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Synthesis of Brazilian Collembola: an update to the species list

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Abstract

The current total number of species found in Brazil is 270, distributed in 19 families and 92 genera, an increase of 71 species and 12 genera in the last 6 years. The greatest known diversity is found in Rio de Janeiro (132 species), Amazonas (56), Espírito Santo (30) and São Paulo (28), while there are no record to seven Brazilian states (Acre, Alagoas, Distrito Federal, Goiás, Rio Grande do Norte, Roraima and Tocantins). Distribution of the records clearly defines the areas that urge investments in scientific research and taxonomic survey and reflects the concentration of information in those centers that host the few specialists in Collembola, currently working in Brazil.

Key words: Brazil, biodiversity, distribution, soil fauna, taxonomy

Introduction

The Brazilian collembologists met in September 2009, at João Pessoa, Northeast Brazil, to the First Workshop on Brazilian Collembola Taxonomy, with the objectives to update the list of Collembola species in Brazil and discuss the state of art of Brazilian Collembology. All the participants worked together and equally to achieve this goal, which resulted in the current paper.

Traditionally Collembola is placed among hexapods (Hexapoda, Ellipura) (Börner 1910), notwithstanding, alternative hypothesis conclude that Collembola are highly specialized terrestrial Crustacea, which reached their evolutionary climax already in the Devonian, when they dominated most terrestrial habitats (present results of molecular analyses where Crustacea is placed paraphyletic in relation to Insecta, and Collembola results sister group of Branchiopoda) (Giribet & Ribera 2000, Janssens & Lawrence 2002–2009, Lawrence 2004, Nardi *et al.* 2001, 2003, Spears & Abele 1997).

Collembola is one of the most important groups in soil mesofauna, mainly because of their importance in soil genesis, dynamics and evolution (Palacios-Vargas 1985). The great diversity of habitats and their prompt response to environmental variations (Pozo *et al*. 1986), mainly those caused by antropic modifications, as deforestation and burning, make this group usefull as bioindicators (Zeppelini *et al*. 2009).

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Collembola has close to 8000 described species worldwide (Bellinger *et al.* 1996–2009). Up to date, very little is, in fact, known about Brazilian collembolan fauna due to the immensity of the task, despite great past efforts (Culik & Zeppelini, 2003). There have been almost no studies reporting the species composition of collembolan communities at any environment in Brazil and there are few studies reporting Collembola diversity of species in agricultural soils (Culik *et al*. 2002, 2006) and reforestation in mined sand dunes (Zeppelini *et al.* 2009). Clearly there is a great need and many opportunities for additional research on these environmentally important organisms in Brazil. The great diversity of Collembola species in Brazil is largely unknown and it is only through continued research, that such biological diversity will be documented and a better understanding of the Neotropical and world Collembola fauna obtained (Machado *et al*. 2008).

In this work we provide an update to the list of Brazilian Collembola published by Culik and Zeppelini (2003), recorded up to September 2009 with associated bibliographies and ecological information for each species. The results can be used to set prioritary areas and ecosystems for future research in the country.

Methods

The update to the list of species of Collembola recorded from Brazil (Tab. 2) is based on bibliographic references and unpublished records from different Brazilian regions. Publications that cite previously published records or do not provide identifications to species were omitted.

The Brazilian collection location, habitat and biotope information for each species recorded were obtained from the cited reference, when available, or from the collection data label for the new records. However, the habitat information listed in table 2 refers to Brazilian records only. Original publications should be consulted for more details on specific habitat information for those species distributed beyond Brazilian territory.

Nomenclatural organization follows that of Bellinger *et al.* (1996–2009), except for Neelidae that was placed in Symphypleona (Bretfeld 1986) and Cyphoderidae was considered a family, instead of a subfamily of Paronellidae.

Information on the world distribution of species was based on Bellinger *et al.* (1996–2009), Culik and Zeppelini (2003), and original new records. Biogeographical distribution regions according to Good (1974), modified by Christiansen and Bellinger (1995), Culik and Zeppelini (2003) were summarized to each species as follows: Boreal (Bor) include regions 1–8, Neotropical (Neo) regions 24–30, South African (SAf) region 31, Paleotropical (Pal) regions 9–23, Australian (Aus) regions 32–34, and Antarctic (Ant) regions 35–37. Species with distribution restricted to Brazil are assigned to biogeographic regions that include Brazil as in Culik and Zeppelini (2003), species distributed, at least, in four of the major regions (Neo, Pal, etc.) are considered cosmopolitan (Cos).

Information to the species with known distribution restricted to Brazil was based on Culik and Zeppelini (2003), Amazon (Amz), North and Central Brazil (NCB) and Pampa (Pam), corresponding to biogeographic regions 26, 27 and 29 respectively.

Result and Discussion

The updated number of Collembola species recorded from Brazil up to September 2009 is 270, distributed in 19 families and 92 genera (Tab. 2). There was an increase of 71 species and 12 genera since Culik and Zeppelini (2003). The species *Dicranocentrus silvestrii* var. *annulata* (Börner, 1906), is supposed to be the completely developed adult form of *D. silvestri* Absolon, therefore it was not included in the total number of species and is not considered in further discussion.

The greatest known diversity is found in Rio de Janeiro (132 species), Amazonas (56), Espírito Santo (30) and São Paulo (28). Seven Brazilian States with no records for Collembola: Acre, Alagoas, Distrito Federal, Goiás, Rio Grande do Norte, Roraima and Tocantins (Tab. 1). The distribution of species recorded in different Brazilian States or regions clearly points out to the priority areas for investments in scientific research and taxonomic survey, and reflects the concentration of information in those centers that host the few specialists in

Collembola and graduate students currently working in Brazil (RJ increased 63 records, PB increased 20 records). The same is true to environment sampling, as instance the known diversity from the littoral and neighboring habitats arose from 27 to 56 records, reflecting a change in the collection efforts in RJ, ES and PB. At the same time, whole representative Brazilian ecosystems are strongly neglected. This is the case of Cerrado (Brazilian savanna), Pantanal (food plains at Central West region) and Pampa (the grassland in South Region), which together occupies more than 50% of the Brazilian territory but share only 3.3% of the total records.

