

Assessing the Resistance Levels of Soil Bacteria for Amoxicillin, Ciprofloxacin, Sulfamethoxazole and Trimethoprim

H.P.S.R. Premarathne², W.S. Dandeniya*, K.K.C.J. Kamburugoda¹ and S. Thaboshini¹

Postgraduate Institute of Agriculture
University of Peradeniya
Sri Lanka

Antibiotic resistance makes the control of infectious diseases a challenging task. Due to extensive use of animal-manure containing antibiotic residues and antibiotic-resistant bacteria (ARB), agricultural soils have become a main reservoir of antibiotic resistance genes. Investigating ARB populations in natural-ecosystems, using the established clinical breakpoint concentrations which have been developed considering pathogenic bacteria may overlook species important in antibiotic resistance. This study aimed to determine the threshold levels of amoxicillin (AMX), ciprofloxacin (CIP), sulfamethoxazole (SMT) and trimethoprim (TRM) to screen ARB from soil. Soils were collected at 0-10 cm depth from two intensively cultivated vegetable lands using animal-manure and a forest land. Bacteria were enumerated using pour plate technique on tryptic soy agar (TSA) medium spiked with each antibiotic separately at 0, 1, 5, 10 and 15 µg/mL in three replicates. Total bacterial population in cultivated soils ($5.28 \pm 0.35 \text{ Log}_{10} \text{ CFU/g}$) was significantly higher ($p < 0.05$) than that in forest soil ($3.21 \pm 0.16 \text{ Log}_{10} \text{ CFU/g}$). Spiking TSA with 1 µg/mL of antibiotic, reduced bacterial abundance by 69% to 99%. Cultivated soils had significantly higher ($p < 0.05$) abundance of ARB than in the forest soil. But relative abundance of ARB was higher in forest soil than in the cultivated soils. The abundance of ARB declined with increasing antibiotic concentration in TSA. In all three soils, relative abundance of ARB declined below 1% with 10 µg/mL concentration of AMX, SMT and TRM, and 1 µg/mL of CIP. Thus, these concentrations could be used as threshold levels to screen for respective ARB populations from soil. This knowledge can be used to monitor and prevent spread of antibiotic resistance in soils.

Keywords: Antibiotic resistance, Animal manure, Amoxicillin, Ciprofloxacin, Soil bacteria

*Corresponding author: warshisd@agri.pdn.ac.lk; ORCID: 0000-0003-0795-3923

¹Department of Soil Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka

²Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka