

A tale of two predators

Crab spider uses pitcher plant's trapping mechanism to catch food, while giving host nutrients

Jose Hong

In the wild, one would expect two predators to compete with each other for food, but research has shown that a spider and the carnivorous plant it calls home have made a pact.

Ecologists from the National University of Singapore's (NUS) Faculty of Science have conducted research on a poorly studied species of spider and how it uses the trapping mechanism of a pitcher plant to catch food, all the while also giving the plant nutrients.

The yellow arachnid, *Thomisus nepenthophilus*, is a species of crab spider – so called because it holds its larger front legs outstretched like a crab in a defensive position. It lives only in the slender pitcher plant, *Nepenthes gracilis*, which is native to Singapore, Malaysia and Indonesia, as well as the island of Borneo.

Pitcher plants, unlike most other plants, get part of their nutrients from other animals, mostly insects. The plants lure their victims with sweet nectar, digesting those that fall into the pitcher.

Associate Professor Hugh Tan and doctoral student Lam Weng Ngai, both from the NUS department of biological sciences, observed 172 individual pitchers in forested areas of Singapore in 2016.

Mr Lam declined to say where they found the pitchers.

"The plants often get poached by enthusiasts, so we try not to reveal

their location," he said.

The two researchers found that the spider was in a sort of partnership with the plant.

Over the course of two studies – one published in August and the other last month – they found that even though the spiders would consume much of their victims' nutrients, they would drop the remains into the pitchers, allowing the plants to take whatever nutrients were left.

Mr Lam said that while this means the plant gets less nutrients from each dead insect, it benefits overall for two reasons.

First, not all insects normally fall into the pitcher plants, but having the crab spider there increases the likelihood of that happening. "We observed that pitchers that contained the spiders generally received more prey," he added.

Second, the spider tended to catch larger insects and this meant relatively more residual nutrients for the plant.

The findings suggest that this relationship is most beneficial during times of scarcity, because the spiders are more efficient at catching flying insects than the pitchers themselves.

Prof Tan said recent research has shown that under more stressful environmental conditions, organisms that normally have a mutually beneficial relationship – known as mutualism – begin relying on that partnership more often and with greater intensity.

"Our findings support this observation. In other words, the age-old adage, 'a friend in need is a friend indeed', is true not just for humans, but also for plants and animals."

Mr Lam said the pitcher-spider relationship is a model for mutualism



The slender pitcher plant (above) gets part of its nutrients from other animals, mostly insects. It lures its victims with sweet nectar, digesting those that fall into the pitcher. The *Thomisus nepenthophilus* (below, left), a species of crab spider, lives only in the plant. PHOTOS: LAM WENG NGAI



Doctoral student Lam Weng Ngai with the slender pitcher plant, *Nepenthes gracilis*, which is native to Singapore, Malaysia, Indonesia and the island of Borneo. PHOTO: NUS

in a broader sense, and is also similar to many other types of cooperation that happen in nature.

He added that understanding the mechanics of this particular relationship will provide clues into how

mutualism is affected by environmental conditions such as scarcity, which will become of greater concern especially in an age of climate change.

"This is also important because

we generally know very little about wild species in Singapore and understanding them is important if we want to conserve them."

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