TABLE 1. Abbreviations of names of the Brazilian states and Federal District (DF), number of Collembola species recorded and region location of each state. Brazilian region designations: N—north, NE—northeast, CW—west (central part), SE—southeast, S—south. Number of species counted by Culik and Zeppelini (2003) in parenthesis.

Abbreviation, State	N° Species	Region	Abbreviation, State	N° Species	Region
AC, Acre	0 (0)	N	PB, Paraíba	20 (0)	NE
AL, Alagoas	0 (0)	NE	PR, Paraná	4 (3)	S
AP, Amapá	3 (3)	N	PE, Pernambuco	13 (12)	NE
AM, Amazonas	56 (56)	N	PI, Piauí	1 (1)	NE
BA, Bahia	3 (3)	NE	RJ, Rio de Janeiro	132 (69)	SE
CE, Ceará	2 (2)	NE	RN, Rio Grande do Norte	0 (0)	NE
DF, Distrito Federal	0 (0)	CW	RS, Rio Grande do Sul	2 (2)	S
ES, Espírito Santo	30 (11)	SE	RO, Rondônia	4 (4)	N
GO, Goiás	0 (0)	CW	RR, Roraima	0 (0)	N
MA, Maranhão	1 (1)	NE	SC, Santa Catarina	3 (2)	S
MT, Mato Grosso	13 (12)	CW	SP, São Paulo	28 (23)	SE
MS, Mato Grosso do Sul	6 (6)	CW	SE, Sergipe	4 (0)	NE
MG, Minas Gerais	13 (10)	SE	TO, Tocantins	0 (0)	N
PA, Pará	25 (25)	N			

TABLE 2. Species of Collembola recorded from Brazil as of September 2009. "*"—species originally described from Brazil (Brazilian Distribution, locality abbreviations refer to Brazilian states as listed in Table 1.) "no"—the reference was not obtained. In parentheses information obtained from not original reference cited. "?"following state abbreviation––questionable state record. "un"—unspecified or unknown Brazilian collection locality. World Distribution––see Methods. "?" following the distribution abbreviation—questionable distribution record. Habitat—representative type of habitat for the species. "un"—unspecified or unknown habitat.

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
Brachystomellidae				
Brachystomella agrosa Wray	Cassagnau & Rapoport (1962)	PE	Neo	
	Mendonça & Arlé (1992)	BA, PE, RJ, SP		Halophyte-psammophyte vegetation , sand dune, flooded areas, pasture, eucaliptus, citric plantation, understory, riparian vegetation, moss, litter and soil over beach rocks
	Bellini & Zeppelini (2004)	PB		
	Culik *et al.* (2006)	ES		

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
B. aspera (Börner) (as *Pseudachorutes*)	Börner (1906)	no (São Francisco)	NCB?	un
**B. ceciliae* Fernandes & Mendonça	Fernandes & Mendonça (2004)	RJ (ES)	NCB	Halophyte-psammophyte vegetation, litter on sand dune, flooded areas
B. contorta Denis	Arlé (1962)	?	Bor, Neo, Pal	Halophyte-psammophyte vegetation, sand dune, beach sand, moss, soil over beach rocks
	Fernandes & Mendonça (2004)	RJ (ES)		
B. parvula Schäeffer	Arlé (1962)	?	Cos	un
B. platensis Najt & Massoud	Fernandes & Mendonça (in press)	ES	Neo, Aus	Beach sand, litter over sandy dune
B. septemoculata Denis	Mendonça *et al.* (in press)	RJ	Pal, Neo	Rotten wood
**B. villalobosi* Cassagnau & Rapoport	Cassagnau & Rapoport (1962)	PE	Neo	un
**Brachystomellides compositus* Arlé	Arlé (1959a)	RJ	Neo	Beach sand, litter
	Oliveira & Deharveng (1995)	AM		
**Folsomiella albida* (Arlé)	Arlé (1959a)	RJ	Neo	Litter
	Arlé (1962)	Serras do Mar e Mantiqueira		
F. caeca (Folsom)	Stach (1949)	(RJ)	Neo	Soil
**F. intermedia* (Arlé)	Arlé (1939b)	RJ	NCB	Soil
	Arlé (1962)	Serras do Mar e Mantiqueira		
**F. pseudocaeca* Mendonça, Fernandes & Abrantes	Mendonça *et al.*, (2005)	RJ	NCB	Soil
**F. trisetosa* Mendonça, Fernandes & Abrantes	Mendonça *et al.*, (2005)	RJ, SP	NCB	Soil and rotten log, soil near stream, soil near stream
**Maricaella duna* Mendonça & Fernandes	Mendonça & Fernandes (1997)	RJ	NCB	Litter, sand dune
Micronella porcus (Denis)	Arlé (1959a)	RJ	Neo	Soil
**Rapoportella pitomboi* Mendonça & Fernandes	Mendonça & Fernandes (1995)	MG	NCB	Halophyte-psammophyte vegetation, sand dune, flooded areas
	Fernandes & Mendonça (2004)	RJ		
**Setanodosa occidentalis* (Arlé)	Arlé (1959a)	RJ	NCB	un
	Arlé (1962)	Itatiaia, Mantiqueira		
Hypogastruridae				
**Acherontides eleonorae* Palacios-Vargas & Gnaspini-Netto	Palacios-Vargas & Gnaspini-Netto (1992)	PR, SP	NCB	Guano piles of haematophagous bats in caves
Acherontiella colotlipana Palacios-Vargas e Thibaud	Culik *et al.* (2006)	ES	Pal, Neo	Soil

