



Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

**Toxicity of ciprofloxacin through generations of the soil
invertebrate *Enchytraeus crypticus***

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January 19th, 2023 from 12:15 to 13:30 CET



Why would ciprofloxacin (CIP) end up accumulating on agricultural soil?

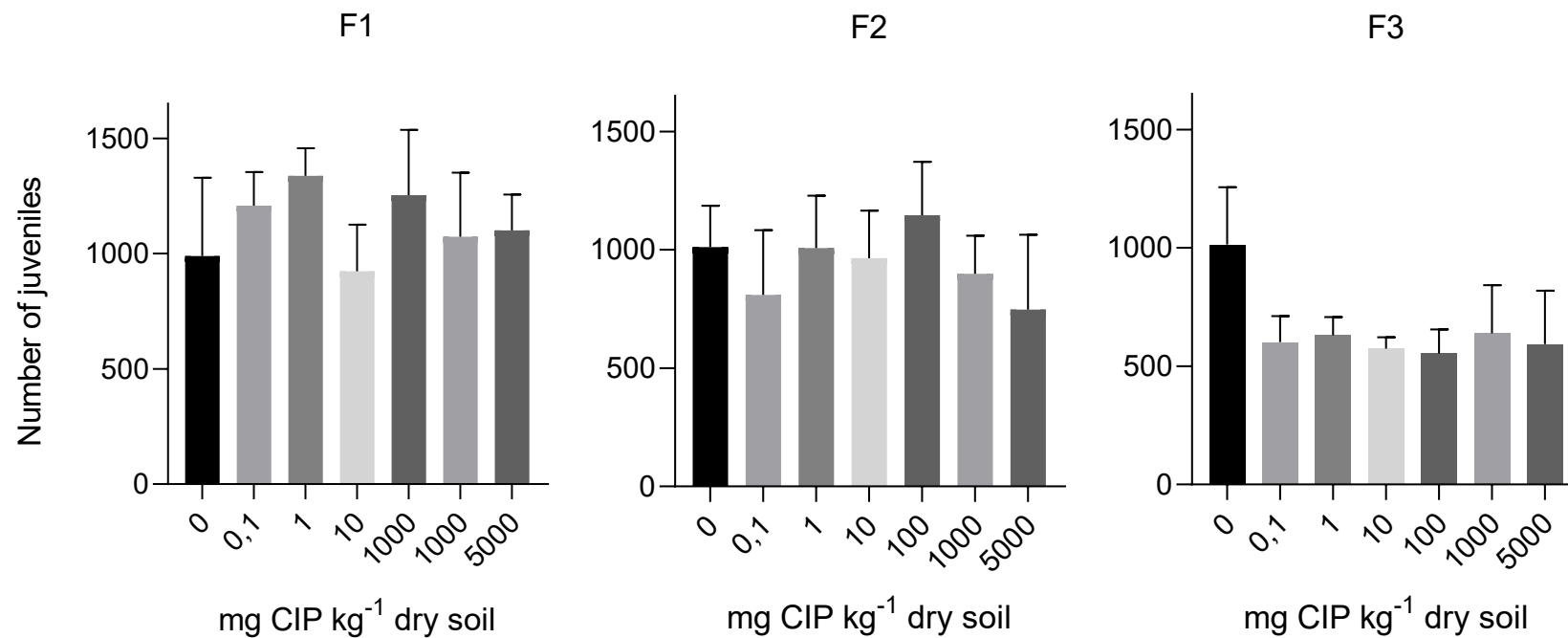
- It is not fully metabolized by human and animal body (approx. 70% is excreted);
- Usage of sewage sludge, manure, poultry litter and several other sustainable alternatives to mineral fertilization;
- Ciprofloxacin has high sorption in soil (Koc of 61000; half life of 3466 days);
- Contaminant of emerging concern by the EPA in 2009.

Therefore, to continue with such sustainable agriculture practices (encouraged by objective 2 of the SDG – Sustainable Development Goals of United Nations), without causing damage to soil quality, it is necessary to study the effects of ciprofloxacin on this matrix considering the long-term exposure.

Multigenerational tests with *Enchytraeus crypticus*

- Artificial Tropical Soil (75% sand; 20% kaolin; 5% coconut fiber);
- Ciprofloxacin was purchased from Sigma-Aldrich (purity >98%);
- 0.1, 1.0, 10.0, 100.0, 1000.0, and 5000.0 mg CIP kg⁻¹ of dry soil;
- **Three generations tested (F1, F2 and F3);**
- **Shapiro-Wilk: normal distribution (p > 0.05);**
- **ANOVA: F1 and F2 (p > 0.05), F3 (p < 0.05);**

Results



- ✓ CIP may cause adverse effects on reproduction of *Enchytraeus crypticus* when considering the long-term exposure.
- ✓ This is paramount information as CIP has high organic matter sorption and is expected to be immobile in soil.

Figure – Number of juveniles from first (F1), second (F2) and third (F3) generations of *Enchytraeus crypticus* exposed to ciprofloxacin.

Thank you!

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*This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil
(CAPES) - Finance Code 001.*