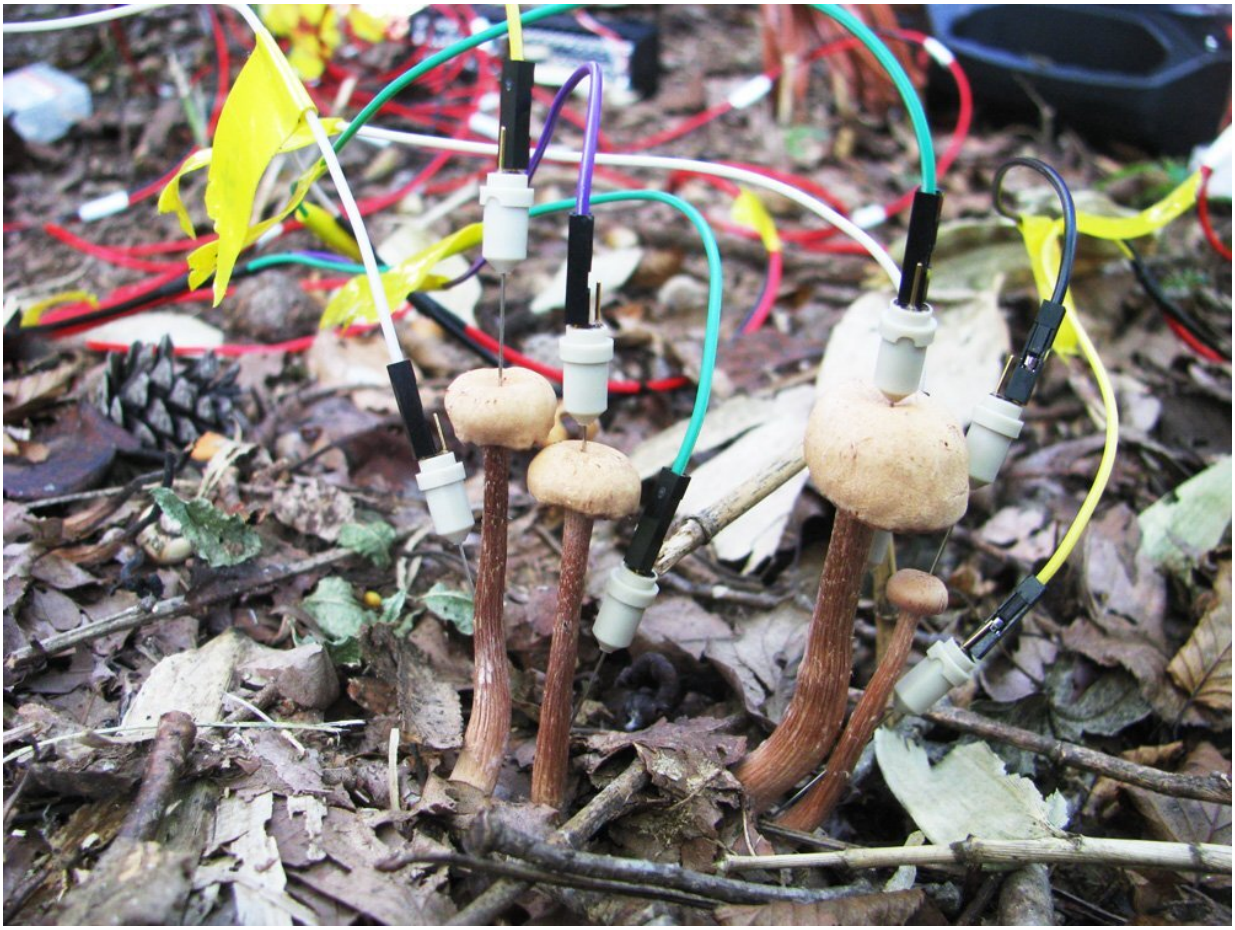
Mushrooms and their post-rain, electrical conversations

April 28 2023



Mushrooms in the field with an electrode attached to the top and bottom. Credit: Yu Fukasawa

Certain fungi play a critical role in the ecological sustenance of forest trees. Ectomycorrhizal fungi are one such example. Commonly found on pine, oak, and birch trees, ectomycorrhizal fungi form a sheath around the outside of tree roots, and their mycelial body develops into vast underground networks that absorb vital nutrients from the soil and transfer it to the trees.

