

Underground carnivore: The first species of pitcher plant to dine on subterranean prey

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A shoot with reduced white leaves and well-developed pitchers extracted from a cavity under a tree. Credit: Martin Dančák

What we thought we knew about carnivorous plants was swiftly called into question after scientists discovered a new species in the Indonesian

province of North Kalimantan, on the island of Borneo. *Nepenthes pudica* is what scientists call a pitcher plant—it has modified leaves known as pitfall traps or pitchers, where it captures its prey. In a strategy so far unknown from any other species of carnivorous plant with pitfall traps, this one operates underground, catching its prey in the soil.

"We found a pitcher plant which differs markedly from all the other known species," says Martin Dančák of Palacký University in Olomouc, Czech Republic, lead author of the study, published in the journal *PhytoKeys*, where his team described the new species.

"In fact, this species places its up-to-11-cm-long pitchers underground, where they are formed in cavities or directly in the soil and trap animals living underground, usually ants, mites and beetles," he adds.

Only three other groups of [carnivorous plants](#) are known to trap underground prey, but they all use very different trapping mechanisms and, unlike *Nepenthes pudica*, can catch only minuscule organisms.

The plant forms specialized underground shoots with entirely white, chlorophyll-free leaves. In addition to lacking their normal green pigmentation, the leaves supporting the pitchers are reduced to a fraction of their normal size. The pitchers, however, retain their size and often also their reddish color.

"Interestingly, we found numerous organisms living inside the pitchers, including [mosquito larvae](#), nematodes and a species of worm which was also described as a new species," explains Václav Čermák of the Mendel University in Brno, Czech Republic, who was also part of the research team.



If no cavity is available, the shoots grow directly into the soil, as seen here where a bunch of pitchers was excavated from the ground. Credit: Martin Dančák

The newly discovered species grows on relatively dry ridge tops at an elevation of 1100–1300 m. According to its discoverers, this might be why it evolved to move its traps underground. "We hypothesize that underground cavities have more stable environmental conditions, including humidity, and there is presumably also more potential prey during dry periods," adds Michal Golos of the University of Bristol, United Kingdom, who also worked on this curious plant.

A series of lucky events back in 2012 led to the discovery of the species. Ľuboš Majeský of Palacký University Olomouc, part of the research team, recounts the key moment: "During a several-day trip with our Indonesian colleagues to a previously unexplored mountain, randomly chosen from a number of candidates, we noted plants which were undoubtedly *Nepenthes* but produced no pitchers. After a careful search, we found a couple of aerial pitchers, a few juvenile terrestrial ones, and one deformed pitcher protruding from the soil."

"At first, we thought it was an accidentally buried pitcher and that local environmental conditions had caused the lack of other pitchers. Still, as we continued to find other pitcherless plants along the ascent to the summit, we wondered if a species of [pitcher plant](#) might have evolved towards loss of carnivory, as seen in some other carnivorous plants. But then, when taking photos, I tore a moss cushion from a tree base revealing a bunch of richly maroon-colored pitchers growing from a short shoot with reduced leaves entirely lacking chlorophyll."



Habitat with a mature plant of *Nepenthes pudica* lacking pitchers on the aboveground shoot. Credit: Martin Dančák

The group then checked the other encountered plants and found that all of them had underground shoots with pitchers, confirming that this species specifically targets the underground environment.

The scientific name *Nepenthes pudica* points to the plant's curious behavior: it is derived from the Latin adjective *pudicus*, which means bashful and reflects the fact that its lower pitchers remain hidden from sight.



A completely buried shoot with a bunch of well-developed pitchers uncovered from beneath a moss cushion. Credit: Martin Dančák

Nepenthes pudica is endemic to Borneo. "This discovery is important for [nature conservation](#) in Indonesian Borneo, as it emphasizes its significance as a world biodiversity hotspot. We hope that the discovery of this unique carnivorous plant might help protect Bornean rainforests, especially prevent or at least slow the conversion of pristine forests into [oil palm plantations](#)," concludes Wewin Tjiasmanto of Yayasan Konservasi Biota Lahan Basah, who helped discover the [new species](#).

More information: Martin Dančák et al, First record of functional underground traps in a pitcher plant: *Nepenthes pudica* (Nepenthaceae), a new species from North Kalimantan, Borneo, *PhytoKeys* (2022). [DOI:](#)

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