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
A. globulata Thibaud & Massoud	Fernandes & Mendonça (2004)	RJ	Neo	Halophyte-psammophyte vegetation, sand dune
**Austrogastrura travassosi* (Arlé)	Arlé (1939d, 1970)	MS	Neo	Halophyte-psammophyte vegetation and littoral sand
	Thibaud & Palacios-Vargas (1999)	RJ		
Ceratophysella armata (Nicolet)	Moniez (1894)	(RJ)	Bor, Cos?, Neo	un
C. bengtssoni (Agren)	Thibaud & Palacios-Vargas (1999)	RJ	Bor, NCB	Littoral sand
Hypogastrura manubrialis (Tullberg)	Denis (1923)	RJ	Cos	un
H. rehi Börner	Börner (1906)	(SP)	NCB	un
Mesogastrura cf. *ojcoviensis* (Stach)	Thibaud & Palacios-Vargas (1999)	RJ	Bor, Neo	Littoral sand
Paraxenylla piloua Thibaud & Weiner	Fernandes & Mendonça (2007)	RJ	NCB	Halophyte-psammophyte vegetation
**P. sooretamensis* Queiroz & Deharveng	Queiroz & Deharveng (2008)	ES	NCB	Forest litter
**Schoettella celiae* Fernandes & Mendonça	Fernandes & Mendonça (1998)	SP	NCB	Forest litter
**Willemgastrura coeca* Oliveira & Thibaud	Oliveira & Thibaud (1988)	AM, RO	Amz, NCB	Soil
Willemia brevispina Hüther	Thibaud & Palacios-Vargas (1999)	RJ	Ant, Neo, Pal	Soil and littoral sand
	Culik *et al.* (2006)	ES		
**Xenylla brasiliensis* (Arlé)	Gama (1978)	MG	NCB	Litter
**X. capixaba* Fernandes & Mendonça	Fernandes & Mendonça (in press)	ES	NCB	Litter over sand dune
X. maritima Tullberg	Fernandes & Mendonça (2004)	RJ	Cos	Halophyte-psammophyte vegetation, sand dune, flooded areas
**X. nirae* Gama & Oliveira	Gama & Oliveira (1994)	AM	Amz	Soil
X. subcavernarum Gama	Gama (1969)	Specific colletion site may be located in Argentina (Culik & Zeppelini 2003)		un
X. welchi Folsom	Culik *et al.* (2006)	ES	Cos	Soil, halophyte-psammophyte vegetation, foredune zone
	Fernandes & Mendonça (2007)	RJ		
X. yucatana Mills	Fernandes & Mendonça (in press)	ES	Pal, Neo, Aus	Beach sand
Neanuridae				
**Aethiopella delamarei* Arlé	Arlé (1959a)	MG	Neo	Litter
	Arĺé (1981)	RJ		
**A. littoralis* Fernandes & Mendonça	Fernandes & Mendonça (2002)	RJ	NCB	Halophyte-psammophyte vegetation, sand dune, flooded areas

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TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
Anurida maritima (Guerin)	Arlé (1959b)	Brazilian coast	Cos	
	Schuster (1965)	PE, SP		
	Arlé (1966b)	RJ		
	Arlé (1981)	ES, RJ, SP		
Arlesia albipes (Folsom)	Arlé (1962)	(PA, PE, RJ, MG?)	Neo	Soil, litter and sand dunes
	Zeppelini *et al.* (2009)	PB (ES)		
**A. arleana* Mendonça & Fernandes	Arlé & Rufino (1976)	PE	NCB	Litter
**A. fluminensis* (Arlé)	Arlé (1939c)	RJ	NCB	
	Arlé (1962)	SE		
**A. intermedia* Fernandes & Mendonça	Fernandes & Mendonça (2004)	RJ	NCB	Sand dune, flooded areas
**A. proxima* (Arlé)	Arlé (1939c)	RJ	NCB	un
	Arlé (1962)	SE		
	Mendonça & Fernandes (1999)	SP		
**Arlesiella amazonica* Arlé	Arlé (1966a, 1981)	AM	Amz	Litter
**Brasilimeria anura* (Arlé)	Arlé (1939c)	RJ	NCB	Humus under dead leaf
**B. wygodzinskyi* (Arlé)	Arlé (1943)	RJ, (Serra da Mantiqueira)	NCB	un
	Arlé & Rufino (1976)	MG		
Friesea arlei Massoud & Bellinger	Arlé (1966a)	MT	Neo	un
F. claviseta (Axelson)	Fernandes & Mendonça (2007)	RJ	Cos	Halophyte-psammophyte vegetation
F. cubensis Potapov & Banasko	Thibaud & Palacios-Vargas (1999)	RJ	Neo	Littoral sand
F. josei Palacios-Vargas	Thibaud & Palacios-Vargas (1999)	RJ	Neo	Littoral sand
F. magnicornis Denis, 1931	Fernandes & Mendonça (2007)	RJ	Neo	Halophyte-psammophyte vegetation
F. mirabilis (Tullberg, 1871)	Fernandes & Mendonça (2007)	RJ	Cos	Halophyte-psammophyte vegetation
F. reducta Denis, 1931	Fernandes & Mendonça (2004, 2007)	RJ	Neo	Halophyte-psammophyte vegetation, sand dune
F. sublimis Macnamara	Culik *et al.* (2006)	ES	Neo, Bor, Pal	Soil
**Furculanurida belemensis* Arlé and Rufino	Arlé & Rufino (1976)	PA	Amz	Soil
**F. goeldiana* Arlé & Rufino	Arlé & Rufino (1976)	PA	Amz	Litter
**F.nessimiani* Fernandes & Mendonça	Fernandes & Mendonça (2002)	SP	NCB	Forest litter
**Halachorutes schusteri* Arlé	Arlé (1966b, 1981)	PA, RJ	Amz, NCB	Litter
**Hylaeanura infima* (Arlé)	Arlé (1959a, 1962)	MT	Neo	Soil, litter, sand dune, flooded areas
	Arlé (1966a)	AM, MT, PA		

