

TITLE: GENOTYPES AND PHENOTYPES OF RESISTANCE TO HEAVY METALS AND PESTICIDES IN CRITICAL PRIORITY BACTERIAL PATHOGENS RELEVANT IN ONE HEALTH

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ABSTRACT:

Industrial and agribusiness activities have caused serious environmental problems due to the inadequate disposal of their effluents, the treatment of which being one of the most important issues in relation to pollution control. Microorganisms can be used as biomarkers of contamination, therefore the knowledge of mechanisms associated with resistance and the immobilization and biotransformation capacity of pollutants can be an important factor for the identification of adapted strains, efficient in the treatment and recovery of contaminated areas. The aim of this study was to evaluate the tolerance profile of critical priority bacterial pathogens relevant in One Health, to heavy metals (mercury, silver, tellurium, and arsenic) and to the pesticide glyphosate, identifying the associated resistome. The phenotype-genotype correlation was evaluated in antibiotic-resistant isolates of *Klebsiella pneumoniae* ($n= 35$), *Escherichia coli* ($n= 46$), and *Salmonella spp.* ($n= 19$), by MIC determination using the microdilution method, and by analysis of their respective genomic sequences. Among the isolates of *K. pneumoniae*, 32 strains showed elevated MIC (64-512 $\mu\text{g/mL}$) for silver metal, of which 20 carried the *silPABCRSE* operon responsible for conferring resistance. A strain of *K. pneumoniae* carrying *terABCEWXY* genes showed a MIC of 64 $\mu\text{g/ml}$ for tellurium. Six strains of *E. coli* showed an MIC ≥ 32 $\mu\text{g/mL}$ for tellurium, with 3 strains carrying the *tehA/B* genes. Other 6 strains of *E. coli* showed MIC for silver of 256-512 $\mu\text{g/mL}$, but only two carried *silPFCE* genes. Two strains of *Salmonella* showed MIC 64-128 $\mu\text{g/mL}$ for tellurium, and carried *tehA/B* and *terABCDEF* genes. In relation to arsenic, 24 strains of *E. coli* had a MIC ≥ 512 $\mu\text{g/mL}$, and of these, 12 strains carried the *arsRBC* genes. *Salmonella spp.*, which carried the *merR* gene, had MICs of 8-16 $\mu\text{g/mL}$ for mercury. It was not possible to correlate the presence of the *phnC-P* operon (suggested as responsible for glyphosate tolerance) with elevated MICs for this compound. The silver tolerance mediated by the operon *silPABCRSE* was a predominant feature in *K. pneumoniae* strains belonging to the clonal group CG258, suggesting an intrinsic property that has contributed to the persistence and wide dissemination of CG258 within a One Health context, which could be as a biomarker to monitor the impact of the use of silver compounds and silver-based biomaterial on different human activities.

Keywords: Multidrug-resistant bacteria, Antimicrobial resistance, Resistome, Heavy metals, One Health, Silver, Biomarker.

Development Agency: CAPES