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THREE-PARTNER SYMBIOSIS AMONG LEGUMES, MYCORRHIZAE, AND N-FIXING BACTERIA CHANGES WITH LIGHT AND SOIL NITROGEN CONDITIONS

Nikayla Ficano, Stephen Porder, and Lindsay A. McCulloch

Study description

Treefall gaps in Neotropical rainforests alter environmental conditions, influencing interactions between plants and microbes. We manipulated light and soil nitrogen availability (which change with gap formation) in gaps and intact forest to explore how these conditions affect the three-partner symbiosis among legumes, nitrogen-fixing bacteria, and arbuscular mycorrhizal fungi (AMF). All partners were more successful in the gaps (under higher light availability), but light only had a positive effect on AMF when nitrogen was added and plants invested less in nitrogen-fixing bacteria. Our results suggest that studying these symbionts together enhances our understanding of how they interact under varying environmental conditions.

Ficano, N., S. Porder, and L. A. McCulloch. 2021. Three-Partner Symbiosis among Legumes, Mycorrhizae, and N-Fixing Bacteria Changes with Light and Soil Nitrogen Conditions. Bull Ecol Soc Am 102(4):e01931. https://doi.org/10.1002/bes2.1931



Photo 1. A canopy gap at La Selva Biological Station in Costa Rica, created from treefalls during a storm. Seedlings planted under gap conditions were located here, and seedlings planted under understory conditions were in adjacent intact forest. Photo credit: Orlando Vargas Ramirez.



Photo 2. Half of the seedlings planted in the gap were kept under a shade cloth to mimic understory light conditions (depicted in panel A). This experimental design allowed us to explore the effects of light alone on the tripartite symbiosis, as it is only one of many factors that vary between gaps and intact forest. Panel B is a top-down view of one of the experimental plots. There are two seedlings of each of the three legume species used in the experiment: (from top to bottom) *Stryphnodendron microstachyum, Zygia longifolia,* and *Pentaclethra macroloba*. Photo credit: Lindsay McCulloch.

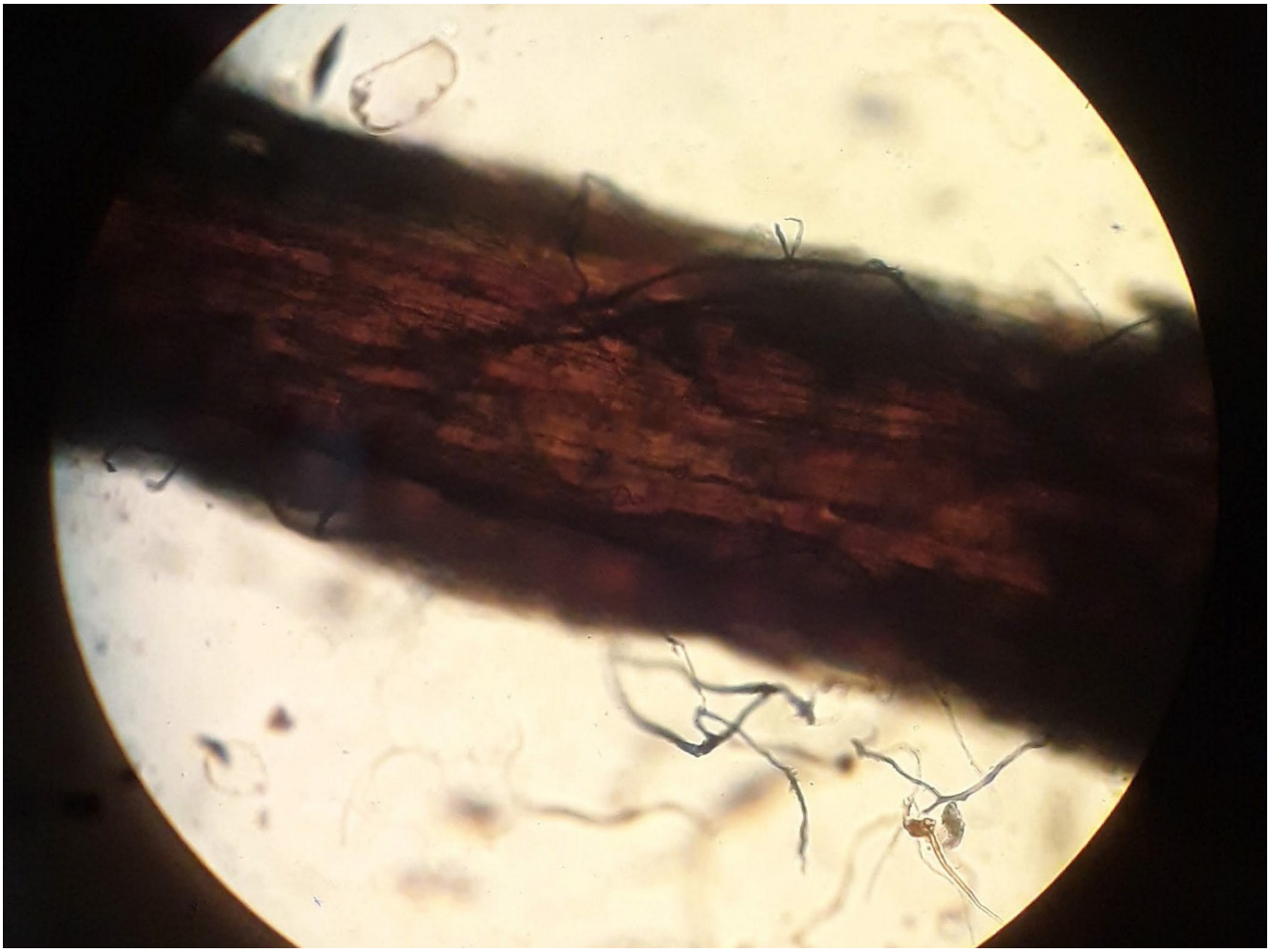


Photo 3. One mm of a root colonized by arbuscular mycorrhizal fungi, stained, and observed under 200× magnification. 100 such images were observed for each seedling to estimate the percentage of each seedling's root system that was colonized by arbuscular mycorrhizal fungi. This metric was a proxy for carbon investment in arbuscular mycorrhizal fungi by the seedling. Photo credit: Nikayla Ficano.

These photographs illustrate the article "Tripartite legume–rhizobia–mycorrhizae relationship is influenced by light and soil nitrogen in Neotropical canopy gaps" by Nikayla Ficano, Stephen Porder, and Lindsay A. McCulloch published in *Ecology*. https://doi.org/10.1002/ecy.3489.