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SCIENCE NOT EXACTLY ROCKET SCIENCE

Flesh-eating plant doubles as bat-cave

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The world's worst flesh-eating plant lives in the jungles of Borneo. It's called *elongata* and it's one of several strains of Raffles' pitcher plant. Like its relatives, it has distinctive pitcher-shaped leaves that can lure insects into a watery grave. But unlike other strains, *elongata* is strangely incompetent at catching insects. Instead, it lures bats into its pitchers, and lives off their poo.

Pitcher plants grow in soils that lack the vital nitrogen that plants depend on. The pitchers make up for this shortfall by harvesting nitrogen from the flesh of animals. Their pitchers are traps, baited with nectar, enticing colours, or tempting smells. If an insect approaches and falls in, it is doomed. It can't clamber up the slippery side of the pitcher, and it soon drowns in the pool of liquid at the bottom. This fluid contains a suite of enzymes that breaks down the plant's prey, releasing its valuable cache of nitrogen and other nutrients.

Elongata looks much like other pitcher plants, except for its giant traps. They're around four times larger than those of its relatives, they don't contain much fluid, and they don't emit any noticeable smell. At such a size, you'd expect the pitchers to be swimming in insects. But when Ulmar Grafe from the University of Brunei Darussalam looked inside the giant pitchers, he found six to seven times fewer insects than in other pitchers. Instead, he found small bats.

Grafe spent a year trekking through Bornean swampland to inspect a group of 400 *elongata* pitchers. In that time, he found 32 Hardwicke's woolly bats, nestled inside. By fitting them with radio-trackers, Grafe found that these bats are exclusive tenants. They nest nowhere else besides these meat-eating plants.

Their green apartments are roomy affairs, adapted to suit their hosts. There's not a lot of fluid inside, so the bats don't inadvertently drown. There's a thickened "girdle" half-way up, which gives them purchase against the slippery sides. And there's enough space for two – on two occasions, Grafe found youngsters snuggling with their parents.

In the pitchers, the bats get shelter from predators and the elements. But what does the plant get in return for providing a living bat-cave? In a word: faeces. The bats defecate into the pitchers, providing the plant with at least a third of its nitrogen, packaged in neat dollops.

This is just the latest in a long line of alliances between pitchers plants and animals. Three species turn their pitchers into latrines for tree-shrews. They produce nutritious nectar that the tree-shrews can only reach if they position their backsides over the mouth of the pitcher. Tree-shrews often mark valuable resources with poo, and when they do so into the pitcher, they provide it with fertiliser. One of these – the king pitcher – has the largest pitchers in the world. They need to be, to double as suitable toilets.

That's just the mammals. The leafy traps can actually house entire communities of creatures and some of these residents are found nowhere else on the planet. Small invertebrates swim within the fluid, including the larvae of various mosquitoes, midges and flies. The black-spotted sticky frog uses the liquid as a nursery for its tadpoles. By eating the animals that die within the pitcher, these residents speed up the release of nutrients. They may be tenants, but they double as part of the plant's digestive system.

And some predators have taken to raiding the pitchers for food. A type of carpenter ant called *Camponotus schmitzi* nests solely in the tendrils of the pitchers, and it risks life and limb by actually *diving into the fluid* to grab drowned prey. A red crab spider can do the same; it spends its life in the pitchers, picking off drowned insects and hauling itself to safety with

lifelines of silk. Strangest of all, a small red land crab also raids the pitchers for food. They might be death-traps, but the pitcher plants can also be havens for life.

Reference: Grafe, Schoner, Kerth, Junaidi & Schoner. 2011. A novel resource–service mutualism between bats and pitcher plants. *Biology Letters* <http://dx.doi.org/10.1098/rsbl.2010.1141>

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