New botanical 'crime scene investigation' may save endangered carnivorous plants

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Credit: Curtin University

Researchers have combined macro photography with DNA

metabarcoding to create a new botanical "CSI" tool that may hold the key to safeguarding the future of Australia's critically endangered carnivorous plants.

The new technology—developed by researchers from Curtin University, the Botanical and Zoological Natural History Collections in Munich and the University of Munich—enables experts to take a sophisticated look inside the stomachs of carnivorous plants, overcoming a hurdle that had previously stumped entomologists.

Researchers set off on a 6,000 km journey to Western Australia's remote Kimberley region to test the new method, capturing macro photographs of carnivorous plants of the genus Drosera, known as sundews.

Lead author Mr. Thilo Krueger, a Ph.D. student from Curtin's School of Molecular and Life Sciences, said understanding how many and what kinds of insects that carnivorous plants ate was critical to their survival.

"Western Australia has—by far—the highest number of carnivorous plant species in the world and many of them are critically endangered, threatened by habitat destruction, environmental pollution and climate change," Mr. Krueger said.

"Quite often, several carnivorous plant species are found in one habitat, and the question arises if different species may rely upon different food sources. To develop conservation plans that protect their future, it is essential to understand their biology, which includes what they eat—their natural prey spectra.

"Studying the prey spectra of carnivorous plants has previously been hampered by the fact that digested insect prey is often hard to identify, even by trained entomologists. Soft-bodied insects such as midges often turn into unidentifiable crumbs during digestion on the leaves."

Co-author Dr. Adam Cross, a Botanist and Restoration Ecologist from Curtin's School of Molecular and Life Sciences, said the new method combined macro photography of the captured insects with DNA metabarcoding, a cutting-edge insect identification tool.

"Any insect that is captured by a carnivorous plant will contain traces of its genetic material or DNA, even after digestion by the plant. This DNA can be detected and compared with DNA libraries of known insects, thus identifying the prey," Dr. Cross said.

"Because DNA metabarcoding is prone to contaminations and does not allow us to estimate the quantity of prey, we carefully controlled our data using macro photographs of the prey items to achieve an unprecedented completeness of prey spectra data."

Senior author Dr. Andreas Fleischmann, from the Botanical Natural History Collection and the University of Munich, said this new method of DNA metabarcoding was so sensitive that it even detected tiny amounts of insect DNA that were not obvious to researchers from field examination and macro photographs.

"Hence, our study of carnivorous prey spectra using genetic DNA fingerprints from the captured insects resembled reconstructing a crime scene—except our crime scene investigation was about finding out what a set of carnivorous plants had for lunch," Dr. Fleischmann said.

More information: Thilo Krueger et al, A novel approach for reliable qualitative and quantitative prey spectra identification of carnivorous plants combining DNA metabarcoding and macro photography, *Scientific Reports* (2022). DOI: 10.1038/s41598-022-08580-8

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