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Biodiversity and distribution of the *Glossoscolex* genus-group (Annelida, Clitellata, Lumbricina, Glossoscolecidae) in South America

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Abstract

An exaustive survey of the terrestrial megadriles belonging to the *Glossoscolex* genus-group produced 54 available endemic nominal taxa (species and subspecies) from South America. These species level taxa belong to *Diaguita, Enantiodrilus, Fimoscolex, Glossoscolex (Assudrilus), Glossoscolex (Glossoscolex), and Holoscolex*. Twenty three of these species-group taxa were described by Gilberto Righi. Full synonyms and detailed South American geographical occurrences are provided. This is the first assessment of the South American species and subspecies of the *Glossoscolex* genus-group.

Key words: biodiversity, earthworms, Glossoscolecoidea, Metameria, Neotropical region, soil fauna.

Introduction

Species are the children of Gaia (Wilson, 2002), and we must know the role each one plays in the whole in order to manage earth wisely (Reynolds, 1994, p. 12). In order ever to achieve this knowledge, however, we must begin by knowing which fraction of South American diversity has already been described.

Everybody is supposedly familiar with earthworms. They are easily encountered in gardens and are used as bait for fishing. Linnaeus (1758) called all earthworms *Lumbricus terrestris* and all marine worms *Lumbricus marinus*.

Oligochaetes have an important role in phylogenetic, zoogeographical, ecological, and agronomical research (Righi, 1996, p. 485). Earthworms help decompose organic matter, and may thus be used in vermicomposting (Reynolds and Eggen, 1993). They aerate the soil, help water penetrate horizontally and vertically, and neutralize acid soils. Charles Darwin was the first to appreciate the key-role of the lowly earthworms for the soil sciences (Reynolds, 1994, p. 11).

Several species of gigantic earthworms over 100 cm long have been reported from tropical and temperate regions: (i) maximum length 140 cm, the Australian megascolecid *Megascolides australis* McCoy; (ii) 120 cm, the Brazilian glossoscolecid, *Glossoscolex giganteus* Leuckart; and (iii) 105 cm, the French lumbricid *Scherotheca occidentalis thibauti* Bouché (Lee, 1985; Tsai *et al.,* 2004, p. 877). These authors do not mention another

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glossoscolecid giant from Minas Gerais, Brazil, *Rhinodrilus fafner* which, according to Stephenson (1930), can measure more than 2 m in length.

The *Glossoscolex* genus-group is characterized by a single pair of tubular calciferous glands in segment 11 or 12 (Righi, 1971, p. 70, group three). *Glossoscolex* is the type species of the most diverse South American tropical endemic family in the world.

This is the first catalogue of the taxa of the *Glossoscolex* genus-group cited to date from the South American continent. This paper has two goals: (i) provide a current starting point for taxonomists and ecologists interested in South American glossoscolecid earthworms; and (ii) compile the available information on the biodiversity and distribution of a neglected zoological group in a megadiverse and only cursorily sampled continent.

Material and methods

Three-letter abbreviations were used for South American countries (ARG, Argentina; BOL, Bolivia; BRA, Brazil; COL, Colombia; ECU, Ecuador; PAR, Paraguay; PER, Peru; SUR, Surinam; URU, Uruguay; VEN, Venezuela) and 2-letter abbreviations for sampled States in Brazil (AM, Amazonas; AP, Amapá; MG, Minas Gerais; MT, Mato Grosso; PA, Pará; PR, Paraná; RJ, Rio de Janeiro; RO, Rondônia; RS, Rio Grande do Sul; SC, Santa Catarina; SP, São Paulo). All information has been obtained in the primary literature.

Results

LUMBRICINA De Blainville, 1830
Synonyms. Terricolae Örsted, 1850; Megadrili Benham, 1890; Diplotesticulata Yamaguchi, 1953; Crassiclitellata Jamieson, 1988

GLOSSOSCOLECOIDEA Michaelsen, 1900

GLOSSOSCOLECIDAE Michaelsen, 1900

Glossoscolex genus-group

Diaguita Cordero, 1942
Type: *D. michaelseni* Cordero, 1942

D. michaelseni Cordero, 1942
Distribution. ARG: Jujuy Province: San Salvador de Jujuy (Cordero, 1942, p. 286). BRA: MT (Righi, 1990, p. 62).

D. vivianae Righi, 1984
Distribution. VEN: Baritas State: Ticoporo Forestal Reserve (Righi and Molina, 1994, p. 310). BRA: MT: Pontes e Lacerda-Vila de Santíssima Trindade highway, km 60: Lagoa do Encando farm (Righi, 1984, p. 207); Postes e Lacerda-Vilhena highway; Nova Alvorada (Righi and Guerra, 1985, p. 154); AM: Parada Modelo; Tabatinga (Righi, 1988a, p. 338).

