How Do Bats Find The Right Carnivorous Plants For Safe Roosting?

TO MAINTAIN MUTUALISM, PALEOTROPICAL CARNIVOROUS PLANTS SPECIFICALLY APPEAL TO THEIR PARTNERS’ PERCEPTION. THEIR REFLECTIVE STRUCTURE IS ACOUSTICALLY ATTRACTIVE FOR BATS.

A few years ago, researchers discovered a delightful instance of mutualism in the dense greenery of Borneo. A little insect eater called Hardwicke’s woolly bat (Kerivoula hardwickii) likes to rest in the carnivorous pitcher plant Nepenthes hemsleyana. Compared to its other carnivorous relatives, this plant is pretty bad at luring insects, and that’s because it gets a third of the nitrogen it needs from bat poo. The bats fertilize the plants with their guano in exchange for a temperature-controlled roosting spot that’s free of parasites and competitors.

Now, researchers have discovered a new twist: This pitcher plant has an acoustic reflector that sends the bats’ ultrasonic calls back to them, helping them find a cozy, suitable place to roost. The findings are published in Current Biology this week.

"Carnivorous plants in general have already solved the problem of nutrient deficiency in a very unusual way by reversing the ‘normal system’ of animals feeding on plants," Michael Schöner of Ernst-Moritz-Arndt-University of Greifswald says in a statement. "It is even more astonishing that in the case of N. hemsleyana the system is taking a new turn. While N. hemsleyana reduced many insect-attracting traits, it obviously exhibits some traits that are highly attractive for a species that provides the plants with nutrients without being digested by the plant itself." Bats don’t fall into the plant’s digestive juices – typically reserved for insects – thanks to the pitcher’s modified shape and low fluid level.
But exactly how the bats and their plant partners find each other has been a bit of a mystery. These bats emit the highest frequencies ever recorded in bats, but in a cluttered swamp, it’s a tough challenge for them to distinguish the reflected echoes of the rare pitcher plant species from that of more common, similarly shaped ones that are ill-suited for roosting.

To investigate, Schöner and colleagues turned to an artificial bat head that emits and records ultrasounds to test the pitchers’ acoustic reflectivity from various positions and angles. Turns out, the bats are acoustically attracted to carnivorous plants. The team discovered a strong echo reflection from the pitchers’ back walls, which seem to work perfectly as an ultrasound reflector. Similar adoptons have been found in flowers that rely on nectar-feeding bats to pollinate them.

With behavioral experiments in a flight tent, the mutualistic bats responded to sounds echoed back to them from the carnivorous plants. The bats were also better at finding pitcher plants hidden with shrubbery when their reflectors were intact, compared to those with trimmed, reduced reflectors. They also preferred to roost in unmodified pitchers.

"With these structures, the plants are able to acoustically stand out from their environments so that bats can easily find them," Schöner adds. "Moreover, the bats are clearly able to distinguish their plant partner from other plants that are similar in shape but lack the conspicuous reflector."