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TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
	Fernandes & Mendonça (2004)	RJ		
**Kenyura delicata* Arlé	Arlé (1966a, 1981)	AM	Amz	Litter
**K. porculus* (Arlé)	Arlé (1959a, 1981)	RJ	NCB	Litter
**K. xinguensis* Arlé	Arlé (1966a, 1981)	MT	NCB	Litter
**Micranurida fluminensis* Fernandes & Mendonça	Fernandes & Mendonça (2004)	RJ	NCB	Sand dune, flooded areas
**Neotropiella denisi* (Arlé)	Arlé (1939c)	RJ	NCB	Soil, litter on roots
	Arlé (1962)	SE		
	Arlé (1981)	MT		
**N. meridionalis* (Arlé)	Arlé (1939c)	RJ	Neo	Litter, rotten woods
	Arlé (1962)	SE		
	Arlé (1966a)	MG, PA, RJ		
	Oliveira & Deharveng (1995)	AM		
N. arlei Najt, Thibaud & Weiner	Oliveira & Deharveng (1995)	AM	Neo	Primary and secondary forest soil and litter
N. carli (Denis)	Arlé (1962)	(AM, AP, PA)	Neo	Litter
N. digitomucronata Thibaud & Massoud	Oliveira & Deharveng (1995)	AM	Neo	Primary and secondary forest soil and litter
N. quinqueoculata (Denis)	Cassagnau & Rapoport (1962)	RJ	Bor, Neo	un
	Arlé (1966a)	AM, AP, MT, PA, RJ		
N. vanderdrifti Massoud	Oliveira & Deharveng (1995)	AM	Neo	Primary and secondary forest soil and litter
**Paleonura brasiliensis* (Arlé)	Arlé (1959a)	MG (RJ)	NCB	Litter
**P. nuda* Cassagnau & Oliveira	Cassagnau & Oliveira (1990)	AM	Amz	Primary and secondary forest soil and litter
**Pronura amazonica* Cassagnau and Oliveira	Cassagnau & Oliveira (1990)	AM	Amz	Litter
**Pseudachorutes bifasciatus* Oliveria & Deharveng	Oliveira & Deharveng (1994)	AM	Amz	Soil
P. difficilis Denis	Fernandes & Mendonça (2004)	RJ	Neo	Sand dune, flooded areas
**P. gilvus* Oliveria & Deharveng	Oliveira & Deharveng (1994)	AM	Amz	Soil
**P. herbert* Arlé & Rufino	Arlé & Rufino (1976)	AM	Amz	Litter
**P. massoudi* Arlé	Arlé (1966a, 1981)	AM	Amz	Litter
Pseudanurida sawayana Schuster	Schuster (1965)	PE, SP, (RJ)	Bor, Neo, Pal	On sand and sea weed in the rocky coast
**Tijucameria mame* Mendonça & Fernandes	Mendonça & Fernandes (2005)	RJ	NCB	Forest litter
Odontellidae				
**Stachiomella folsomi* (Arlé) (as *Pseudostachia*)	Arlé (1968)	PA	Amz, Pal	Soil
Onychiuridae				

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
Agraphorura cf. mariapetrae Thibaud	Fernandes & Mendonça (2004)	RJ	Neo	Flooded areas
**Onychiurus cunhai* Arlé	Arlé (1970)	PA	Neo	Soil
	Rufino & Schubart (1974)	AM		
**O. fernandae* Oliveira & Thibaud	Oliveira & Thibaud (1992)	PA	Amz	Litter
Protaphorura cryptopyga (Denis)	Cassagnau & Rapoport (1962)	RJ	Neo, Pal	un
Tullbergiidae				
Fissuraphorura cubanica Rusek	Thibaud & Palacios-Vargas (1999)	ES	Neo	Soil, halophyte-psammophyte vegetation
	Fernandes & Mendonça (2007)	RJ		
**Mesaphorura amazonica* Oliveira & Thibaud	Oliveira & Thibaud (1992)	AM	Amz, NCB	Litter, halophyte-psammophyte vegetation, sand dune, soil
	Fernandes & Mendonça (2004)	RJ		
	Culik *et al.* (2006)	ES		
**M. maricaensis* Fernandes & Mendonça	Fernandes & Mendonça (2004)	RJ	NCB	Sand dune
M. iowensis Mills (= *M. krausbaueri* Börner)	Palacios-Vargas & Díaz (1996)	SP	Cos	Soil and litter
Mesaphorura sp. gr. *atlantica*	Thibaud & Palacios-Vargas (1999)	RJ	-	Littoral sand
M. yosiii (Rusek) (as *M. yosii* (sic) (Rusek))	Oliveira & Thibaud (1992)	AM	Cos	Primary and secondary forest soil and litter
M. yosii (Rusek)	Palacios-Vargas & Díaz (1996)	SP		Halophyte-psammophyte vegetation, sand dune and flooded areas, soil, litter
	Thibaud & Palacios-Vargas (1999)	RJ		
**Tullbergia minensis* Arlé	Arlé (1959a)	MG	NCB	Litter
Entomobryidae				
**Dicranocentrus bicolor* Handschin	Handschin (1924)	no	Pam	un
**D. heloisae* Arlé and Mendonça	Arlé & Mendonça (1982)	RJ	NCB	Forest litter
**D. silvestrii* Absolon	Cassagnau (1963)	RJ	Neo	Forest
(as var. annulata)	Börner (1906)	São Francisco river		
**D. termophilus* Handschin	Handschin (1924)	no	NCB	un
**Mastigoceras camponoti* Handschin	Handschin (1924)	no	Amz, NCB	Ant nest, forest, litter, soil
	Stach (1935)	MG		
	Cassagnau (1963)	RJ		
	Mari Mutt (1978)	SP		
	Cassagnau & Oliveira (1992)	AM		

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TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
**Entomobrya aipatse* Arlé	Arlé (1959a)	MT	NCB	Scrubland, litter
**E. ataquensis* Arlé	Arlé (1959a)	MG-SP border	NCB	On plants
E. decora (Nicolet)	Christiansen (1963)	RJ	Neo	Duneland
**E. egleri* Arlé & Guimarães	Arlé & Guimarães (1978)	PA	Amz	Forest, litter
	Oliveira & Deharveng (1995)	AM		
E. griseoolivata (Packard)	Zeppelini *et al.* 2009	PB	Bor, Neo	Forest litter, duneland
E. inaequalis Arlé & Guimarães	Denis (1924)	no	NCB	un
E. cf. nivalis (Linnaeus)	Zeppelini *et al.* 2009	PB	Cos	Forest litter, duneland
E. paroara Arlé & Guimarães	Arlé & Guimarães (1978)	PA	Amz	Littoral
E. spectabilis Reuter	Reuter (1892) cited in Mari Mutt & Bellinger (1990) possibly refers to Reuter (1891)		NCB, Pal	On plant
	Reuter (1895)	un		
	Kraepelin (1901)	São Francisco river		
**E. tupiana* Arlé	Arlé (1939b)	RJ	NCB	Forest
**E. uambae* Arlé	Arlé (1959a)	MT	Amz, NCB	Forest
	Oliveira & Deharveng (1995)	AM		
**E. wasmanni* Handschin	Handschin (1924)	(RJ)	Neo	Forest litter
**Nothobrya schubarti* Arlé	Arlé (1961)	PE, PI	NCB	Lagoon
**Rynchocyrtus klausi* Mendonça & Fernandes	Mendonça & Fernandes (2007)	RJ	NCB	Forest litter
	First record	PB		
**Seira annulata* (Handschin)	Christiansen & Bellinger (2000)	SP	Neo	un
**S. arenicola* Bellini & Zeppelini	Bellini & Zeppelini (2008a)	PB	NCB	Forest litter, duneland
**S. atrolutea* (Arlé)	Arlé (1939d)	MS, SP	NCB	Over plants, rocks and dead wood
**S. bicolorcornuta* Bellini *et al.*	Bellini *et al.*(2009)	PE	NCB	Over sand, rocks
**S. brasiliana* (Arlé)	Arlé (1939d)	MS, RJ, SP, (RJ)	Bor, Neo	Beach sand, forest litter
	Zeppelini *et al.* 2009	PB		
S. domestica (Nicolet)	Mendonça *et al.* (in press)	RJ	Cos	Grassland
**S. eidmanni* (Stach)	Stach (1935)	RJ	NCB	Ant nest, tree bark
	Arlé (1939a)	RJ		
	Christiansen & Bellinger (2000)	SP		
**S. mataraquensis* Bellini & Zeppelini	Bellini & Zeppelini (2008a)	PB	NCB	Forest litter, duneland
**S. melloi* (Arlé)	Arlé (1939a)	ES, RJ	NCB	Lichen, moss