Enantiodrilus Cognetti, 1902
Type: *E. borellii* Cognetti, 1902

E. borellii Cognetti, 1902
Distribution. ARG: Tucumán Province (Roldán and Teisaire, 2000, p. 1); Jujuy Province: San Lorenzo (Cognetti, 1902, p. 9). BOL: Beni Department: Urios River, Espíritu Viejo, close to Espíritu; Ballivian Province: Quiquibey River (Römbke and Hanagarth, 1994, p. 13); Vaca Diez Province: Beni Department: Estancia Esperanza, Nicolas Suarea Island, close to Guayaramerín: Marmoré River; (Zicsi, 1995, p. 588). SUR: Hendriktop (Michaelsen, 1933, p. 121). BRA: PA: Marajó Island (Michaelsen, 1927, p. 369).

E. cognetti Michaelsen, 1933
Distribution. SUR: Hendriktop (Michaelsen, 1933, p. 121).

Fimoscolex Michaelsen, 1900
Type: *F. ohausi* Michaelsen, 1900

F. angai angai Righi, 1971
Distribution. BRA; SP (Brown and James, 2006, p. 147): Salesópolis: Boracéia Biological Reserve (Righi, 1971, p. 55).

F. angai minor Zicsi and Csuzdi, 1987
Distribution. PAR: Puerto Presidente Franco (Zicsi and Csuzdi, 1987, p. 272).

F. inurus Cognetti, 1913
Distribution. BRA (Cognetti, 1913, p. 615): SP (Lüderwaldt, 1927, p. 545; Michaelsen, 1927, p. 370; Brown and James, 2006, p. 147): Salesópolis: Boracéia Biological Reserve; Cotia; Ribeirão Pires; Mogi das Cruzes (Righi, 1971, p. 57).

F. ohausi Michaelsen, 1900
Distribution. BRA: RJ: Serra de Macaé (Michaelsen, 1926, p. 299); Petrópolis (Michaelsen, 1900, p. 55).

F. sacii (Righi, 1971)
Synonym. *Glossoscolex* (*Assudrilus*) *sacii* Righi, 1971.
Distribution. BRA: SP (Brown and James, 2006, p. 147; Righi, 1999, p. 13): Vargem Grande, near Cotia; Ibiúna; Juquitiba (Righi, 1971, p. 53).

F. sporadochaetus Michaelsen, 1918
Distribution. BRA: MG: Gorduras, near Belo Horizonte (Michaelsen, 1918, p. 299); Conselheiro Lafaiete: Rio de Janeiro-Belo Horizonte highway, km 418 (Righi, 1971, p. 10).

F. tairim Righi, 1974
Distribution. BRA: RJ: Itatiaia (Righi, 1974, p. 560).

F. thayeri (Cernosvitov, 1934)
Synonym. *Glossoscolex thayeri* Cernosvitov, 1934.
Distribution. BRA: RJ: Mendez (Cernosvitov, 1934a, p. 58; 1935, p. 34).

Glossoscolex F. S. Leuckart, 1835
Type: *G. giganteus* F. S. Leuckart, 1836
Synonym. *Geoscolex* F. S. Leuckart, 1841 (Type: *G. maximus* F. S. Leuckart, 1841)

G. crucifer Righi and Römbke, 1987
Distribution. PER: Panguana (Righi and Römbke, 1987, p. 532).

Glossoscolex (*Assudrilus*) Righi, 1971

Type: *G. jimi* Righi, 1972

G. (*Assudrilus*) *jimi* Righi, 1972
Distribution. BRA: SC: Cedros (Righi, 1972, p. 41).

Glossoscolex (*Glossoscolex*) F. S. Leuckart, 1835
Type: *G. giganteus* F. S. Leuckart, 1836
Synonym. *G.* (*Praedrilus*) Righi, 1971 (Type: *G. tupii* Righi, 1971)

G. (*Glossoscolex*) *amomee* Righi, 1971
Distribution. BRA: SP: Cubatão: Serra de Cubatão; São Vicente: Morro do Xixová (Righi, 1971, p. 42); Peruíbe (Brown and James, 2006, p. 147); São Bernado do Campo: Alto da Serra; Paranapiacaba: reserva biológica; Cotia; Jarinu (Righi and Araújo Lobo, 1979, p. 952); Vila Indiana; Butantan; RJ (Zicsi and Csuzdi, 1999, p. 124).

