



First records of *Lithobius (Lithobius) forficatus* (Linnaeus, 1758) and *Lithobius (Lithobius) obscurus* Meinert, 1872 (Lithobiomorpha, Lithobiidae) introduced to Colombia

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Abstract

The lithobiomorph centipedes *Lithobius (Lithobius) forficatus* (Linnaeus, 1758) and *Lithobius (Lithobius) obscurus* Meinert, 1872 are here reported for the first time in Colombia. We examined 193 individuals from collections kept in several universities and natural history museums from Bogotá city were examined. *Lithobius forficatus* (191 specimens) was recorded up to 2746 m above sea level in areas with some amount of anthropic disturbance. *Lithobius obscurus* (2 specimens) was recorded at 2700 m above sea level in a rural area near Sogamoso, Boyacá. We note morphological variation and habitats for both species. These are the first records of introduced centipedes belonging to the genus *Lithobius* Leach, 1814 in Colombia.

Key words

Bogotá, Boyacá, Colombian Andes, Chilopoda, centipedes, habitats, Europe.

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Introduction

The order Lithobiomorpha Pocock, 1895 consists of more than 1500 species, thereby making it the second-most diverse class of Chilopoda Latreille, 1817 after Geophilomorpha Pocock, 1895 (Edgecombe and Giribet 2007). This order is distributed throughout all continents, except for Antarctica and some areas in the world's tropical and subtropical regions (Zapparoli 2003, Bonato and Zapparoli 2011). It includes 2 families: Lithobiidae Newport, 1844 with nearly 1000 species and subspecies belonging

to 44 genera, mainly distributed in the Northern Hemisphere's temperate regions (Bonato and Zapparoli 2011) and Hemicopidae Pocock, 1901, which predominates in the Southern Hemisphere and displays less diversity as only 120 species are known to date (Edgecombe and Hollington 2002, Bonato and Zapparoli 2011).

Lithobiomorpha generally inhabit soil surface, litter, moss and bark or fallen tree trunks and crevices (Foddai et al. 2002, Tuf 2002, Jabin et al. 2007). Lithobiomorphs can be found in different kinds of forest but are also known to inhabit grasslands and environments

with scarce vegetation, where they are found commonly under stones (Foddai et al. 2002). Some species can be linked to certain environmental factors like humidity, however mention about these habitat preferences are rare (Voigtländer 2005, Iorio 2007). Some eurytopic species, that prefer xeric environments have been identified in Europe, even inhabiting urban areas, like greenhouses, households, and other places with anthropic influence, and are typically found underneath garden debris (Lesniewska 1996, Foddai et al. 2002, Barber 2011).

Various European Lithobiomorpha species have been introduced into different continents, becoming successfully established and dispersed there (Eason 1977c). At least 5 species (mostly from Europe) have been recorded in South and Central America, distributed from Mexico to Argentina (Eason 1973, 1974, 1991). It has been difficult to establish when these centipedes arrived on the continent, but Crabill (1958) suggested that they may have appeared during colonial times (i.e. the 15th century). Maritime trade has played an important role and many of these arthropods may have arrived with the soil of imported plants (Eason 1977c).

Several species of Lithobiomorpha have been recognised in South America. The Andean region has presented the largest number of these centipede species to date (Foddai et al. 2002). However, the order's diversity has not yet been explored in Colombia. The present study has thus been aimed at ascertaining the distribution of the introduced species *Lithobius (Lithobius) forficatus* (Linnaeus, 1758) and *Lithobius (Lithobius) obscurus* Meinert, 1872 as well as providing data regarding their morphological variations and the habitats where they are frequently found in Colombia.

Methods

Three zoological collections kept in Bogotá, Colombia, were examined for this study: Universidad Nacional de Colombia, Museo Javeriano de Historia Natural "Lorezo Uribe, S.J.", and the Universidad Distrital Francisco José de Caldas. The study involved reviewing individuals from 2 species: *L. forficatus* and *L. obscurus*. Body length, sex, number of ocelli, number of rows in which they were arranged, number of antennal articles, number of teeth at the forcipular coxosternite, number of coxal pores at trunk segments XII, XIII, XIV and XV and localities where they were found (as registered by the entomological collections revised) were recorded for each specimen. Occurrence data were obtained from information on each specimen's label. ArcGIS 10.3 was used for converting incidence data to point data. Geographic coordinates were recorded in decimal degrees, based on the WGS84 datum; the WorldClim database (<http://www.worldclim.org>) altitude layer was used. All datasets were gridded to 30 arc sec (ca 1 km²) spatial resolution. Eason's (1982) key was used for a preliminary identification of the specimens and each specimen was compared to these references: Farzaliyeva and Eshyunin (2008), Eason and Ashmole (1992),

Eason (1973), Eason (1974), Voigtländer and Reip (2013) and Brölemann (1930) were compared to each individual. The terminology used for describing external anatomy followed (Bonato et al. 2010).

Abbreviations. C = coxa; Tr = trochanter; P = prefemur; F = femur; T = tibia; in plectrotaxy: a = anterior spur; m = middle spur; p = posterior spur; asl = above sea level. Repository acronyms are as follows: ICN-UNAL = Instituto de Ciencias Naturales de la Universidad Nacional de Colombia; MPUJ = Museo Javeriano de Historia Natural "Lorezo Uribe, S.J."; CAUD-216 = Colección de artrópodos y otros invertebrados de la Universidad Distrital Francisco José de Caldas.

