Evolutionary chance made the barbastelle bat a specialist hunter, says study

October 27 2023

A barbastelle bat flying in the dark. Credit: Sherri and Brock Fenton

Ask a biologist why predators don't exterminate all their prey, and part of the answer is often that there is an ongoing arms race between predators and prey, with both parties continuously evolving new ways to

cheat each other.

The hypothesis is particularly prevalent for bats and their prey, insects. About 50 million years ago, the first bats evolved the ability to echolocate and thus hunt in the dark, and in response to this, some insects evolved ultrasound-sensitive ears so they could hear and evade the bats.

But if there is an ongoing arms race, bats should have responded to this, says University of Southern Denmark biologist, associate professor and bat expert Lasse Jakobsen, co-author of a new study published in *Current Biology*. In the study, he and colleagues question the evolutionary arms race between bats and insects.

The main argument supporting the arms race hypothesis is that some bats do not call as loudly as others when hunting, and thus cannot be heard as easily by the insects. These are the barbastelles (Barbastella barbastellus), and they are approximately 20 dB quieter than other bats that hunt flying insects, which means that the sound pressure they emit is 10 times lower.

"The barbastelle is traditionally highlighted as the bat that has 'struck back' at the insects," says Jakobsen.

But something puzzled him and his colleagues: If you look at the barbastelle's close relatives, there are virtually no other members catching insects in the air. Instead, they eat insects that sit on surfaces such as leaves and branches, and those species are all quieter than the species that hunt flying insects.

In bat research circles, the bats that catch insects in the air are called hawking bats, while the bats that pick insects from a surface, so to speak, are called gleaning bats. The barbastelle is a hawking bat. "If most of the

barbastelle's family are gleaners, then their ancestor was very likely also a gleaner," says Jakobsen.

Accordingly, it is therefore unlikely that the ancestor of the barbastelle was a loud hawker that evolved into the whispering barbastelle as a response to insect hearing.

"A species does not have free choice when it evolves in a new direction. For example, it is a condition for mammals that their ancestor did not have feathers, so their descendants will never evolve a wing with feathers. Instead, they have found another solution for flying: modified skin between the fingers," explains Jakobsen.

But if the barbastelle didn't evolve its ability to be quieter when hunting in the air, as part of the arms race between insects and bats; where does it come from?

"It is not an evolved ability. It just cannot produce louder calls than it does, because as a descendant of a gleaner it is probably morphologically limited. But it has found a niche, where it can use its low amplitude calls. It is an evolutionary coincidence; it sort of fell into this niche, where there was something to eat," adds Jakobsen.

This niche is populated by flying, nocturnal insects that can hear and are thus good at avoiding nocturnal bats. But they cannot hear well enough to register the barbastelle, so they end up as their prey.

The reason for the morphological limitation must be found in how bats emit their sound. Most bats call out of their mouths, and this allows them to emit loud sounds. Many gleaners, on the other hand, emit sound with their noses, and this makes their calls 20 dB lower.

"So, the reason why the barbastelles are so quiet today is not an

expression of an arms race between bats and insects, but rather simply an expression of the fact that it is descended from bats that cannot call as loudly as others," says Jakobsen.

More information: Lasse Jakobsen et al, Stealth echolocation in aerial hawking bats reflects a substrate gleaning ancestry, *Current Biology* (2023). DOI: 10.1016/j.cub.2023.10.014. www.cell.com/current-biology/f … 0960-9822(23)01372-6

Provided by University of Southern Denmark