G. (*Glossoscolex*) *bergi* (Rosa, 1900)
Synonym. *Geoscolex bergi* Rosa, 1900.
Distribution. ARG: Misiones Province (Rosa, 1900, p. 209). PAR: Puerto Presidente Franco (Zicsi and Csuzdi, 1987, p. 273). BRA: PR (Sautter *et al.,* 2006, p. 298): Foz do Iguaçu (Zicsi and Csuzdi, 1987, p. 273).

G. (*Glossoscolex*) *bonariensis* Cordero, 1942
Distribution. ARG: Buenos Aires Province: Buenos Aires; San Fernando (Cordero, 1942, p. 284); Punta Lara Reserve (Ringuelet, 1962, p. 83); Entre Rios Province (Di Persia, 1980, p. 77): Villaguay: Mestra Mojones norte (Righi, 1978, p. 169). URU: Paysandú Department: Paysandú (Cordero, 1943, p. 1).

G. (*Glossoscolex*) *bondari* Michaelsen, 1914 [1926]
Distribution. BRA: SP (Brown and James, 2006, p. 148): Piracicaba (Michaelsen, 1926, p. 297); Rio Claro (Righi and Araújo-Lobo, 1979, p. 948).

G. (*Glossoscolex*) *catharinensis* Michaelsen, 1918
Distribution. BRA: RS: São Sebastião do Cai (Righi, 1974, p. 557); SC: Joinville; Itapoaí river; SP (Brown and James, 2006, p. 148); Ribeirão Pires (Michaelsen, 1918, p. 1; 1927, p. 370).

G. (*Glossoscolex*) *colonorum* Michaelsen, 1918
Distribution. URU: Tacuarembó: Tambores (Cordero, 1931, p. 352). BRA: SC: Joinville; Itapoaí River (Michaelsen, 1927, p. 370).

G. (*Glossodrilus*) *corrientes* Righi, 1984.
Distribution. ARG: Corrientes Province: Corrientes (Righi, 1984, p. 116).

G. (*Glossoscolex*) *facchinii* Righi, 1971
Distribution. BRA: SP (Brown and James, 2006, p. 148): Araras Municipe: Monte Alto Farm: Araras brooklet (Righi, 1971, p. 43).

G. (*Glossoscolex*) *fasold* Michaelsen, 1918
Distribution. BRA: SP (Brown and James, 2006, p. 148): Paranapiacaba: Alto da Serra (Michaelsen, 1918, p. 273).

G. (*Glossoscolex*) *forguesi* (E. Perrier, 1881)
Synonym. *Geoscolex forguesi* E. Perrier, 1881
Distribution. ARG: La Plata (Perrier, 1881, p. 217).

G. (*Glossoscolex*) *giganteus australis* Righi and Araújo-Lobo, 1979
Distribution. BRA: SP (Brown and James, 2006, p. 148): between Apiaí and Guapiara: São Paulo-Curitiba highway, km 305 (Righi and Araújo-Lobo, 1979, p. 952).

G. (*Glossoscolex*) *giganteus giganteus* F. S. Leuckart, 1836
Synonyms. *G. giganteus typicus* F. S. Leuckart, 1836; *Geoscolex maximus* F. S. Leuckart, 1841; *G. maximus* (F. S. Leuckart, 1841); *Titanus brasiliensis* E. Perrier, 1872; *G. paucisetis* Michaelsen, 1900; *G. maximus campestris* Michaelsen, 1926; *G. campestris* Michaelsen, 1926; *G. giganteus campestris* (Michaelsen, 1926).
Distribution. COL: Nariño: Patia River (Beddard, 1892, p. 119). BRA: SP (Brown and James, 2006, p. 148): Paranapiacaba: Alto da Serra (Lüderwadlt, 1927, p. 545); Campos do Jordão (Michaelsen, 1918, p. 266); RJ: Rio de Janeiro (Leuckart, 1836, p. 764); Agulhas Negras (Righi, 1971, p. 45); Teresópolis (Michaelsen, 1918, p. 266); Seropédica (Righi, 1980a, p. 243).

G. (*Glossoscolex*) *gordurensis* Michaelsen, 1918
Distribution. BRA: SP (Brown and James, 2006, p. 148): Paranapiacaba: Alto da Serra (Lüderwadlt, 1927, p. 545); Itanhaém; Ribeirão Pires (Michaelsen, 1926, p. 290); MG: Gorduras, near Belo Horizonte (Michaelsen, 1918, p. 276).

G. (*Glossoscolex*) *grandis grandis* (Michaelsen, 1892)
Synonym. *Tykonus grandis* Michaelsen, 1892.
Distribution. BRA: RS: Passo Fundo (Michaelsen, 1892, p. 214; 1918, p. 1; Moreira, 1903, p. 125).