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
**S. mirianae* Arlé & Guimarães	Arlé & Guimarães (1981a)	RJ	NCB	Duneland, forest litter, soil, duneland
	Bellini & Zeppelini (2004)	PB		
**S. mendoncea* Bellini & Zeppelini	Bellini & Zeppelini (2008b)	PB	NCB	Litter, soil, rocks
**S. musarum* Ridley	Ridley (1890)	F. de Noronha Island	NCB	On plant
**S. nigrans* (Arlé)	Arlé (1959a)	MT	NCB	Scrubland, leaf litter, soil and rocks
	Bellini & Zeppelini (2004)	PB		
**S. nunezae* Christiansen & Bellinger	Christiansen & Bellinger (2000)	MS, SP	NCB	Litter, soil
**S. paraibensis* Bellini & Zeppelini	Bellini & Zeppelini (2009)	PB	NCB	Forest litter, soil
**S. paranensis* (Stach)	Stach (1935)	PR	NCB	un
**S. prodiga* (Arlé)	Arlé (1959a)	MT, PE, RJ	NCB	Forest litter, duneland
	Bellini & Zeppelini (2004)	PB		
**S. pseudoannulata* Bellini & Zeppelini	Bellini & Zeppelini (2008a)	PB	NCB	Forest litter, duneland
**S. pulcher* (Handschin)	Handschin (1924)	SC	Bor, Pam	un
	Christiansen & Bellinger (2000)	SC		
**S. raptora* Zeppelini & Bellini	Zeppelini & Bellini (2006)	PB	NCB	Litter, soil, rocks
**S. reichenspergeri* (Handschin)	Handschin (1924)	SC	Pam	un
**S. subannulata* (Denis)	Arlé (1939a)	ES, RJ	Neo	Lichen, moss
**S. xinguensis (*Arlé)	Arlé (1959a)	MT	NCB	Scrubland, reforestation in duneland
	Zeppelini *et al.* (2009)	PB	NCB	
**Lepidosira tapuia* Arlé & Guimarães	Arlé & Guimarães (1980)	RJ	NCB	Forest
**L. villasboasi* Arlé & Guimarães	Arlé & Guimarães (1981b)	MT	NCB	Forest
Lepidocyrtus nigrosetosus Folsom	Bellini & Zeppelini (2004)	PB	Neo	Forest litter, river sand
L. pallidus Reuter	Kraepelin (1901)	RS	Bor, Neo, Pal	On plant
	Börner (1907)	RS		
**Pseudosinella alba* (Packard)	Mendonça *et al.* (in press)	RJ	NCB	Forest litter
P. cf. *biunguiculata* Ellis	Culik *et al.* 2006	ES	Neo	Papaya orchards
**P. brevicornis* Handschin	Handschin (1924)	(RJ)	NCB	Forest litter, soil and roots
P. octopunctata Börner	Mendonça *et al.* (in press)	RJ	Cos	Forest soil, beach sand
Paronellidae				

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
**Salina celebensis* (Schäffer)	Cassagnau (1963)	RJ	Bor, Neo, Pal	Forest
**Paronellides alticolus* (Arlé)	Arlé (1939b)	RJ	NCB	Forest, leaf litter
Campylothorax cassagnaus Mitra & Dallai	Cassagnau (1963)	RJ	Neo	Forest litter
**C. schaefferi* Börner	Börner (1906)	no	Amz, Pam	Forest
	Mitra & Dallai (1980)	São Francisco river		
	Oliveira & Deharveng (1995)	AM		
C. schaefferi Börner	Mendonça *et al.* (in press)	RJ	Amz, Pam	Forest litter and soil
**Trogolaphysa aelleni* Yoshii	Yoshii (1988)	SP	NCB	Cave
**T. hauseri* Yoshii	Yoshii (1988)	SP	NCB	Cave
**T. hirtipes* (Handschin)	Handschin (1924)	no	Neo	Forest
	Cassagnau (1963)	RJ		
**T. millsi* (Arlé)	Arlé (1939b)	RJ	NCB	Forest
**T. tijucana* (Arlé & Guimarães)	Arlé & Guimarães (1979)	RJ	NCB	Forest
**Troglobius brasiliensis* Palacios-Vargas & Zeppelini	Palacios-Vargas & Zeppelini (1995a)	PA, SP	Amz, NCB	Cave
Cyphoderidae				
Cyphoderus agnotus Börner	Cassagnau (1963)	PE	Bor?, Neo	Forest
**C. arlei* Cassagnau	Cassagnau (1963)	RJ	NCB	un
C. innominatus Mills	Cassagnau (1963)	PE, RJ	Neo	Duneland, Grassland
C. cf. *similis* Folsom	Culik *et al.* (2006)	ES	Bor, Pal, Neo	Papaya orchards
**Cyphoderodes xenopus* Börner	Börner (1913)	RS	NCB	Ant nest
Oncopoduridae				
Oncopodura hyleana Arlé	Arlé (1960)	AP	Amz	Forest litter
O. itatiaiensis Arlé	Arlé (1960)	RJ	NCB	Forest litter
Isotomidae				
**Archisotoma catiae* Abrantes & Mendonça	Abrantes & Mendonça (2007)	RJ	NCB	Sand dune
Archisotoma cf. *besselsii* (Packard)	Strenzke (1958)	RJ	Bor, Neo	Intertidal zone
Archisotoma gourbaultae Thibaud	Thibaud & Palacios-Vargas (2001)	RJ	Neo	Beach
**Arlea adetolai* Mendonça, Abrantes & Fernandes	Mendonça *et al.* (2006)	RJ	NCB	Soil, litter
**Arlea arenicola* Abrantes & Mendonça	Abrantes & Mendonça (2005)	RJ	NCB	Sand dunes
**Arlea lucifuga* Arlé	Arlé (1939b)	RJ	NCB	Litter, soil, humus, termites nest
	Mendonça & Arlé (1987)	MG, RJ		
**Arlea psammophila* Mendonça, Abrantes & Fernandes	Mendonça *et al.* (2006)	RJ	NCB	Beach

