

Title: Association between heavy metal uptake and growth and reproduction in the anecic earthworm, *Alma nilotica* (Grube 1855)

Abstract:

Elevated heavy metal concentrations in soils are a cause for concern as they are hazardous to soil organisms including earthworms which are considered as ecosystem engineers. Current ecotoxicity tests predominantly use temperate earthworm species, and thus there is the need to include a broader genera of native species to improve ecological risk assessment. *Alma nilotica*, is a tropical anecic earthworm species that survives well under laboratory conditions and has potential for use in ecotoxicology testing but lacks published toxicity data for important pollutants. Growth and reproduction bioassays were carried out with *A. nilotica* to determine the relationship between the concentrations of Cu, Zn, Pb and Cr in spiked soils and their bioaccumulation and toxic effects. Positive linear relationships were found between soil-metal and internal earthworm-metal concentrations. Cu did not inhibit growth up to 35 days of exposure but became toxic with longer exposure duration. Zn was not regulated by *A. nilotica* although it is an essential metal that is well regulated by *Eisenia* sp. commonly used in standard ecotoxicity tests, showing differences in metal regulation by earthworms of different ecological categories. Based on bioaccumulation factors (BAFs), growth inhibition and reproduction effects the metals were ranked in decreasing toxicity as Pb > Cr > Zn > Cu. The mean 20% Internal Effects Concentrations (IEC20s) for reproduction were 1.04, 2.9, 8.3 and 224.2 mg metal kg⁻¹ earthworm for Pb, Cr, Zn and Cu respectively. These data can contribute to the improvement of metal risk assessment particularly in tropical contexts.