

Evaluation of potential bacteriocin-producing bacteria recovered from soil. A holistic OneHealth strategy against multidrug-resistant pathogens and for food-industry applications.

Mario Sergio Pino-Hurtado^{1*}, Rosa Fernández-Fernández^{1*}, Beatriz Robredo², Carmen González-Azcona¹, Irene Marañón-Clemente¹, Oscar García-Tuesta¹, Carmen Tenorio¹, Carmen Lozano¹, Myriam Zarazaga¹, Carmen Torres¹.

¹Area of Biochemistry and Molecular Biology, OneHealth-UR Research Group, University of La Rioja, Logroño, Spain.
²Area of Didactic of Experimental Sciences, OneHealth-UR Research Group, University of La Rioja, Logroño, Spain.

mario-sergio.pino@unirioja.es

rosa.fernandez@unirioja.es



OneHealth-UR Group

INTRODUCTION

Soils are reservoirs for a wide variety of bacteria, that coexist and compete for access to better nutrient sources by producing bacteriocins as a defense mechanism to a hostile ecosystem. These antimicrobial peptides would be of great interest for biomedical and food-industry applications.

OBJECTIVES

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Evaluate the antimicrobial-activity (AA) of soil bacteria against a wide range of relevant pathogens to detect bacteriocin-producing isolates (P-BAC+).