G. (*Glossoscolex*) *grandis ibirai* Righi, 1971
Distribution. BRA: SP: Ibirá, close to São José do Rio Preto (Righi, 1971, p. 46).

G. (*Glossoscolex*) *grecoi* Righi and Araújo-Lobo, 1979
Distribution. BRA: SP (Brown and James, 2006, p. 148): Pirassununga-Aguaí highway, km 10, near Mogiguaçu River; Pirassununga: Vassununga (Righi and Araújo-Lobo, 1979, p. 947).

G. (*Glossoscolex*) *klossae* Righi, 1972
Distribution. BRA: RJ: Jipóia Island, near Angra dos Reis (Righi, 1972, p. 39).

G. (*Glossoscolex*) *lacteus* Zicsi and Csuzdi, 1999
Distribution. PAR: Obligado, northeast of Asunción (Zicsi and Csuzdi, 1999, p. 124).

G. (*Glossoscolex*) *matogrossensis* Righi, 1984
Distribution. BRA: MT (Righi, 1984, p. 114); PR (Sautter *et al.*, 2006: 298): Foz do Iguaçu (Zicsi and Csuzdi, 1987, p. 269).

G. (*Glossoscolex*) *minor* Zicsi, 1999
Distribution. PAR: Obligado, northeast of Asunción (Zicsi and Csuzdi, 1999, p. 124).

G. (*Glossoscolex*) *montagneri* Righi, 1972
Distribution. BRA: SP (Brown and James, 2006, p. 148): São Sebastião (Righi, 1972, p. 37); RJ (Zicsi and Csuzdi, 1999, p. 124).

G. (*Glossoscolex*) *mrazi* Cernosvitov, 1934
Distribution. BRA: SP (Brown and James, 2006, p. 148): São Paulo (Cernosvitov, 1934b, p. 183).

G. (*Glossoscolex*) *paulistus* Michaelsen, 1926
Distribution. BRA: SP (Michaelsen, 1926, p. 255; Brown and James, 2006, p. 148): Piracicaba (Marques and Meirelles, 1995, p. 311); Araras: Araras-Rio Claro highway, km 5 (Righi, 1971, p. 74).

G. (*Glossoscolex*) *rione* Cordero, 1943
Distribution. URU: Tacuarembó Department: margins of Negro River (Cordero, 1943, p. 2).

G. (*Glossoscolex*) *robustus* Cernosvitov, 1938
Distribution. BRA: RJ: Teresópolis (Cernosvitov, 1938, p. 255).

G. (*Glossoscolex*) *sazimai* Righi and Araújo-Lobo, 1979
Distribution. BRA: SP (Brown and James, 2006, p. 148): Caraguatatuba (Righi and Araújo-Lobo, 1979, p. 951).

G. (*Glossoscolex*) *taunayi* Michaelsen, 1926
Distribution. BRA: SP (Brown and James, 2006, p. 148): Serra da Bocaina (Michaelsen, 1926, p. 291).

G. (*Glossoscolex*) *tocape* Righi, 1980
Distribution. BRA: SP (Brown and James, 2006, p. 148): Ribeirão Preto (Righi, 1980a, p. 243).

G. (*Glossoscolex*) *truncatus* (Rosa, 1895)
Synonym. *Tykonus truncatus* Rosa, 1895.
Distribution. PAR: Central Department: vicinity of Asunción (Rosa, 1895, p. 2; 1896, p. 89). BRA (Michaelsen, 1926, p. 255): RS: Uruguaiana (Michaelsen, 1927, p. 370).

G. (*Glossoscolex*) *tupii* Righi, 1971
Synonym. *G. (Praedrilus) tupii* Righi, 1971.
Distribution. BRA: SP (Brown and James, 2006, p. 148): Serra do Mar: Engenheiro Marsillac (Righi, 1971, p. 51).

G. (*Glossoscolex*) *umijiae* Righi and Araújo-Lobo, 1979
Distribution. BRA: SP (Brown and James, 2006, p. 148): Cotia: Vargem Grande (Righi and Araújo-Lobo, 1979, p. 954).

G. (*Glossoscolex*) *uruguayensis corderoi* Righi, 1968
Synonyms. *G. corderoi* Righi, 1968; *G.* (*G.*) *corderoi* Righi, 1968.
Distribution. BRA (Righi, 1971, p. 74): SP (Brown and James, 2006, p. 148): Botucatu: São Maunuel (Righi, 1971, p. 74).

