

In symbiosis: Plants control the genetics of microbes

February 4 2021



Each spore contains hundreds of nuclei. The image was generated using confocal microscopy. The bright spots within the spores represent nuclei labelled with fluorescent dye. Images are colour coded along z-axis for depth recognition, with white and red colours being closer to the observer while blue colours being the furthest. Each image is the result of approximately 300 z-stacks (0.35um intervals). Credit: University of Ottawa/ Microscope Laboratory (Ottawa-RDC, Agriculture and Agri-Food Canada)

Researchers from the University of Ottawa have discovered that plants may be able to control the genetics of their intimate root symbionts—the organism with which they live in symbiosis—thereby providing a better understanding of their growth.

In addition to having a significant impact on all terrestrial ecosystems, their discovery may lead to improved eco-friendly agricultural applications.

We talked to research lead Nicolas Corradi, Associate Professor in the Department of Biology and Research Chair in Microbial Genomics at the University of Ottawa, and lead author Vasilis Kokkoris, Postdoctoral Fellow in the Corradi Lab, to learn more about their recent study published in the journal *Current Biology*.

Can you tell us more about your findings?

Nicolas Corradi: "We have uncovered a fascinating [genetic](#) regulation between [plants](#) and their microbial symbionts, known as Arbuscular Mycorrhizal Fungi (AMF).

AMF are plant obligate symbionts that grow within the [plant roots](#) and

help their hosts to grow better and be more resistant to environmental stressors.

AMF genetics have long been mysterious; while typical cells carry one nucleus, the cells of AMF carry thousands of [nuclei](#) that can be genetically diverse. How these nuclei communicate with each other and whether the plants can control their relative abundance, has been a total mystery.

Our work provides insights into this unique genetic condition:

1. We demonstrate that the host plant symbiont influences the relative abundance of thousands of co-existing nuclei carried by their fungal symbionts.
2. We find evidence that co-existing nuclei of different genetic backgrounds cooperate, rather than compete with one another thus potentially maximizing growth benefits for both the fungi and their plant partners."

How did you come to these conclusions?

Vasilis Kokkoris: "We implemented a novel molecular approach accompanied by advanced microscopy and mathematical modelling. Every single AMF spore carries hundreds of nuclei (see image).

By analyzing single spores, we were able to quantify the genetics of thousands of nuclei and define their relative abundance in different fungal strains and across plant species.

To ensure that we accurately analyze single nuclei, we used advanced microscopy to visualize and count the nuclei in the spores.

Lastly, we used mathematical modelling to prove that the observed abundance of nuclear genotypes we identified cannot be a product of luck but instead is the result of a driven cooperation between them.

To better understand what is regulating the AMF nuclei we grew different AMF strains with different hosts and found that plants have control of the relative abundance of the fungal nuclei."

What are the impacts of your discovery?

Nicolas Corradi: "For many years, AMF have been considered to be genetic peculiarities and far away from model organisms. Inconsistencies are commonly observed in plant-AMF experiments. For example, growing the same fungal strain with different plants can lead to drastically different plant yields. For a long time, this variance in plant growth was blamed on the AMF mysterious genetics.

Our research provides an answer as we demonstrate that the genetics of these fungi, and their effect on plant growth, can be manipulated by plants thus explaining the reason for the observed variability on plant growth.

From an environmental standpoint, this new knowledge allows for better understanding how plants can influence the genetics of their symbiotic partners, thus influencing entire [terrestrial ecosystems](#).

From an economic standpoint, it opens doors to improved sustainable agricultural applications."

The paper "Host identity influences nuclear dynamics in [arbuscular mycorrhizal fungi](#)" is published in the journal *Current Biology*.

More information: *Current Biology* (2021). [DOI:](#)

[10.1016/j.cub.2021.01.035](https://doi.org/10.1016/j.cub.2021.01.035) , [www.sciencedirect.com/science/ ...
ii/S0960982221000683](https://www.sciencedirect.com/science/article/pii/S0960982221000683)

Provided by University of Ottawa

Citation: In symbiosis: Plants control the genetics of microbes (2021, February 4) retrieved 24 April 2024 from <https://phys.org/news/2021-02-symbiosis-genetics-microbes.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.