MATERIALS AND METHODS

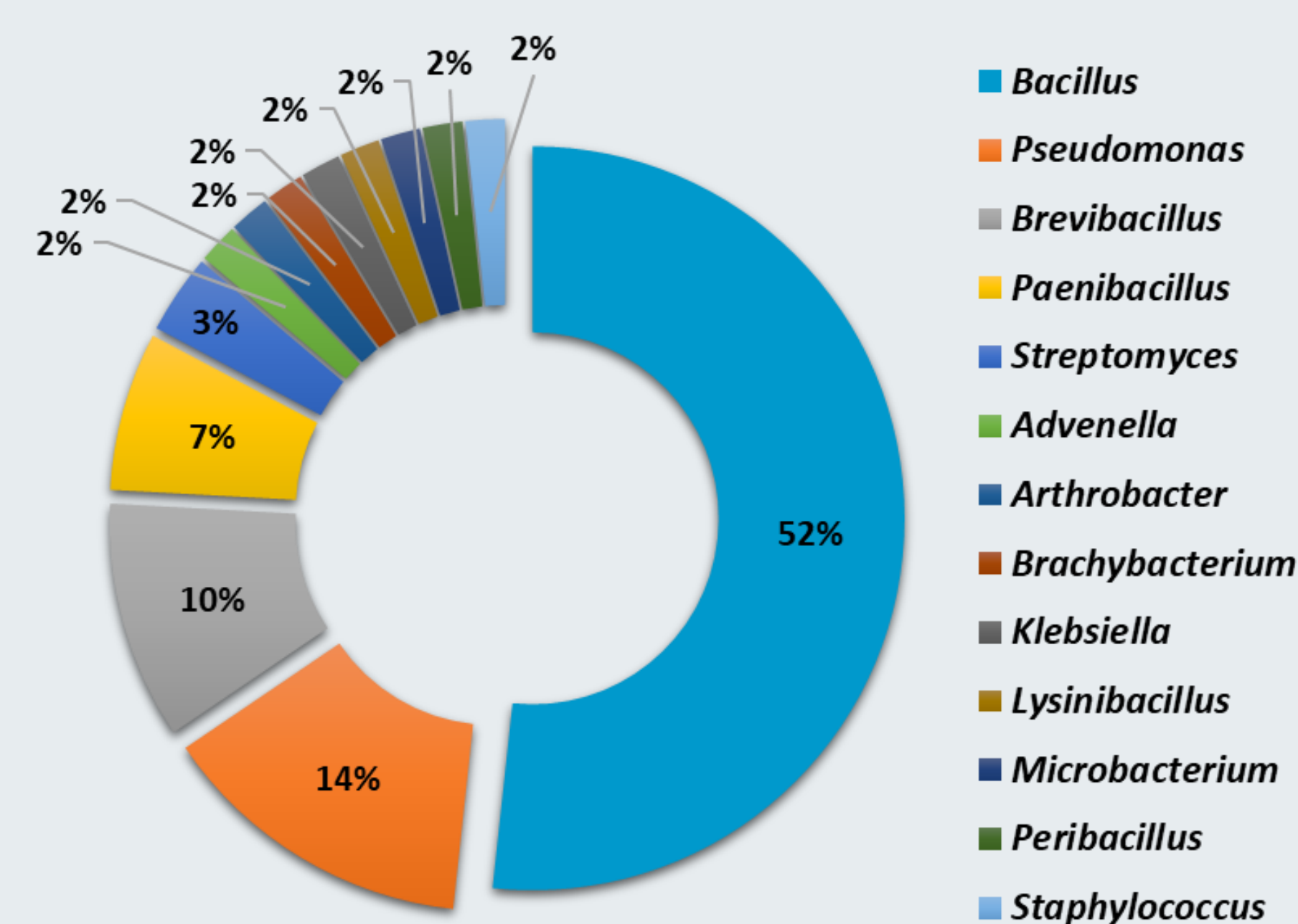
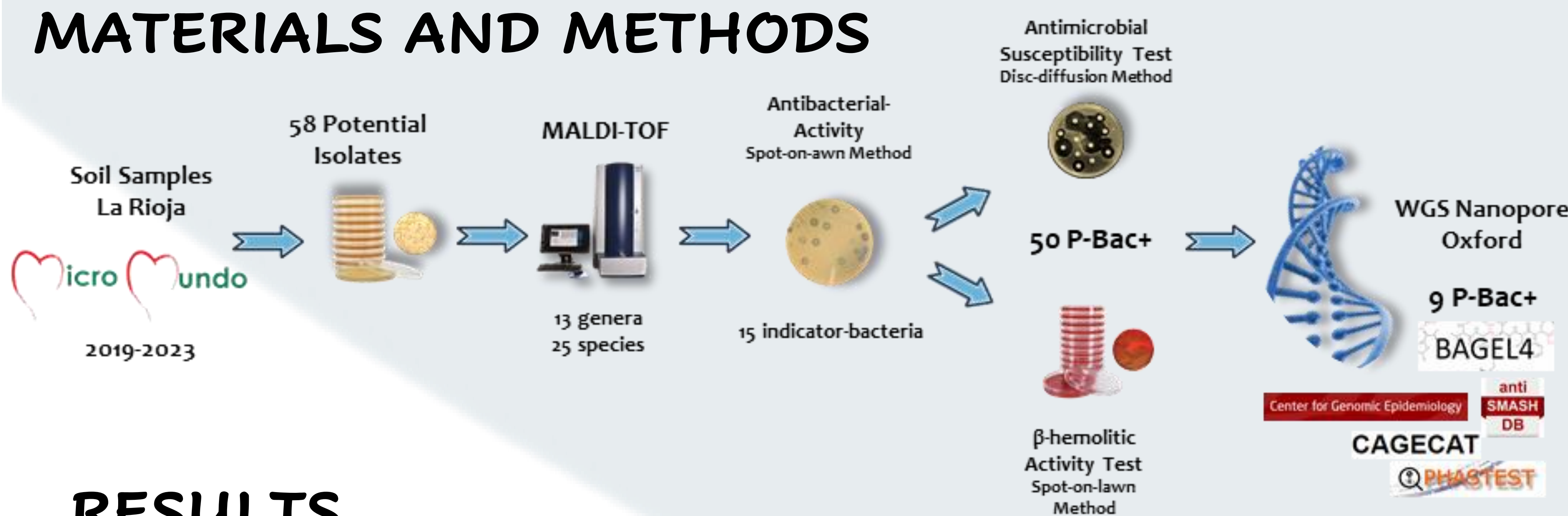