G. (*Glossoscolex*) *uruguayensis ljungstroemi* Righi, 1978
Distribution. ARG: Santa Fé Province: La Capital; Misiones Prov: Garupa (Righi, 1978, p. 172).

G. (*Glossoscolex*) *uruguayensis uruguayensis* Cordero, 1943
Synonym. *G. uruguayensis* Cordero, 1943.
Distribution. ARG (Ljungström, 1972, p. 197; Zicsi and Csuzdi, 1987, p. 269): Santa Fé Prov: Rafaela; Cululú; São Gerónimo del Norte; Videla; Calchaquí (Ljungström, 1971, p. 41; 1972, p. 197); Curupayti; Hersilla (Righi, 1978, p. 175); Entre Ríos Province: La Paz; San Gustavo (Ljungström *et al.*, 1975, p. 8); Misiones Province: Guarupá (Righi, 1978, p. 175). URU: Tacuarembó Department: confluence of Yaguarí and Tacuarembó rivers; Paysandu Department: Chapicui (Cordero, 1943, p. 4). BRA: RS: São Leopoldo (Righi, 1974, p. 558).

G. (*Glossoscolex*) *vizottoi* Righi, 1971
Distribution. BRA (James and Brown, 2006, p. 56): SP (Caballero, 1973, p. 1; Brown and James, 2006, p. 148): São José do Rio Preto: margins of Preto River (Righi, 1971, p. 49); Santo Anastácio (Righi, 1980b, p. 12).

G. (*Glossoscolex*) *wiengreeni* (Michaelsen, 1897)
Synonym. *Tykonos wiengreeni* Michaelsen, 1897.
Distribution. BRA: RS (Knäpper and Porto, 1979, p. 137); SC: Nova Friburgo (Michaelsen, 1897, p. 378); margins of Itapocú River (Michaelsen, 1918, p. 272); SP (Brown and James, 2006, p. 148): São Paulo: Alto da Serra: Paranapiacaba (Lüderwaldt, 1927, p. 545); Serra da Bocaina (Michaelsen, 1897, p. 378); Eldorado: Cordilheira André Lopes (Righi, 1971, p. 51); RJ: Itatiaia; Miritu (Moreira, 1903, p. 134).

Holoscolex Cognetti, 1904
Type: *H. nemorosus* Cognetti, 1904

H. caramuru Righi, 1975
Distribution. BRA: PA: Amazonia National Park: Tapajós: Assaial do Meio and Mambuaizinho riverbanks (Righi, 1982, p. 111); AM: near Calado Lake (Righi *et al.,* 1978, p. 21); Manaus (Lavelle and Lapied, 2003, p. 422); RO: Porto Velho: Airclub highway, km 15; Mirante da Serra highway, km 13 (Righi, 1988b, p. 121); AP (Righi, 1975, p. 83).

H. mahunkai Zicsi and Csuzdi, 1987
Distribution. PAR: Puero Presidente Stroessner: Salto waterfall (Zicsi and Csuzdi, 1987, p. 270).

H. nemorosus nemorosus Cognetti, 1904
Distribution. ECU: Loja Prov: Gualaquiza River (Cognetti, 1904, p. 17).

H. nemorosus tacoa Righi, Ayres and Bittencourt, 1978
Distribution. BRA: AM: Manaus-Itacoatiara highway, km 10-15 (Righi *et al.,* 1978, p. 21).

Discussion

Some textbooks convey the idea that there is still only one earthworm, *Lumbricus terrestris*. Yet there are well over 400 species of glossoscolecids alone in South America, while published information mentions circa 200 (*e.g.,* Blakemore, 2002).

Fifty four endemic species and subspecies belonging to *Glossoscolex* and related genera were catalogued to date from South America. Twenty three of these species were described as new by the late Gilberto Righi (†1937-1999). The species are all endemic to the South American continent. Of the 38 species of the genus *Glossoscolex*, 30 are restricted to subtropical latitudes in South America, while 4 are tropical and 4 are tropical-subtropical. The genus-group as a whole is mainly subtropical, although 3 of the 4 species of *Holoscolex*, 1 of the 2 species of *Diaguita*, and 1 of the 2 species of *Enantiodrilus*, are equatorial.

Earthworms from native, undisturbed areas comprise very large numbers of species with limited distribution areas (Lavelle and Lapied, 2003, p. 425). Because of high biodiversity and sensitivity to environmental disturbances, they may represent an exceptional tool for predicting environmental health. Without exceptions, all species of the *Glossoscolex* genus-group are endemic to the South American continent. Information on taxonomy and biogeography are necessary when trying to use soils for agriculture or forestry in a sustainable way. Knowledge on the distributions of both native and introduced species may function as an efficient tool for environmental assessment, and may provide an index for measuring the huge human impact on the various ecosystems in South America.

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References

BEDDARD, F.E. 1892. The earthworms of the Vienna Museum. *Annals and Magazine of Natural History Series 6,* **9**:113-134.

BLAKEMORE, R.J. 2002. *Cosmopolitan earthworms - an eco-taxonomic guide to the peregrine species of the world.* Kippax, VermEcology, 506 p.

BROWN, G.G. and JAMES, S.W. 2006. Earthworm biodiversity in São Paulo State, Brazil. *European Journal of Soil Biology Supplement,* **42**:145-149.

CABALLERO, M.E.S. 1973. *Bionomia dos Oligochaeta terrestres da região norte-ocidental do Estado de São Paulo.* Ph.D. Thesis, São José do Rio Preto, Universidade Estadual Paulista Júlio de Mesquita Filho.

CERNOSVITOV, L.1934a. Les Oligochetes de la Guyane Française et d´autres pays de l´Amerique du Sud. *Bulletin du Museum d´ Histoire Naturelle Series 2,* **2**:47-59.

CERNOSVITOV, L. 1934b. Eine neue *Glossoscolex*-Art aus den Sammlungen des Nationalmuseums in Prag. *Zoologischer Anzeiger,* **105**:183-185.

CERNOSVITOV, L. 1935. Oligochäten aus dem Tropischen Süd-Amerika. *Capita Zoologica,* **6**:1-36.

CERNOSVITOV, L. 1938. Oligochaeta. Mission scientifique de l´ Omo. *Memoires du Museum National d´Histoire Naturelle de Paris Nouvelle Serie,* **8**:255-328.

COGNETTI, L. 1902. Viaggio del Dr. A. Borelli nel Chaco Boliviano e nella Repubblica Argentina. XVII. Terricoli boliviani ed argentini. *Bolletino del Museo di Torino,* **17**(420):1-11.

COGNETTI, L. 1904. Oligocheti dell´Ecuador. *Bolletino del Museo di Torino,* **19**(474):1-18.

COGNETTI, L. 1913. Contributo alla conoscenza del genero *Fimoscolex*. *Zoologische Jahrbüch Systematik,* **34**:615-632.

CORDERO, E.H. 1931. Notas sobre los oligoquetos del Uruguay. *Anales del Museu Nacional de Historia Natural Bernardino Rivadavia Buenos Aires,* **36**:343-357.

CORDERO, E.H. 1942. Oligoquetos terrícolas del Museo Argentino de Ciencias Naturales. *Anales del Museo Argentino de Ciencias Naturales Buenos Aires,* **40**:269-293, pls 1-2.

CORDERO, E.H. 1943. Oligoquetos sudamericanos de la familia Glossoscolecidae, 1. El género *Glossoscolex* en el Uruguay, con una synopsis de las especies del grupo *truncatus. Comunicaciones Zoologicas del Museo de Historia Natural de Montevideo*, **1**(2):1-9.

DI PERSIA, D. 1980. Aportes a la oligoquetofauna acuática y terrestre de la Provincia de Entre Rios. *Historia Naturalis,* **1**:77-83.

KNÄPPER, C.F.U. and PORTO, R.P. 1979. Ocorrência de oligoquetas nos solos do Rio Grande do Sul. *Acta Biologica Leopoldensia,* **1**:137-166.

LAVELLE, P. and LAPIED, E. 2003. Endangered earthworms of Amazonia: An homage to Gilberto Righi. *Pedobiologia,* **47**:419-427.

LEE, K.E. 1985. *Earthworms. Their ecology and relationships with soils and land use.* Sydney, Academic Press, 411 p.

LEUCKART, F.S. 1836. Abbildung neuer Genus Ringelwurm. *Isis Oken,* **1836**:764.

LINNAEUS, C. 1758. *Systema Naturae per Regna tria Naturae, secundum Classes, Ordines, Genera, Species, cum characteribus, differentiatiis, synonymis, locis. Ed. 10, vol. 1.* Holmiae, Laurntii Salvii, 1-824.

LJUNGSTRÖM, P.O. 1971. Sistemática de los oligoquetos santafesinos. *Revista de la Asociacion de Ciencias Naturales del Litoral,* **2**:39-42.

LJUNGSTRÖM, P.O. 1972. Biology of *Glossoscolex uruguayensis* (Glossoscolecidae, Oligochaeta). A new species for Argentina. *Studies on Neotropical Fauna,* **7**:195-205.

