

Functional shifts of rhizospheric fungi in lead-contaminated soils

Eugenia Menoyo^{a*}, Valeria Faggioli^b, M. Julieta Salazar^c, Alejandra G. Becerra^c

^aGEA-IMASL-CONICET, Universidad Nacional de San Luis, Ejército de los Andes 950, 5700 San Luis, Argentina. ^bInstituto Nacional de Tecnología Agropecuaria, EEA Marcos Juárez, Ruta 12 km 36, 2580 Marcos Juárez, Argentina. ^cIMBIV-CONICET, Universidad Nacional de Córdoba, Av. Vélez Sársfield 1611, X5016CGA Córdoba, Argentina. *e-mail: emenoyo@email.unsl.edu.ar

Introduction

A wide range of anthropogenic activities contributes to the accumulation of heavy metals in soil, water, and air, thereby altering the physicochemical and biological properties of the environments. Microbial communities that inhabit contaminated ecosystems offer significant potential tools for bioremediation. In this study, we analysed rhizospheric soils associated with two native plant species that naturally occur in lead-contaminated sites to assess how Pb levels and host identity influence fungal communities.

Methods

Six sampling sites were selected around a battery recycling factory in Bouwer, Córdoba, Argentina (Fig. 1, Table 1). *Bidens pilosa* L. (Asteraceae), an annual herb, and *Jarava* aff. *ichu* (Poaceae), a perennial grass, were established spontaneously along a gradient of distance from a Pb smelting site. At each site, three individuals per species were sampled. In rhizospheric soil, DNA extraction and sequencing were performed, and fungal function profiles were assigned to fungal amplicon sequence variants (ASVs).

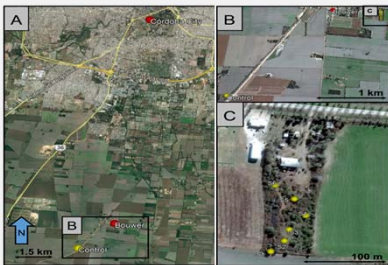


Fig. 1. A, B, C: Sites around battery recycling factory in Bouwer, Córdoba.

Site	Pb _{total} (μg g ⁻¹)
C	15 ± 1,6
Pb 1	212 ± 19,6
Pb 2	291,8 ± 50
Pb 3	353,2 ± 144,1
Pb 4	1608,9 ± 569
Pb 5	12484 ± 1539.5
Pb 6	29447 ± 9929

Table 1. Sampling sites and Pb levels.

Results

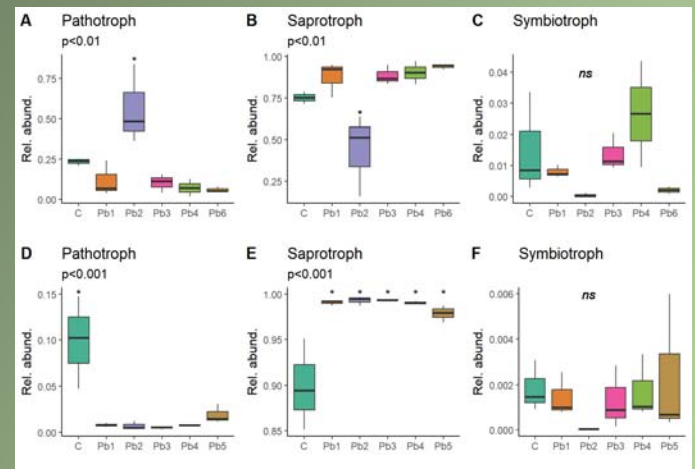


Figure 2. Relative abundance of fungal functional guilds in the rhizosphere of *B. pilosa* (A, B, C) and *J. ichu* (D, E, F) under increasing levels of soil Pb.

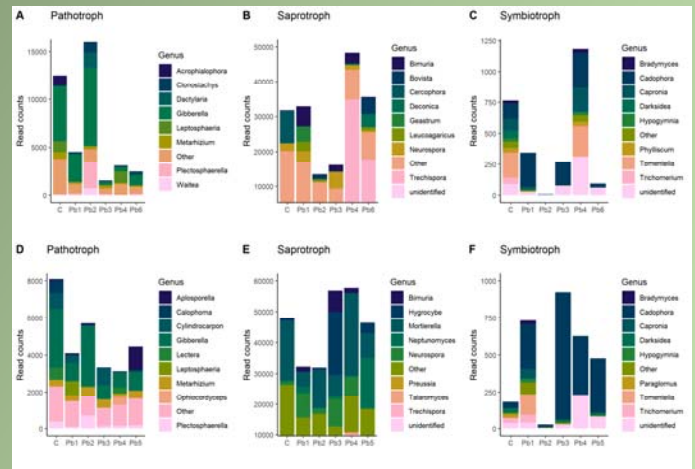


Figure 3. Representative genera for each functional guild in the rhizosphere of *B. pilosa* (A, B, C) and *J. ichu* (D, E, F) under increasing levels of soil Pb. "Other" represents taxa with less than 0.001 relative abundance.

Conclusions

Our findings indicate that fungal communities associated with native plants are strongly influenced by soil Pb contamination levels. We highlight the importance of identifying taxonomic and functional groups adapted to specific Pb conditions, an essential step toward the future selection of native fungi for bioremediation.

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