# No such thing as a free lunch for Venus flytraps

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Charles Darwin described the Venus Flytrap as 'one of the most wonderful plants in the world.' It's also one of the fastest as many an unfortunate insect taking a stroll across a leaf has discovered. But what powers this speed? Dr Andrej Pavlovic of Comenius University, Slovakia, has been studying the plants with the help of some specialised equipment and a few unlucky insects.

In the wild the Venus Flytrap grows in the bogs and savannahs of North and South Carolina. This is not a healthy environment for many plants as it is low in the nitrogen to needed to build proteins. The Venus Flytrap has overcome this problem by developing a taste for meat. It has convex bi-lobed leaves with three trigger hairs on each lobe. When something knocks these hairs twice an electrical signal flips the leaves into concave shapes. If the captured creature struggles to escape it continues to tickle the trigger hairs. This causes the plant's trap to close tighter and release enzymes to digest its prey.

Pavlovic looked at how the Flytraps snapped their leaves around their prey and thought that it might cost the plant energy to catch its food this way. To test his idea, he set up an infrared gas analyzer and a chlorophyll fluorescence imaging camera to watch the plants. He used a wire to make a trap snap and then simulated an insect struggling in the closed trap. Then he watched what happened as the plant caught its victim.

Pavlovic said: "When a trap was triggered, photosynthesis slowed down and then recovered over ten minutes after the traps stopped being stimulated. In addition, the gas analyser showed an increase in respiration from the traps. To power the trap, the Venus Flytraps converted sugars they had photosynthesized back into carbon dioxide and energy. It is like an animal which also increases breathing when it has an increased demand for energy. The measurements showed that the effects are linked not to whether or not the trap is open, but to the stimulation of the trigger hairs. The measurements are connected with electrical signals produced by trigger hair irritation. These signals are similar to the signals which spread through the animal neurons."

The results mean that the plants should not been seen as entirely passive. Pavlovic added: "These results show that the plant is as active as it appears and that it has adapted to trade-off the costs of lost photosynthesis against the benefits of additional nutrients from animal prey which in turn may later stimulate photosynthesis. This agrees with my earlier studies on carnivorous plants and shows why Venus Flytraps live in sunny habitats. The energy used in eating insects means that they need a lot of opportunity for photosynthesis, otherwise they lose more than they gain."

It also suggests an answer to a question posed by Darwin over a century ago. Pavlovic noticed that when the traps closed there were gaps between the 'teeth' at the edge of the trap that a small creature could escape through. He said: "This could be an adaptive trait. Victims with little useful nitrogen can escape, ensuring the plant doesn't waste energy digesting them. The Venus Flytrap is not a merciless killer."

**More information:** 'Trap closure and prey retention in Venus flytrap (Dionaea muscipula) temporarily reduces photosynthesis and stimulates respiration' is now available for free at the Annals of Botany
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