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
**Arlea spinisetis* Mendonça & Arlé	Mendonça & Arlé (1987)	CE, (RJ)	NCB	Scrubland, Beach, riparian vegetation and farming areas
Axelsonia littoralis (Moniez)	Arlé (1959b)	Brazilian Coast	Bor, Aus, Neo	un
Axelsonia tubifera Strenzke	Strenzke (1958)	SP	Neo	un
Ballistura fitchi (Denis)	Arlé (1939a)	ES	Bor, Pal, Neo	Lichen, Moss, Soil
	Mendonça & Reis (1990)	RJ		
Clavisotoma filifera (Denis)	Mendonça & Reis (1991)	(RJ)	Bor, Aus, Neo	Sand dune
Cryptopygus pentatomus (Börner)	Börner (1906)	?	NCB	un
C. separatus (Denis)	Mendonça *et al.* (in press)	RJ	Neo, Pal	Soil, litter
Desoria trispinata Mac Gillivray	Mendonça (1981)	RJ	Bor, Pal, Neo	Soil, litter, halophyte-psammophyte vegetation
Folsomia candida Willem	Massoud & Rapoport (1968)	(RJ)	Cos	Litter
F. similis Bagnall	Mendonça *et al.* (in press)	RJ	Bor, Aus, Neo	Litter under rock
F. wellingdae Potapov & Culik	Potapov & Culik (2002)	ES	NCB	Soil
Folsomides centralis (Denis)	Arlé (1939a)	ES, (RJ)	Cos	Soil, tree trunk, halophyte-psammophyte vegetation, foredune environments, litter, grass over rocks between sand beach and mangrove
	Oliveira & Deharveng (1995)	AM		
F. parvulus Stach	Mendonça (1984)	RJ, PA	Cos	Soil, litter, humus, rotten trunk, grass over rocks between sand beach and mangrove, Sand dunes, forest litter
	Oliveira & Deharveng (1995)	AM		
	Culik *et al.* (2006)	ES		
F. semiparvulus Fjellberg	Abrantes & Mendonça (2007)	RJ	Bor, Neo	Sand dunes
Folsomina onychiurina Denis	Arlé (1939a)	ES	Cos	Beach, soil, litter, riparian vegetation, understory vegetation, sand dunes, beach, grass
	Oliveira & Deharveng (1995)	AM		
	Thibaud & Palacios-Vargas (1999)	RJ, ES		
Hemisotoma thermophila (Axelson)	Bellini & Zeppelini (2004)	PB, (RJ)	Cos	Sand dune, halophyte-psammophyte vegetation, sand dune, litter
**Isotomiella amazonica* Oliveira & Deharveng	Oliveira & Deharveng (1990)	AM	Amz, NCB	Litter

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
	Mendonça & Abrantes (2007)	RJ		Sand dune, litter
**I. arlei* Oliveira & Deharveng	Oliveira & Deharveng, (1990)	AM	Amz	Flood plain, primary and secondary forest soil and litter
**I. barrai* Deharveng & Oliveira	Deharveng & Oliveira (1990)	AM	Amz, NCB	Primary forest soil and litter
	Mendonça & Fernandes (2003b)	RJ		
**I. barrana* Mendonça & Abrantes	Mendonça & Abrantes (2007)	RJ	NCB	Herbaceous vegetation, sand dunes, litter and soil
I. bidentata Delamare Debouteville	Mendonça & Abrantes (2007)	RJ	Neo, Pal	Litter
**I. canina* Mendonça & Fernandes	Mendonça & Fernandes (2003a)	RJ	NCB	Soil, litter
**I. digitata* Deharveng & Oliveira	Deharveng & Oliveira (1990)	RO	Amz	Forest soil and litter
**I. distincta* Mendonça & Fernandes	Mendonça & Fernandes (2003b)	RJ	NCB	Soil, litter
**I. dupliseta* Deharveng & Oliveira	Deharveng & Oliveira (1990)	AM	Amz	Soil
**I. f*alcata Mendonça & Fernandes	Mendonça & Fernandes (2003b)	RJ	NCB	Soil
**I. felina* Mendonça & Fernandes	Mendonça & Fernandes (2003a)	RJ	NCB	Soil, litter
**I. granulata* Oliveira & Deharveng	Oliveira & Deharveng (1990)	AM, RO	Amz, NCB	Scrub, forest litter
I. minor (Schäffer)	Arlé (1939a)	ES	Cos	un
**I. nummulifer* Deharveng & Oliveira	Deharveng & Oliveira (1990)	AM, (RJ)	Pal, Neo	Soil
**I. proxima* Mendonça & Fernandes	Mendonça & Fernandes (2003b)	RJ	NCB	Soil, litter
**I. quadriseta* Deharveng & Oliveira	Deharveng & Oliveira (1990)	AM	Amz, NCB	Litter, soil
	Mendonça & Fernandes (2003a)	RJ		
**I. sensillata* Oliveira & Deharveng	Oliveira & Deharveng (1990)	AM, RO	Amz, NCB	Litter
**I. similis* Oliveira & Deharveng	Oliveira & Deharveng (1990)	AM	Amz	Litter
**I. spinifer* Deharveng & Oliveira	Deharveng & Oliveira (1990)	AM	Amz	Soil
I. symetrimucronata (Najt & Thibaud)	Oliveira & Deharveng (1990) as *I. prussianae*	AM, (RJ)	Pal, Neo	Soil, litter, fore dune zone vegetation
	Culik *et al.* (2006)	ES		
**Isotomodes carioca* Thibaud & Palacios-Vargas	Thibaud & Palacios-Vargas (1999)	RJ	NCB	Beach
**I. fernandesae* Abrantes & Mendonça	Abrantes & Mendonça (2007)	RJ	NCB	Beach

