Theme 1
Status and trends of global soil nutrient budget

Rhizosphere community diversity of *Coffea arabica* implanted in the Gorongosa National Park (Mozambique) across different agroforestry systems

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INTRODUCTION

The genus *Coffea* is native to Africa and comprises more than 125 species, of which only two dominate the world market: *C. arabica* L. (Arabica type of coffee) and *C. canephora* Pierre ex A. Froehner (Robusta type of coffee). Gorongosa National Park (GNP) in Mozambique is perhaps Africa's greatest wildlife restoration story. However, the link between soil microbial diversity and *C. arabica* agroforestry system productivity is unclear. In this context, the present study aims to:

Explore the genetic diversity, structure and microbial composition of *C. arabica* with emphasis (Bacteria, Fungi and Archaea) in different agroforestry systems (Figure 1).

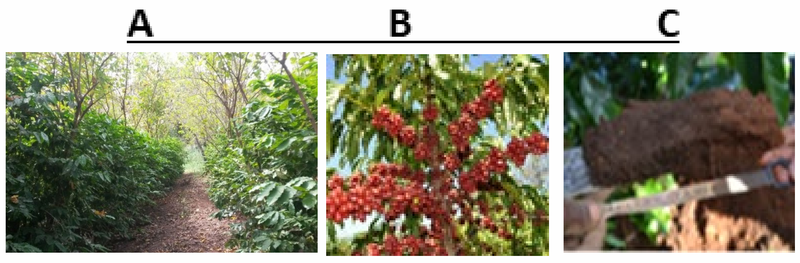


Figure 1. (A) Shaded coffee production system (B) Coffee fruits in the ripening phase (C) Harvest of coffee rhizosphere implanted in the Gorongosa-Mozambique National Park.

METHODOLOGY

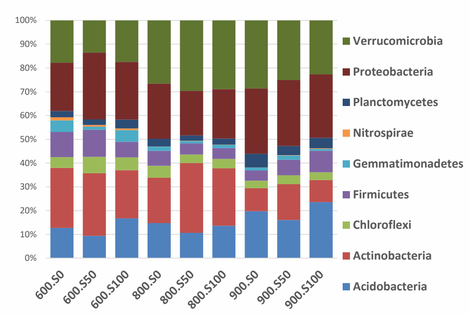
This study, based on high-throughput Illumina MiSeq sequencing, explores the diversity, structure, and composition of *C. arabica* rhizosphere communities (Bacteria, Fungi, and Archaea) grown in the GNP at different elevations (600m, 800m, and 900m) and under different levels of canopy shading (no shadow, 50% and 100% of shadow from native trees).

RESULTS

The alpha-diversity results (observed operational taxonomic units and Shannon index) were significantly different between agroforestry systems, especially in the case of Fungi that showed the lowest diversity in the rhizosphere of *C. arabica* plants grown at 600m without shade (Figure 2).

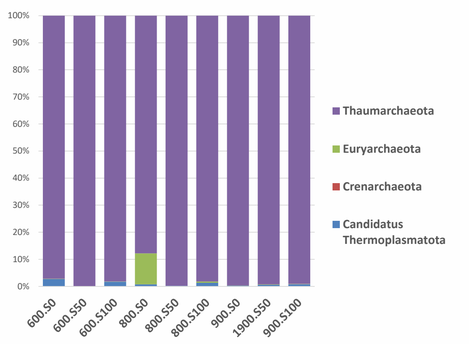
A: Bacteria

Level	Shadow	OTUs	H
600	0	691	7
	50	649	6
	100	728	7
800	0	672	6
	50	568	5
	100	586	6
900	0	635	6
	50	681	7
	100	648	7



B: Archaea

Level	Shadow	OTUs	H
600	0	316	4
	50	303	4
	100	346	4
800	0	280	3
	50	318	4
	100	269	3
900	0	315	4
	50	340	4
	100	291	4



C: Fungi

Level	Shadow	OTUs	H
600	0	277	2
	50	583	5
	100	435	4
800	0	413	4
	50	443	5
	100	406	4
900	0	463	4
	50	437	3
	100	352	3

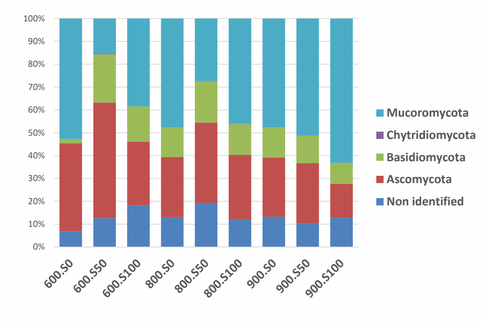


Figure 2. Left: Shannon diversity values (H) and community richness (OTUs). Right: Taxonomical diversity. A: Bacteria; B: Archaea; C:Fungi. *Coffea arabica* grown in 3 altitude levels (600, 800, 900 meters) and different levels of shading: 0% (no shading), 50% of shading and 100% of shading by neighboring trees.

The evaluation of the microbiome composition revealed the presence of abundant phyla such as Proteobacteria and Verrucomicrobia for Bacteria, Ascomycota and Mucoromycota for Fungi, while Archaea was dominated by Thaumarchaeota (Figure 2).

CONCLUSIONS

This study demonstrates the benefits of shade trees in this agroforestry system and emphasizes the rhizosphere as a key link in indirect impacts of shade trees on the health and productivity of *C. arabica* in diverse systems. Evidencing the need for more genetic studies to clarify the importance of using agroforestry systems in coffee trees, taking into account different altitudes and shading levels.

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