Earthworm taxonomy, biology and ecology. An overview of recent advances (2013-2016) in Brazil*

George Brown*1, Marie Bartz2, Samuel James3, Luis Cunha4, Elodie Da Silva1, Alexander Feijoo5, Marcio Rosa6, Telma Silva7, David Stanton4, Peter Kille4, Dilmar Baretta8, Thibaud Decaens9, Patrick Lavelle10, Alessandra Santos11, Herlon Nadolny11, Talita Ferreira11, Willian Demetrio11, Guilherme Cardoso11, Shabnam Taheri12, Lise Dupont12, Tatiane Gorte2, Lucas Braga13, Siu Tsai13, Mauricio Zagatto14, Stephanie Ferreira11, Amarildo Pasini15, Gerusa Steffen16, Ricardo Steffen17, Zaida Antoniolli17, Maria Auxiliadora Drumond18, Raquel Da Silva18, Maria Raquel Carvalho*18, Esther Esteves11, Leda Chubatsu11, Luis Hernandez19, Guillaume Rousseau19, Bianca Santos20, Marlucia Martins20, and Guilherme Schuhli1

1Embrapa Forestry – Brazil
2Positivo University – Brazil
3University of Iowa – United States
4Cardiff University – United Kingdom
5Universidad Tecnologica de Pereira – Colombia
6Universidade do Estado de Santa Catarina – Brazil
7INPA – Brazil
8UDESC-CEO – Brazil
9Centre d’écologie fonctionnelle et évolutive (CEFE) – CNRS : UMR5175, Université Montpellier II - Sciences et techniques, Université Montpellier I, Université Paul Valéry - Montpellier III, École Pratique des Hautes Études (EPHE) – Campus CNRS - 1919 route de Mende - 34293 Montpellier cedex 5, France
10Institut de Recherche pour le Développement (IRD) – Colombia
11Universidade Federal do Paraná – Brazil
12Université Paris-Est Créteil Val-de-Marne – Paris 12 (UPEC UP12) – Communauté Université Paris-Est, Université Paris-Est Créteil Val-de-Marne (UPEC) – 61 avenue du Général de Gaulle - 94010 Créteil cedex, France
13CENA-USP – Brazil
14ESALQ-USP – Brazil
15Universidade Estadual de Londrina – Brazil
16FEPAGRO – Brazil
17Universidade Federal de Santa Maria – Brazil
18Universidade Federal de Minas Gerais – Brazil
19Universidade Estadual do Maranhao – Brazil
20MPEG – Brazil

Abstract

*Speaker
As done in the past two IOTM's, the present talk synthesizes recent (2013-2016) advances in earthworm taxonomy, biology and ecology in Brazil. The work presented includes mostly unpublished results of research performed over the last 3 years by graduate and undergraduate students and researchers belonging to various collaborating institutions, both in Brazil and abroad. Earthworm populations were quantitatively evaluated by handsorting soil monoliths (generally using the TSFB-method) in 11 locations (total 98 sites) including agricultural, pastoral, agroforestry, regenerating and old forest systems. Furthermore, at these and at > 10 other locations (140 sites total) scattered throughout Brazil, earthworms were collected using qualitative methods, by searching in various niches (soil, litter, under rocks, next to streams, swamplands, rotten logs, bromeliads). Many of these worms were identified to species level, but much material must still be processed. Over 1000 individuals were barcoded, of which ~50% were *Pontoscolex corethrurus*, for which neotypes were collected at the type locality (Blumenau). The genetic variation and DNA size of this species was found to be more variable than previously assumed. The Fritz Müller Oligochaete Collection at Embrapa Forestry now contains over 1000 glass vials with earthworms and over 1500 tubes with tissue samples or whole worms, representing well over 200 species, all preserved in alcohol 80%. Over 60 new species were found, many in the *Glossoscolex* and *Fimoscolex* genera, but also in several Ocnerodrilidae genera. Overall 100 new COI barcode MOTUs were generated for BOLD. Five taxonomy courses were given, training over 60 persons in earthworm identification. Additionally, a molecular phylogeny course trained 10 students in these techniques. For the first time on record, sperm was found in the nephridia of *Glossoscolex*, shedding some light on how this genus lacking spermathecae may actually reproduce. The biology of some *Glossoscolex*, *Rhinodrilus* and *Andiorrhinus* species were studied, revealing differences in growth, casting rates and cast properties. The gut and cast bacteria of *Perionyx excavatus* and *Dichogaster annae* were studied, and the impacts of *P. corethrurus* on sugarcane rhizosphere microbial diversity were evaluated. The use of mustard, onion and formalin were compared, revealing formalin as more efficient for population and biodiversity assessment. Earthworms were found to be important components of Amazonian Dark Earths, although their populations were greatly affected by land use system in these soils. The role of earthworms as environmental and soil quality bioindicators was further elucidated, indicating the need for methodological and theoretical adaptations in order for optimal adoption of this practice. *Funded by CNPq, Newton-CONFAP, NERC, EU, Fapesp, Fapema, Fapemig, Fapeam, Fundação Araucária, Embrapa and CAPES*