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TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
I. trisetosus Denis	Oliveira & Deharveng (1995)	AM	Bor, Pal, Neo	Primary and secondary forest soil and litter
Isotomurus palustris (Müller)	Arlé (1939a)	ES, PE	Cos	Seedbed
	Costa (1961)	BA		
**I. pseudosensillatus* Mendonça	Mendonça (1990)	CE	NCB	Scrubland, litter
**I. riparius* Mendonça	Mendonça (1990)	RJ	NCB	Duneland
Micranurophorus musci Bernard	New Record	RJ	Bor, Neo	Sand dunes
**Najtia vicaria* (Arlé)	Arlé (1959a)	RJ	NCB	Soil, litter, rotten trunk, termite galleries
**Paracerura itatiaiensis* (Arlé)	Arlé (1959a)	RJ	NCB	Moist soil
**P. virgata* Deharveg & Oliveira	Deharveng & Oliveira (1994)	AM	Amz	Forest soil
Proisotoma minuta (Tullberg)	Moniez (1894)	(RJ)	Cos	Soil, litter, humus
**P. oliveirae* Deharveng	Deharveng (1984)	AM	Amz	Plant litter
**P. ramosi* Arlé	Arlé (1959a)	MG, SP Border	NCB	
	Arlé (1960)	RJ		Litter
P. subminuta Denis	Mendonça & Reis (1990)	NCB	Bor, Neo	un
P. tenella (Reuter)	Arlé (1970)	PR	Cos	Halophyte-psammophyte vegetation, sand dunes, soil
	Mendonça & Reis (1990)	RJ, PR		
	Culik *et al.* (2006)	ES		
**Psammisotoma* restingae Abrantes & Mendonça	Abrantes & Mendonça (2009)	RJ	NCB	Halophyte-psammophyte vegetation
**Yosiiella mira* Hüther	Hüther (1967)	(AM)	Amz	
Neelidae				
Megalothorax minimus Willem	Arlé (1959b)	PA	Cos	un
Neelus cf. *minimus* Willem	Culik *et al.* (2006)	ES	Cos	Papaya orchards
Sminthurididae				
**Sminthurides macroceros* Arlé	Arlé (1961)	MT	NCB	Lake
**Sphaeridia betschi* Arlé	Arlé (1984)	RJ	NCB	Forest
**S. biniserrata* (Salmon)	Bretfeld & Gauer (1994)	MG, RJ	NCB, Pal	un
**S. boettgeri* Bretfeld & Gauer	Arlé (1984)	AM	Amz	Forest
**S. cardosi* Arlé	Arlé (1984)	RJ	NCB	Forest
**S. carioca* Arlé	Bretfeld & Gauer (1994)	RJ	NCB	Forest
**S. cerastes* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. clara* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. coronata* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
**S. fibulifera* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. fluminensis* Arlé	Arlé (1984)	RJ	NCB	Forest
**S. franklinae* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. heloisae* Arlé	Arlé (1984)	RJ	NCB	Forest litter
	Bellini & Zeppelini (2004)	PB		
**S. irmleri* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. martii* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. paroara* Arlé	Arlé (1984)	PA	Amz	un
**S. pilleata* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. pumilis* (Krausbauer)	Arlé (1984)	AM	Cos	un
**S. robusta* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
**S. squamifera* Bretfeld & Gauer	Bretfeld & Gauer (1994)	AM	Amz	Forest
Katiannidae				
**Sminthurinus molinai* Arlé	Arlé (1940)	RJ	NCB	Plant litter
Sphyrotheca mucroserrata Snider	Zeppelini *et al.* (2009)	PB	Pal, Neo	Forest litter, duneland
Sturmiidae				
Sturmius truncivivus Bretfeld & Gauer	Bretfeld & Gauer (1999)	AM	Amz	Forest
Arrhopalitidae				
**Arrhopalites alambariensis* Zeppelini	Zeppelini (2006)	SP	NCB	Cave
**A. amorimi* Palacios-Vargas & Zeppelini	Palacios-Vargas & Zeppelini (1995b)	SP	NCB	Cave
**A. botuveraensis* Zeppelini	Zeppelini (2006)	SC	Pam	Cave
**A. gnaspinii* Palacios-Vargas & Zeppelini	Palacios-Vargas & Zeppelini (1995b)	SP	NCB	Cave
**A. heteroculatus* Zeppelini	Zeppelini 2006	SP	NCB	Cave
**A. lawrencei* Palacios-Vargas & Zeppelini	Palacios-Vargas & Zeppelini (1995b)	SP	NCB	Cave
**A. paranaensis* Zeppelini	Zeppelini (2006)	PR	Pam	Cave
Dicyrtomidae				
**Ptenothrix brasiliensis* Deboutteville & Massoud	Delamare Deboutteville & Massoud (1963)	no	NCB	un
**P. utingae* Arlé & Guimarães	Arlé & Guimarães (1976)	PA	Amz	Forest
Bourletiellidae				
**Deuterosminthurus separatus* Arlé	Arlé (1943)	RJ	NCB	On plant

continued next page

TABLE 2. (continued)