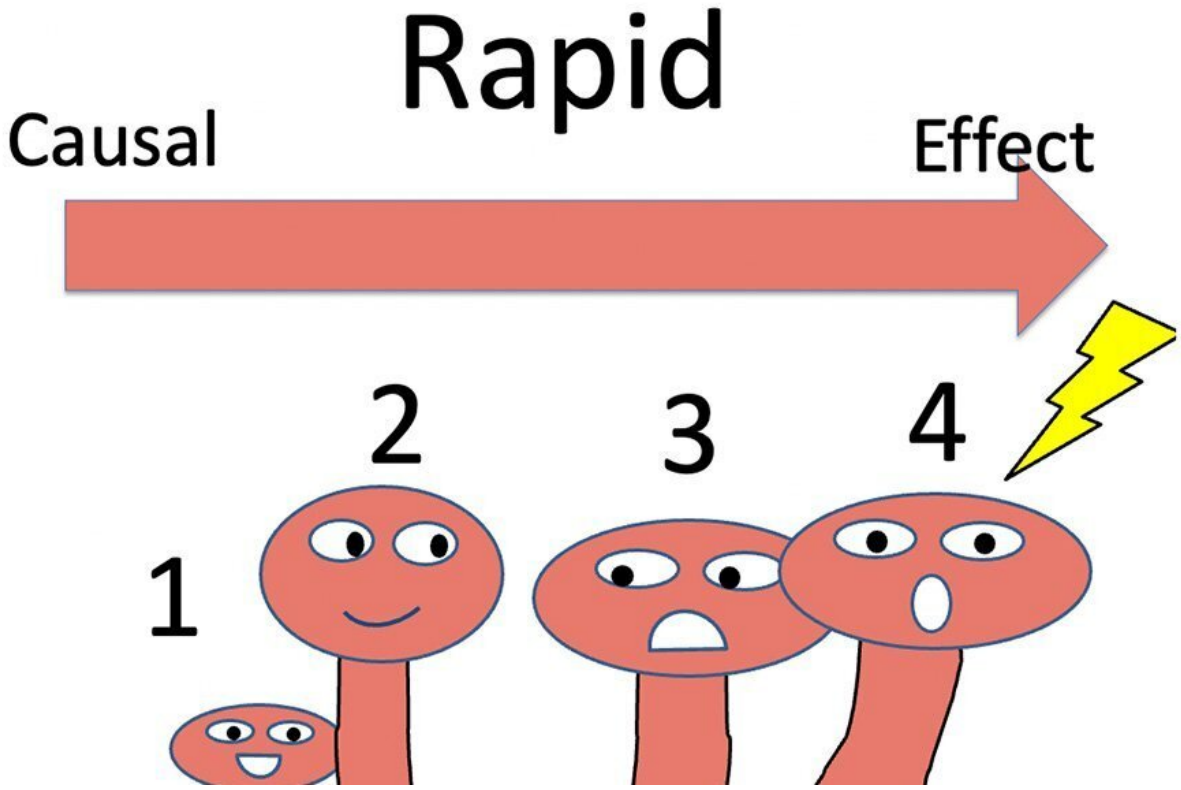
Scientists have been studying the possibility of electrical signal transfer between mushrooms and across trees via the mycelial networks. It is thought that fungi generate electrical signals in response to external stimuli and use these signals to communicate with each other, coordinating growth and other behavior. It has even been hypothesized that these signals can be used to help transfer nutrients to plants and trees.

Still, current scientific evidence remains sparse. Moreover, many studies have been limited to the laboratory, failing to recreate what happens in the wild.

Now, a group of researchers has recently headed to the forest floor to examine small, tan-colored ectomycorrhizal mushrooms known as Laccaria bicolor. Attaching electrodes to six mushrooms in a cluster, the researchers discovered that the electrical signals increased after rainfall. Details of their research were reported in the journal *Fungal Ecology* on March 14, 2023.

"In the beginning, the mushrooms exhibited less electrical potential, and we boiled this down to the lack of precipitation," says Yu Fukasawa from Tohoku University, who lead the project along with Takayuki Takehi and Daisuke Akai from the National Institute of Technology, Nagaoka College, and Masayuki Ushio from the Hakubi Center, Kyoto University (presently at the Hong Kong University of Science and Technology). "However, the electrical potential began to fluctuate after

raining, sometimes going over 100 mV."



The potential electrical signal transfer across mushrooms and its directionality. Credit: Yu Fukasawa

The researcher correlated this fluctuation with precipitation and temperature, and causality analysis revealed that the post-rain electric potential showed signal transport among mushrooms. This transport was particularly strong between spatially close mushrooms and demonstrated directionality.

"Our results confirm the need for further studies on fungal electrical potentials under a true ecological context," adds Fukasawa.

More information: Yu Fukasawa et al, Electrical potentials in the ectomycorrhizal fungus Laccaria bicolor after a rainfall event, *Fungal Ecology* (2023). DOI: 10.1016/j.funeco.2023.101229

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