

CARNIVOROUS PLANTS

Getting the juices flowing

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Credit: Mim Friday / Alamy Stock Photo

The life style of a carnivorous plant requires patience. They grow traps of various kinds then wait for their prey to stumble in. Once the trap is sprung they produce enzymes to digest their victims. Plants with active traps, such as the sundew (*Drosera sp.*) or Venus flytrap (*Dionaea muscipula*), use the struggling of their captive to trigger production of digestive enzymes, but this is not possible for plants that use passive traps. Andrej Pavlovič, of the Palacký University Olomouc, Czech Republic, and colleagues have addressed this question with pitcher plants of the genus *Nepenthes* and found that protein is the primary trap stimulus.

The Czech researchers used the horticultural variety *Nepenthes* × *Mixta*,

a hybrid of *Nepenthes northiana* and *Nepenthes maxima*, in their investigations due to its particularly large pitchers and high volume of digestive fluid. They sealed newly developing pitchers as they opened, then, once mature, added meal worms, bovine serum albumin (BSA) solution or chitin. For nine days after the addition of worms the contents of the pitchers became progressively more acidic, reaching as low as pH 1.8. The effect produced by BSA had a similar timecourse, although only reaching in the region of pH 3, while chitin only lowered the pH very slightly. Whole prey and protein also stimulated an increase in proteolytic, phosphatase and endochitinase activity in the pitcher fluid, but again chitin had only a small effect.

Using qPCR and semi-quantitative immunoassays, the basis for the changes in pitcher fluid was identified as increased transcription of relevant genes, although the patterns of gene expression were not clear-cut. The proteinases nepenthesins I and II showed a strong and sustained response to prey, protein and ammonium chloride solutions but not to chitin. However, while both chitinase III and IV eventually responded to worms, BSA and ammonium, there was a fast but short-lived upregulation of chitinase III to chitin itself. These results hint at the presence of receptors controlling enzyme production in the *Nepenthes* pitchers, specifically attuned to the presence of rich nitrogen sources.

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