LJUNGSTRÖM, P.O., EMILIANI, F. and RIGHI, G. 1975. Notas sobre los oligoquetos (lombrices de tierra) argentinos. *Revista de la Asociacion de Ciencias Naturales del Litoral,* **6**:1-42.

LÜDERWALDT, H. 1927. A colleção de minhocas (Oligochaeta) do Museu Paulista com notas biológicas. *Revista do Museu Paulista,* **15**:545-556.

MARQUES, M.B. and MEIRELLES, N.C. 1995. Erythrocruorin of *Glossoscolex paulistus* (Righi) (Oligochaeta, Glossoscolecidae): effects of divalent ions, acid-alkaline transitions and alkali and urea denaturation. *Comparative Biochemistry and Physiology B - Biochememistry and Molecular Biology,* **111**(2311-3318):1057-1064.

MICHAELSEN, W. 1892. Terricolen der Berliner Zoologischen Sammlung, II. *Archiv für Naturgeschicht,* **58**:209-261.

MICHAELSEN, W. 1897. Organisation einiger neuer oder wenigbekannter Regenwürmer von Westindien und Südamerika. *Zoologische Jahrbüch Abteilung für Anatomie,* **10**:359-388.

MICHAELSEN, W. 1900. *Oligochaeta. Das Tierreich 10.* Berlin, R. Frieländer and Sohn, p 1-575.

MICHAELSEN, W. 1918. Die Lumbriciden, mit besonderer Berücksichtigung der bischer als Familie Glossoscolecidae zusammengefassten

Unterfamilien. *Zoologische Jahrbüch Jena Abteilung für Systematik Ökologie und Geographie der Tiere,* **41**:1-398.

MICHAELSEN, W. 1926. Zur Kenntnis einheimischer und ausländischer Oligochäten. *Zoologische Jahrbüch Jena Abteilung für Systematik Ökologie und Geographie der Tiere,* **51**:255-328.

MICHAELSEN, W. 1927. Die Oligochätenfauna Brasiliens. *Abhandlungen Senckenberg Naturforschung Geselsschaft,* **40**:369-374.

MICHAELSEN, W. 1933. Die Oligochaetenfauna Surinames mit Erörterung der verwandschaftlichen und geographischen Beziehungen der Octochätinen. *Tijdschrift der Nederlandsk Dierkunde Vereins Series 3,* **3**:112-131.

MOREIRA, C. 1903. Vermes oligoquetos do Brasil. *Arquivos do Museu Nacional do Rio de Janeiro,* **12**:125-136.

PERRIER, E. 1881. Études sur l´organization des lombriciens terrestres. *Archives de Zoologie Expérimentale et Générale,* **9**:175-248.

REYNOLDS, J.W. 1994. Earthworms of the world. *Global Biodiversity,* **4**:11-16.

REYNOLDS, J.W. and EGGEN, A.B. 1993. *Earthworm biology and vermi-composting I.* Lindsay, Sir Sandford Fleming College, 72 p.

RIGHI, G. 1971. Sobre a família Glossoscolecidae (Oligochaeta) no Brasil. *Arquivos de Zoologia,* **20**:1-95.

RIGHI, G. 1972. Additions to the genus *Glossoscolex* (Oligochaeta, Glossoscolecidae). *Studies on Neotropical Fauna,***7**:7-47.

RIGHI, G. 1974. Notas sobre os Oligochaeta Glossoscolecidae do Brasil. *Revista Brasileira de Biologia,* **34**:551-564.

RIGHI, G. 1975. Some Oligochaeta from the Brazilian Amazonia. *Studies on Neotropical Fauna and Environment,* **10**:77-95.

RIGHI, G. 1978. Alguns Oligochaeta megadriles da Argentina. *FAVE,* **1**:167-178.

RIGHI, G. 1980a. Alguns Oligochaeta, Ocnerodrilidae e Glossoscolecidae do Brasil. *Papéis Avulsos de Zoologia São Paulo,* **33**:239-246.

RIGHI, G. 1980b. Alguns Megadrile (Oligochaeta, Annelida) brasileiros. *Boletim de Zoologia da Universidade de São Paulo,* **5**:1-18.

RIGHI, G. 1982. Oligochaeta, Glossoscolecidae, do Parque Nacional da Amazônia, Tapajós. *Revista Brasileira de Biologia,* **42**:107-116.

RIGHI, G. 1984. On a collection of Neotropical Megadrili Oligochaeta, II. *Studies of Neotropical Fauna and Environment,* **19**:100-120.

RIGHI, G. 1988a. Uma coleção de Oligochaeta da Amazonia Brasileira. *Papéis Avulsos de Zoologia São Paulo,* **36**:337-351.

