Meat-eating plant digests insects using ants

Many insects eat plants, but some plants can turn the tables on their would-be diners. The pitcher plants are among several groups that can capture insects and digest their flesh. And one species – the fanged pitcher plant – goes even further. It digests insects with insects.

There are around 120 species of pitcher plants and all of them have large leaves that fold to produce fluid-filled traps. The rims of the pitchers are usually extremely slippery, and insects that wander by lose their foothold and fall into the pool of fluid within. There, they drown and are digested by the plant.

The fanged pitcher is unusual. Its rim lacks the usual waxy layer and is less slippery than those of its cousins. And it’s the only species that recruits ants. The base of each pitcher contains a swollen tendril that houses ants of the species Camponotus schmitzi. These insects are permanent residents; they’ve never been seen in any other plant.

People have assumed that this is yet another case of a plant-ant alliance. Aside from accommodation, the ants also get food from the nectar that exudes from the pitcher’s rim and that drips from its distinctive ‘fangs’. The pitcher presumably gets something in return. But until now, and despite many hypotheses, no one could really say what those benefits were. Vincent Bazile
from Universite Montpellier II has finally produced some hard numbers to show what the plant gets out of the partnership.

He found that fanged pitchers with ants produced leaves that were three times bigger than those of unoccupied plants, and the larger the colonies, the bigger the leaves. Those leaves also contained around three times more nitrogen in their leaves – a sign of healthier growth. More surprisingly, plants with pitchers but no ants grew just as poorly as those without pitchers at all. Without the ants, the plants couldn’t extract enough nutrients from their victims to offset the cost of making the traps in the first place.

That’s an incredible result. It means that the fanged pitcher’s traps are useless without an insect component. The ants are a bit like the gizzards of birds – a secondary stomach where food is ground up with swallowed stones. They’re a living, crawling digestive system made of thousands of bodies, as essential to the plant’s meat-eating lifestyle as any of its own cells.

But why do the ants actually matter? Bazile’s study helped to assess some obvious ideas. Some scientists assumed that the ants defend the plant from hungry insects, parasites and competitors, just as other species do for other plants. Weevils certainly like to chew on the buds of growing pitchers, but they are only mildly troubling to the plant. Bazile found that the ants only offer slight protection against the forces of weevil.

Other scientists have suggested that the ants help the pitchers to catch their prey. They wait underneath the rims, descending upon insects that fall inside. Bazile found that the ants are particularly useful in restraining large insects, or ones that can fly, preventing them from escaping the traps. But since the plant captures mostly small prey, this makes relatively little difference to its energy budget.

Instead, Bazile found that the ants’ biggest contribution lies in feeding the plant with their faeces. As the ants hang around the rim, they defecate into the pitchers, transferring the nitrogen that they harvested from their meals. The plant, rather than digesting its victims directly, lets the ants do the job. Bazile estimated that around 42 per cent of the plant’s nitrogen supply comes from its partners’ poo, while the most heavily colonised plants get around 76 per cent of their nitrogen in this way. And because the pitchers grow much bigger with the ants around, they can catch twice as many insects.

There is precedent for this. The flycatcher bush of South Africa relies on an assassin bug to digest its meals. It traps insects on sticky leaves (here, it’s got a wasp), but it doesn’t secrete the digestive enzymes that a Venus fly-trap or a sundew might. Instead, the bug (which moves freely over the hairs) eats the trapped insects and the plant absorbs its poo. Meanwhile, another pitcher plant, Heliamphora, relies on bacteria to digest its victims.

Some scientists argue that these species aren’t true carnivorous plant, because they rely on other partners to digest their meals. Indeed, the fanged pitcher has lost many of the adaptations that
make its relatives self-sufficient, including a slippery waxy layer on their rims, and potent digestive enzymes in their fluids. On the other hand, it has unusually long-lived leaves that can stretch up to 20 metres into the forest canopy – a record-breaking feat for a group that lives in nutrient-poor soils. It seems that outsourcing digestion to ants is a very successful strategy.


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