

# Profitable cooperation: Ants protect and fertilize plants

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Weaver ants eat insects when wandering around the crowns of trees and bushes, leaving nutrient-rich waste that the plants can absorb and use directly. Credit: Kim Aaen, NatureEyes.

In a new article, researchers from Aarhus University describe how the

waste left by ants on plant leaves serves as a valuable fertiliser for the plants - handed on a silver platter.

You have often seen [ants](#) wandering about on leaves - even in tall [trees](#). In fact, it is the plants themselves that attract them by secreting sugar-containing nectar, which the ants eat with great pleasure. And on their journey around trunks and leaves, the ants snap insects that could otherwise damage the plants.

This has been known for many years and Danish researchers now use this knowledge in the battle against harmful insects in organic apple orchards. They simply move wood ants from the forest and create new anthills in the orchards.

Now researchers have found yet another positive effect of the ants' visit to the trees. Their urine or faeces, excreted together, contain amino acids and urea - substances that are commercially used to spray on leaves to fertilise the plants.

## **A small coffee plantation in the laboratory**

In tropical areas, there are many different species of ants that live exclusively in the tree crowns. They do not come down to the ground and therefore cannot get nutrition there. This applies, for example, to weaver ants that live in the crowns of many different trees and bushes - including coffee trees. Each tree can have up to 60,000 ants.



The leaves of the coffee plant are full of small dark fecal droppings -- ant waste containing urea and amino acids that the plants can absorb and exploit for growth. Credit: Joachim Offenberg.

In the laboratory, the researchers built a mini-coffee plantation with several individual coffee trees. The central coffee tree held a colony of weaver ants. All the coffee trees were placed in water, so the ants could not move from tree to tree unless there was a bridge to take them across. Accordingly, the researchers built suspension bridges between some, but not all, of the trees.

On the central tree, the ants were fed with an amino acid - glycine -

where the nitrogen atom consisted of the heavier nitrogen 15 ( $^{15}\text{N}$ ). The researchers were able to follow the labeled nitrogen in the neighbouring trees to which the ants walked over via the suspension bridges.

And the results were quite amazing.

## **Intravenous nutritional supplement**

First, the researchers observed that the visited trees had a higher content of nitrogen than the trees to which the ants did not have access. The trees visited by the ants also had larger crowns than the trees without ants.

On the 'visit trees' some of the leaves were wrapped so that the ants could not leave their waste here. But also in these leaves, the researchers were able to trace the labeled nitrogen.





Weaver ants are aggressive and protect their host plants from everything that moves. They even attack large animals to defend their territory. Credit: Kim Aaen, NatureEyes.

"For the first time, we have shown that nutrients from ant waste are taken up by the leaves and transported to other places in the tree," says senior scientist Joachim Offenberg, Department of Bioscience, Aarhus University, who was in charge of the studies.

"This has great ecological importance. The ants, which primarily feed on insects in the trees, digest the insects and hand the nutrients on a silver platter to the plants. You can almost say that the plants receive the nutrition intravenously exactly where they need it," explains Joachim Offenberg.

## **Great ecological importance**

The ants appear frequently on new shoots and on fruits - both areas of the plant that can benefit from an additional nutrient input.

The nutritional supplement to the leaves can be a great advantage for many different plants, and the researchers will now investigate how widespread the phenomenon is.

"We know that globally there are lots of [plants](#) inhabited by ants. The [nutritional supplement](#) for their leaves can have a major ecological significance and may also have been decisive for the evolution of ant-plant interactions," says Joachim Offenberg.

**More information:** "Foliar uptake of nitrogen from ant fecal droplets: an overlooked service to ant plants," *Journal of Ecology* 31 August, 2017  
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Provided by Aarhus University

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