Fig. 1. Diversity of genera of the 50 P-Bac+ recovered

RESULTS

- 50 P-Bac+ showed AA against at least one of the 15 indicator-bacteria tested, corresponding to 13 genera and 25 species (Figure 1).
- 51.4% of the P-Bac+ were susceptible to all antibiotics tested, while 67% lacked β -hemolytic activity.
- B. laterosporus* strain X7237 showed AA against 8/15 indicators, including methicillin-resistant *S. aureus* and *L. monocytogenes*.

4. The WGS analysis of the nine selected P-Bac+ isolates revealed:

- Presence of 9 different BGC in 8 out of the 9 genomes analysed. It highlights the high presence of Lanthipeptide-like and Uberolysin-like coding operons (Figure 2).
- No plasmids were detected (Table 1).
- Complete phages were detected in 7 out of 9 P-Bac+ isolates (Table 1).

Table 1. Phenotypic and Genotypic characterizations of the nine selected P-Bac+ isolates

Isolates	Identification	Phenotypic Characterization	Genotypic Characterization (WGS)				
			AMR	AMR	AMR non structural genes	BGC	Plasmids
X7237	<i>Brevibacillus laterosporus</i>	Susceptible	-	<i>vanS-F</i> <i>vanR-F</i>	Lanthipeptide (Gallidermin, Linocin_M18) Sactipeptide	-	NC_028930 NC_028749 NC_028969
X7259	<i>Bacillus pumilus</i>	Susceptible	<i>cat86</i>	-	Lanthipeptide-like Uberolysin/Pumilarin	-	NC_001884 NC_048631 NC_028991
X7262	<i>Brevibacillus laterosporus</i>	Susceptible	-	<i>vanY-F</i>	RiPP-Like	-	NC_022980 NC_028805 NC_028749
X7264	<i>Paenibacillus apiarius</i>	PEN-FOX-TOB	<i>blaBPU</i>	-	Uberolysin/Pumilarin	-	NC_028991
X7270	<i>Pseudomonas kilonensis</i>	TIC-ATM	<i>blaBPU</i>	-	Uberolysin/Pumilarin	-	NC_029104
X7276	<i>Staphylococcus hominis</i>	Susceptible	-	-	-	-	NC_020490 NC_020490
X9431	<i>Bacillus pumilus</i>	Susceptible	<i>blaBPU</i> , <i>cat86</i>	-	Uberolysin/Amylocyclin	-	NC_029104 NC_048640
X9467	<i>Bacillus mycoides</i>	Susceptible	<i>fosB</i> , <i>bla1</i> , <i>bla2</i>	<i>vanR-A</i>	Lanthipeptide i (Subtilomycin) Lanthipeptide ii (SwittermicinA/ Macedovicin, Cerecidin) RiPP-like	-	-
X9472	<i>Bacillus altitudinis</i>	Susceptible	-	-	Uberolysin/Pumilarin/ Amylocyclin	-	-

Antibiotics tested: penicillin (PEN), ceftazidime (CAZ), cefepime (CEP), ceftazidime (CAZ), ciprofloxacin (CIP), chloramphenicol (CHL) and linezolid (LZD). For *Pseudomonas kilonensis*: ticarcillin (TIC), levofloxacin (LEV), meropenem (MER), aztreonam (AZT), ceftazidime (CAZ) and ciprofloxacin (CIP).

