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DNA barcoding facilitates earthworm taxonomy

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Traditional morphological taxonomy of earthworms generally requires dissection of adult individuals and extensive training for species-level identifications. On the other hand, the Cytochrome Oxidase 1 (COI) barcode region has been shown to be very effective for earthworms, allowing species-level identification of adults, juveniles and cocoons, for which the latter two are generally impossible morphologically. While the barcode sequence itself is not sufficient for robust phylogenetic tree generation, it is a valuable tool for preliminary species delineation, detection of cryptic species, and estimation of biodiversity. Therefore earthworms were chosen for inclusion in both the iBOL and BR-BOL projects, and the global Earthworm Barcoding Campaign of BOLD now includes barcodes of over 2500 individuals representing 217 described species and >500 clusters with no names (many of them new species). Here we report the results of barcoding of Brazilian earthworms, all of which were obtained from other projects, rather than from a dedicated barcoding survey. Individual earthworms (n=398) came from a total of 65 sites concentrated in Southern Brazil, and most others from Amapá and Amazonas. In total, we estimate that barcodes have been generated for approx. 100 species, most of them new to science. In Eastern SP state, approximately 45 species-level lineages were found within the genera *Glossoscolex* and *Fimoscolex*, none of which belong to described species. The neighbor joining tree of these sequences shows geographical structure within each genus, sometimes on very small spatial scales. Other genera in the same region also showed among-site differences at the species-level, including earthworms of bromeliad leaf-tanks, despite their presumed high dispersal rates and gene flow. On the other hand, we found that *Urobenus brasiliensis* Benham, 1886 a very widely distributed species, is probably a complex of morphologically very similar, but genetically distinct lineages qualifying as cryptic species. In contrast the barcodes of common species like *Pontoscolex corethrurus* (Müller, 1857) even though native to Brazil and widely sampled, show little or no geographical structure. Another *Pontoscolex* (n. sp.) from Amapá was differentiated genetically at the scale of several kilometers. While there are still restrictions to the extensive use of barcodes for the identification of earthworm species in Brazil, mainly due to the small number of species barcoded thus far, and to the presence of several widespread exotic species that possess higher-than-typical divergence levels, we still expect that a comprehensive Brazilian earthworm barcode database can be a powerful taxonomic tool that merits further development.

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