

August 2012, Volume 10, Number 8

## Living Inside a Deadly Trap

The "pitcher" of pitcher plants is a death trap for insects and other small invertebrates. These vine-like plants of the genus *Nepenthes* grow in the nutrient-poor soils of peat-swamp forests. To compensate for the lack of nutrients, the plants developed trapping structures shaped like pitchers and partly filled with liquid. When small creatures fall into the trap, they drown in the liquid and are digested by enzymes produced by the plant. So what are bats doing roosting in these lethal pitchers?



*A Hardwicke's woolly bat settles into a pitcher plant. Photo by Michael Schöner*

Professor Ulmar Grafe at the University of Würzburg in Germany discovered that Hardwicke's woolly bats were regularly roosting in pitcher plants in Brunei (on the tropical island of Borneo). Grafe wanted to investigate that peculiar relationship and invited students Caroline and Michael Schöner to join his team.

The researchers traveled to Brunei and quickly found Hardwicke's woolly bats roosting in pitchers. They attached miniature radio-tracking transmitters to the backs of all captured bats and followed each bat for up to 12 days through the dense, swampy jungle. The Schöners said they were astonished to find that all the woolly bats in the study area roosted only in pitchers of *Nepenthes hemsleyana* plants. Each bat was settled in, head first, above the digestive fluid in a well-defined region – a girdle-like structure below which the pitcher tapers significantly. The bats fit so perfectly that they don't even use their feet to hold on the pitchers' walls.

Unlike other *Nepenthes* species, the digestive fluid inside the *Nepenthes hemsleyana* pitchers is limited to the lowest part of the cone, so the bats never contact it. Normally these bats roost alone, but some pitchers provide enough space for a mother with its pup.

While roosting in the pitchers, bats can hardly be seen from the outside, the students report. Thus, the pitchers provide a secure roost that helps bats avoid detection by predators. All things considered, pitcher plants seem well adapted for the bats. But what's in it for the plant?

Previous studies had found that *Nepenthes hemsleyana* captures seven times less prey than other, closely related species. Perhaps bat feces serves as a kind of fertilizer that compensates for the lack of nutrients. To test this hypothesis, the team collected tissue samples of plants that had been occupied by bats and compared their nitrogen content to pitcher plants that did not host bats. They found that plants used by bats gained more than 33 percent of their nitrogen from bat droppings. "We now have strong evidence that the relationship between pitcher plants and woolly bats demonstrates a mutualism that benefits both partner species," the Schöners said.

The research continues as the Schöners work toward doctoral degrees at the University of Greifswald. "We hope to learn whether Hardwicke's woolly bats and *N. hemsleyana* plants have co-evolutionary adaptations for one another, and exactly what each partner gains from this relationship – and what price each pays for it," they said.

*BCI Members can read the full story of this unusual relationship between bats and plants in the Fall 2012 issue of BATS magazine.*

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