Leafcutter ants accelerate the cutting and transport of leaves during stormy weather

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Leafcutter ants such as Atta sexdens or Acromyrmex lobicornis face two

major challenges when they leave the safety of the nest to forage: choosing the best plants from which to collect leaves and avoiding being surprised by strong winds or heavy rain, which would prevent them from carrying out their task.

A study by researchers at the University of São Paulo's Luiz de Queiroz College of Agriculture (ESALQ-USP) in Brazil shows that leafcutter ants are capable of predicting adverse weather by sensing changes in atmospheric pressure.

When the ants detect a sharp drop in atmospheric pressure, which in most cases is a sign that heavy rain and strong winds are imminent, they greatly accelerate the speed concluded that the ants are able to collect and store the largest possible amount of food for the nest.

The results of the study are published in the journal *Ethology*. The study was conducted under the aegis of the National Institute of Science and Technology for Semiochemicals in Agriculture, one of the NISTs funded by São Paulo Research Foundation—FAPESP and the National Council for Scientific and Technological Development (CNPq) in São Paulo State.

"We found that the leafcutter ant can sense changes in atmospheric pressure to anticipate adverse weather and change its foraging strategy," said José Maurício Simões Bento, a professor at ESALQ-USP and one of the authors of the study.

According to Bento, the search for food is essential for ant colonies, since relatively few individuals leave the nest.

"Many ant castes, such as queens and gardeners, as well as immature stages, stay inside the nest," he said. "The only castes that go outside are foragers, to cut and transport leaves, and soldiers, to defend the colony

entrance."

The first foragers to exit the nest are scouts, whose job is to search for leafy plants in the surrounding area. Once they locate plants with leaves available for cutting, they return home, marking the trail with a pheromone so that other workers can find the plants, cut leaves and carry them back to the nest.

Most of this vegetative material is used by the ants to grow a fungus, Leucoagaricus gongylophorus, with which they exhibit a mutualistic symbiotic relationship.

The role played by the ants in this mutualism is to go outside and bring back plant material to serve as a substrate for the growth of the fungus. The fungus donates nutrients through its hyphae (cell filaments) that the ants can eat.

"These leafcutter ants cultivate the fungus to have plenty of food available, especially as a reserve for periods of scarcity," Bento said.

Faster foraging

To determine whether the ants are able to sense changes in atmospheric pressure and change their foraging strategy accordingly, researchers decided to analyze worker recruitment and leaf-cutting patterns under low and high atmospheric pressure compared with stable conditions.

They placed three nests of A. sexdens in a barometric chamber and tested different pressure levels for their impact on the ants' foraging activity. The pressure was first raised to 950 millibars (mbar) and maintained for one hour to allow the colony to acclimatize. It was then held steady, followed by an increase to 958 mbar and a decrease to 942 mbar, for three hours in each case.

"We chose 8 mbar as the interval between low, stable and high pressure because this is the average recorded for Brazilian cities that produce eucalyptus or roses, and where A. sexdens occurs naturally and is a pest for these crops," Bento explained.

After these different levels of atmospheric pressure were reached, the colonies were filmed for one hour, since rain and wind occur several hours after the pressure drops.

At this point, the entrance to each colony was opened to allow the ants exit to a rosebush via a platform. The number of leaves cut and carried into each nest was counted, as were the time taken by the first scout to leave and the total number of workers recruited to forage. The results were subjected to statistical analysis.

The analysis showed that scouts left to forage much faster when the atmospheric pressure fell. At low pressure, they left 2.8 times faster than at steady pressure and 3.7 times faster than at high pressure.

"Increasing their foraging speed enables the ants to find a larger number of leaves on plants. Rainstorms blow many leaves away, reducing the amount of material available for ants to take back to the colony," Bento said.

The researchers did not observe a difference in the number of workers recruited for foraging. However, between 1.5 and 2.0 times as many leaves were cut and taken to the nests under low pressure than under steady or high pressure.

"Individual ants perceive the advent of low pressure, and this change triggers an increase in foraging efficiency," Bento said.

"They individually start cutting and carrying more leaves, and this results

in higher productivity for the nest as a whole."

In Bento's opinion, the efforts of all a colony's individual members to harvest and bring in a larger amount of food when they are stressed by adverse conditions shows a high capacity for decision making in favor of group maintenance with no central or unitary control. "This is additional evidence of how evolved these insects are," he said.

More information: Fernando R. Sujimoto et al, Foraging activity of leaf-cutter ants is affected by barometric pressure, *Ethology* (2019). DOI: 10.1111/eth.12967

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