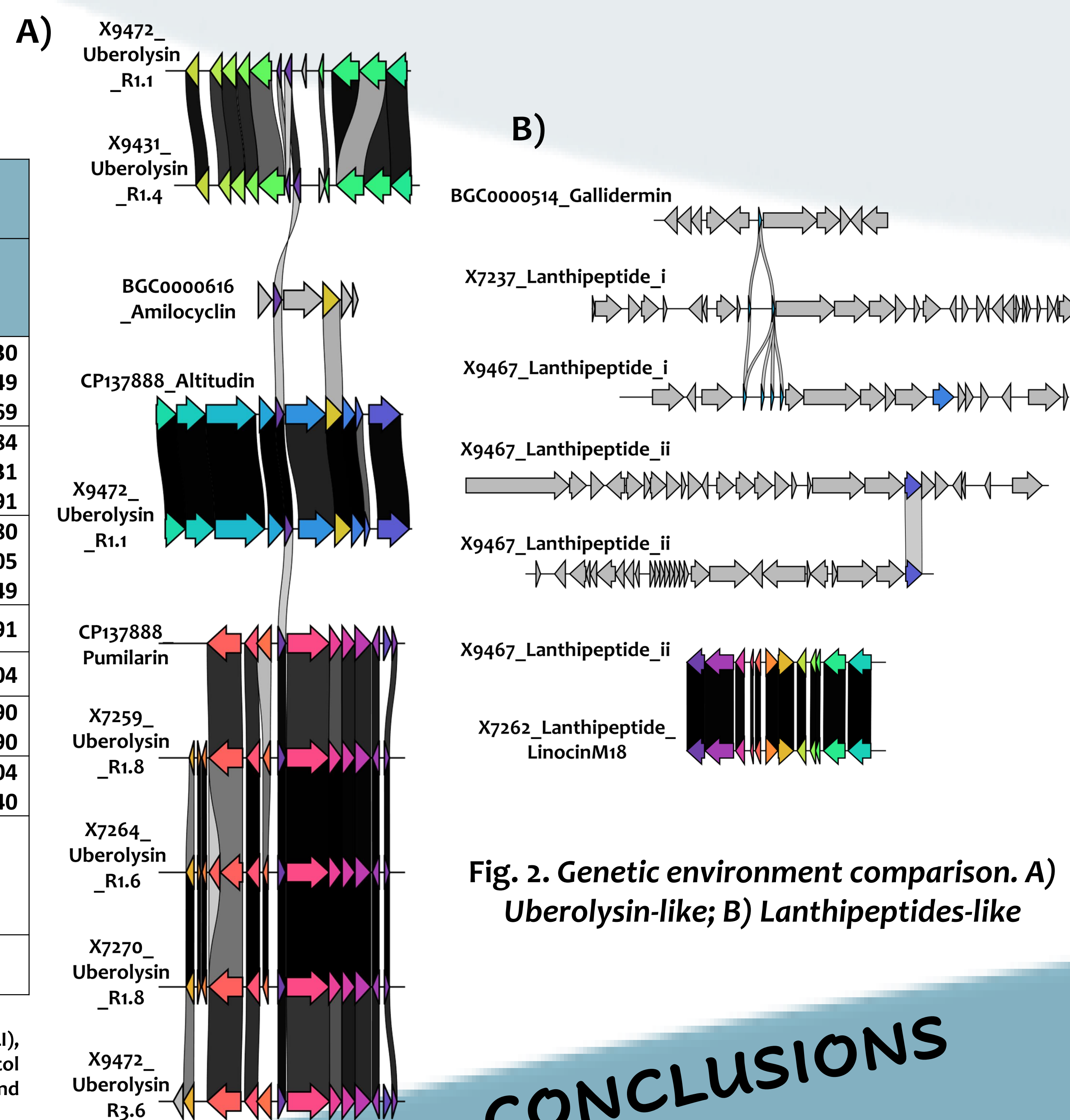


Fig. 2. Genetic environment comparison. A) Uberolysin-like; B) Lanthipeptides-like

CONCLUSIONS

Soils are reservoirs of bacteriocin-producing bacteria with antimicrobial-activity against relevant pathogens, which is of great interest for biomedical and food-industry applications.

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