Family / species	Reference	Distribution in Brazil	World distribution	Habitat
**Arlesminthurus aueti* (Arlé)	Arlé (1961)	MT	Amz, NCB	Lake
	Arlé (1971)	MT, PA		
**A. richardsi* (Arlé)	Arlé (1971)	PA	Amz	Plant litter
**A. salinensis* (Arlé)	Arlé (1971)	PA	Amz	Littoral
Sminthuridae				
**Pararrhopalites papaveroi* Zeppelini & Palacios-Vargas	Zeppelini & Palacios-Vargas (1999)	MS	NCB	Cave
**P. wallacei* Palacios-Vargas & Zeppelini	Palacios-Vargas & Zeppelini (1995b)	SP	NCB	Cave
**Pseudobourtiella spinata* (MacGillivray)	Arlé (1971)	PA	Amz, Bor	Aquatic plants
**Temeritas amazonensis* Arlé & Oliveira	Arlé & Oliveira (1977)	PA	Amz	Forest
**T. caatingae* Arlé & Oliveira	Arlé & Oliveira (1977)	BA	NCB	Scrubland
**T. ormondae* Arlé & Oliveira	Arlé & Oliveira (1977)	PA	Amz	Forest
**T. surinamensis* Arlé & Oliveira	Arlé & Oliveira (1977)	MA, PA	Neo	Forest
**T. tucumanensis* Deboutteville & Massoud	Arlé & Oliveira (1977)	MS	Neo	On mushrooms
**Sminthurus rosai* Arlé	Arlé (1939a)	ES	NCB	un

Of the 270 species recorded from Brazil 203 species (75.1%) have occurrence recorded in Southeast region, 88 (32.5%) in North, 44 (16.3%) in Northeast, 19 (7.0%) in Central West and 9 (3.3%) in South region. The species with known distribution restricted to Brazil and total number of records are shown in Figure 1. We list here a total of 181 species restricted to Brazil (67% of the total records), which are supposed to be endemic, however, it is a reflect of the nature of most studies on Collembola in Brazil and Neotropical region, which concerns mainly on taxonomy and description of new species, and the absence of studies in other South American countries.

In conclusion, results presented here indicate that the diversity of Collembola is still underestimated in Brazil and neighboring countries, only increase in taxonomic and ecological research can improve our knowledge and help to establish efficient conservation plans. At the other hand, Brazil is the first country to include Collembola species in the list of endangered fauna, however, only seven cave species where listed as vulnerable, based on the risk on their environment (Machado *et al.* 2005). Many other species must be directly in risk of extinction, or endangered by threats on their environments, but are not included on the list due to the lack of information concerned to Brazilian Collembola (Machado *et al.* 2008).

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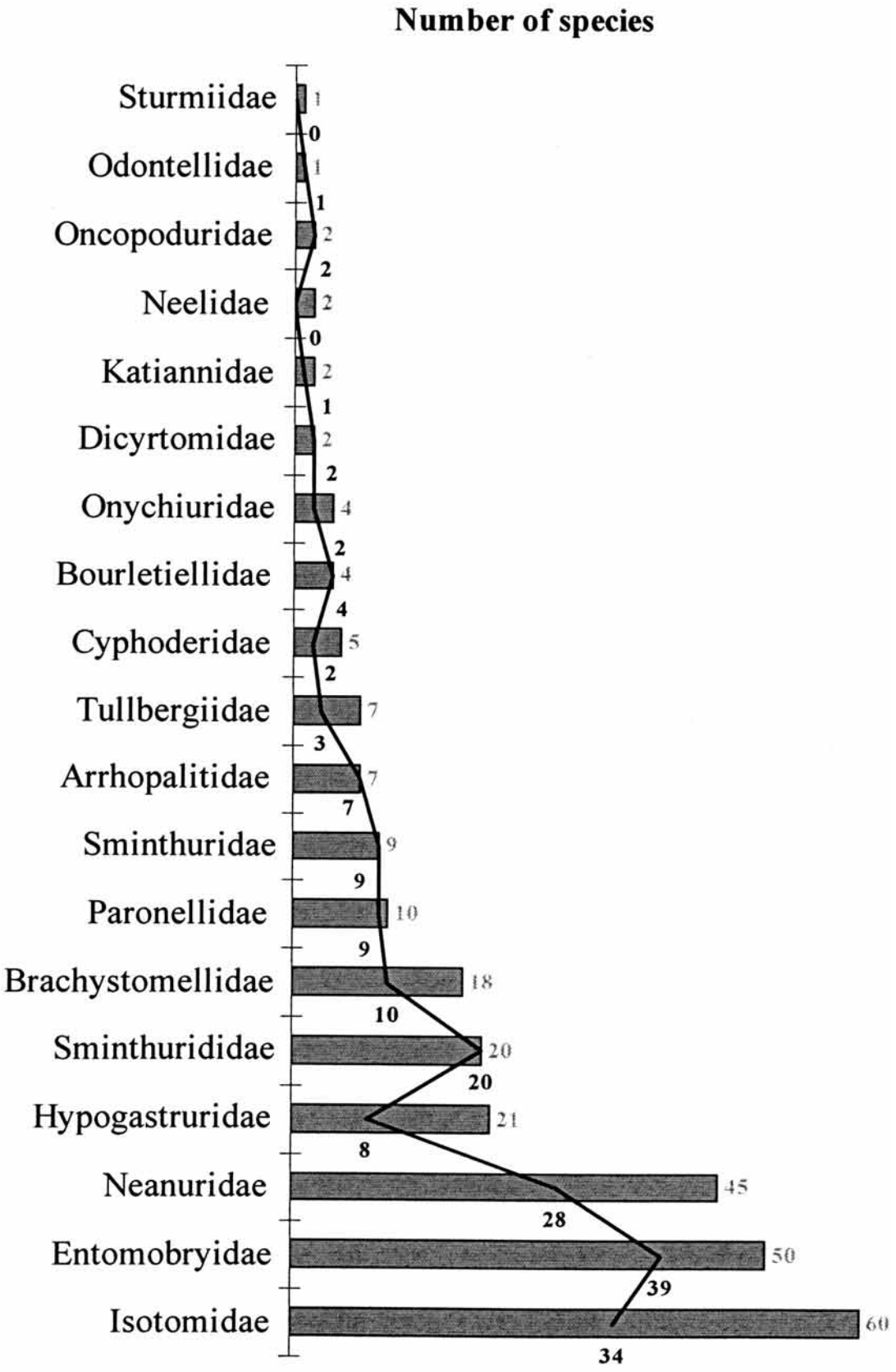

FIGURE 1. Number of species of Brazilian Collembola: bars indicate total number of species recorded in each family (values in gray); line indicates the species with known distribution restricted to Brazil (values in black).

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