RIGHI, G. 1988b. Adições à drilofauna de Rondônia. Brasil. *Revista Brasileira de Biologia,* **48**:119-126.

RIGHI, G. 1990. *Minhocas de Mato Grosso e de Rondônia.* Brasília, CNPq, 157 p.

RIGHI, G. 1996. Colombian earthworms. *Studies on Tropical Andean Ecosystems,* **4**:485-607.

RIGHI, G. 1999. Oligochaeta. *In:* C.R. BRANDÃO and E.M. CANCELLO (eds.), *Biodiversidade do Estado de São Paulo, Brasil: síntese do conhecimento ao final do século XX: 5. Invertebrados terrestres.* São Paulo, SP, FAPESP, p. 13-21.

RIGHI, G. and ARAÚJO-LOBO, D. 1979. Nova contribuição ao gênero *Glossoscolex* com sinopse do grupo *giganteus* (Oligochaeta, Glossoscolecidae). *Revista Brasileira de Biologia,* **39**:947-959.

RIGHI, G.; AYRES, I. and BITTENCOURT, E.C.R. 1978. Oligochaeta (Annelida) do Instituto Nacional de Pesquisas da Amazônia. *Acta Amazônica Supplenento,* **1**:1-49.

RIGHI, G. and GUERRA, R.A.T. 1985. Alguns Oligochaeta do norte e noroeste do Brasil. *Boletim de Zoologia da Universidade de São Paulo,* **9**:145-157.

RIGHI, G. and MOLINA, S. 1994. Terricolous Oligochaeta (Glossoscolecidae) of the Venezuelan llanos. *Revue Suisse de Zoologie,* **101**:299-313.

RIGHI, G. and RÖMBKE, J. 1987. Alguns Oligochaeta da Bolívia e do Peru. *Revista Brasileira de Biologia,* **47**:523-534.

RINGUELET, R. 1962. Rasgos faunísticos de las reservas naturales de la Província de Buenos Aires. *Physis,* **10**:83-91.

ROLDÁN, I.A. and TEISAIRE, E S. 2000. New record and redescription of *Enantiodrilus borellii* (Oligochaeta: Glossoscolecidae) for Tucumán Province, Argentina. *Megadrilogica,* **8**:1-3.

RÖMBKE, J. and HANAGARTH, W. 1994. The present faunistic knowledge on terrestrial Oligochaeta from Bolivia. *Andrias,* **13**:7-16.

ROSA, D. 1895. Oligocheti terricoli (Inclusi quelli raccolti nel Paraguay dal Dr. Paul Jordan). *Bolletino dei Museo di Zoologia et Anatomia Comparata di Torino,* **10**(204):1-3.

ROSA, D. 1896. Contributo allo studio dei Terricoli Neotropicali. *Mémories de la Real Accademia de Scienze di Torino (2)* **45**:89-152.

ROSA, D. 1900. *Geoscolex bergi* n. sp. *Comunicaciones del Museo de Buenos Aires,* **1**:209-211.

SAUTTER, K.D.; BROWN, G.G.; JAMES, S.W.; PASINI, A.; NUNES, D.H. and BENITO, N.P. 2006. Present knowledge on earthworm biodiversity in the State of Parana, Brazil. *European Journal of Soil Biology Supplement,* **42**:296-300.

STEPHENSON, J. 1930. *The Oligochaeta.* Oxford, Oxford University Press, 978 p.

TSAI, S.-C.; TSAI. S.-C. and SHEN, H.-P. 2004. A new gigantic earthworm of the genus *Metaphire* Sims and Easton (Megascolecidae: Oligochaeta) from Taiwan with reference to evolutional trends in body sizes and segment numbers of the *Pheretima* genus-group. *Journal of Natural History,* **38**:877-87.

WILSON, E.O. 2002. *The future of life.* Knopf, Vintage Books, 256 p.

ZICSI, A. 1995. Regenwürmer aus Bolivien (Oligochaeta). Regenwürmer aus Südamerika 23. *Revue Suisse de Zoologie,* **102**:585-608.

ZICSI, A. and CSUZDI, C.1987. Neue und bekannte Glossoscoleciden-Arten aus Südamerika, 2. (Oligochaeta: Glossoscolecidae). *Acta Zoologica Hungarica,* **33**:269-275.

ZICSI, A. and CSUZDI, C. 1999. Neue und bekannte Regenwürmer aus verschiedenen Teilen Südamerikas (Annelida, Oligochaeta: Glossoscolecidae, Acanthodrilidae, Megascolecidae) Regenwürmer aus Südamerika 26. *Senckenbergiana Biologica,* **78**:123-134.

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