result of sound waves being increasingly compressed as they move into the narrow end of the leaf. Outgoing calls were faintly amplified, probably as a result of increased sound directionality. Both types of call, however, experienced significant sound distortion, which might explain the patterns of signal recognition previously observed in behavioural experiments. Our study provides the first evidence of the potential role that a roost can play in facilitating acoustic communication in bats.

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