Results

Lithobius (Lithobius) forficatus (Linnaeus, 1758)

Figures 1–5

Material examined. Cundinamarca: ICN-M.Ch-0103, 1 ♂, Facatativá, N. Ocampo, 5-VIII-2005, 04°48.88' N, 074°21.31' W, 2640 m; ICN-M.Ch-0132, 1 ♀, Bogotá, Universidad Nacional de Colombia, D. Luna, 9-II-2011, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0219, 1 ♂, Bogotá, D. Martínez, 23-I-2012, 04°38.57' N, 074°04.09' W, 2600m; ICN-M.Ch-0225, 1 ♀, 2 ♂, Bogotá, neighbourhood of "Suba", 15-X-1975, 04°44.46' N, 074°05.02' W, 2600 m; ICN-M.Ch-0227, 1 ♂, Bogotá, E. Flores, 9-IV-1999, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0229, 8 ♂, 2 ♀, Bogotá, S. Galvis, 4-V-2012, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0230, 2 ♂, 4 ♀, Bogotá, S. Galvis, 3-V-2012, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0232, 1 ♂, Bogotá, S. Galvis, 3-V-2012, 04°38.57' N, 074°4.09' W, 2600 m; ICN-M.Ch-0233, 1 ♂, Bogotá, S. Galvis, 4-V-2012, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0249, 1 ♂, Bogotá, S. Galvis, 4-V-2012, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0250, 1 ♂, Bogotá, S. Galvis, 4-V-2012, 04°38.57' N, 074°04.09' W, 2600 m; ICN-M.Ch-0337, 1 ♂, Chia, Vereda Fonqueta, E. Chaparro & S. Galvis, V-2012, 04°53.78' N, 074°04.71' W, 2564 m; ICN-M.Ch-0363, 10 ♂, 5 ♀, Chia, Vereda Cerca de Piedra, E. Chaparro, S. Galvis & D. Triana, 25-VIII-2012, 04°50.66' N, 074°05.21' W, 2600 m; LIT-0001, 1 ♀, Bogotá, P. Carreño, 10-XI-2010, 04°37.99' N, 074°7.55' W, 2600m; LIT-0002, 1 ♂, 1 ♀, Bogotá, E. Ussa, 8-III-2004, 04°37.99' N, 074°07.55' W, 2600 m. LIT-0003, 1 ♀, Villeta, A. García, 19-XI-2010, 05°00.76' N, 074°28.38' W, 500 m; LIT-0005, 3 ♂, Bogotá, Monserrate, A. Oliveros, 23-V-2004, 04°36.33' N, 074°3.42' W, 3152 m; LIT-0007, 2 ♀, Tibacuy, Vereda Liberia, K. Mora, 7-IV-2008, 04°37.99' N, 074°07.55' W, 1647 m; LIT-0010, 1 ♂, Choachí, C. Ramirez, 20-II-2006, 04°31.58' N, 073°55.28' W, 1924 m; LIT-0012, 1 ♀, Bogotá, N. Garzón, 23-X-2010, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0013, 1 ♀, Tobia, M. Vasquez, 10-V-2009, 05°20.03' N, 074°26.99' W, 715 m; LIT-0014, 1 ♀, 1 ♂, Bogotá, A. Sánchez, 17-IV-2007, 04°37.99' N,



Figures 1–4. *Lithobius (Lithobius) forficatus* (Linnaeus, 1758), male, collected on campus of Universidad Nacional de Colombia, Bogotá. 1. Habitus, male, dorsal view. 2. Cephalic plate, dorsal view. 3. Forcipular coxosternite. 4. Coxal pores of last legs. 5. XIV and XV legs. Photographs by Camilo Prado.

074°07.55' W, 2600 m; LIT-0016, 1 ♀, Bogotá, A. Santafe, 12-IV-2008, 04°37.99' N, 074°07.55' W, 2600m; LIT-0017, 1 ♀, Tenjo, C. Forero, 3-III-2002, 04°52.18' N, 074°08.63' W, 2685 m; LIT-0020, 1 ♂, Bogotá, N. González, 18-I-2012, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0021, 1 ♂, La Vega, D. León, 5-V-2005, 04°59.95' N, 074°20.46' W, 1230 m; LIT-0022, 1 ♀, Fusagasuga, E. Patiño, 16-V-2002, 04°20.49' N, 074°22.95' W, 1500 m; LIT-0023 1 ♀, La Mesa, 12-VIII-2004, 04°37.81' N,

074°27.75' W, 1200 m; LIT-0025, 1 ♀, Bogotá, M. Albaracín, 7-XI-2003, 04°37.99' N, 074°7.55' W, 2600 m; LIT-0026, 1 ♂, 1 ♀, La Calera, O. Rodríguez, 19-V-2001, 04°42.78' N, 073°58.37' W, 2746 m; LIT-0027, 1 ♀, Tobia, N. Ramirez, 10-XI-2012, 05°20.03' N, 074°26.99' W, 715 m; LIT-0028, 1 ♀, Tibacuy, I. Cortez, 29-V-2003, 04°20.83' N, 074°27.15' W, 1647 m; LIT-0030, 1 ♂, Bogotá, R. Rodríguez, 3-VI-2010, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0032, 1 ♂, Bogotá, L. Gutier-

- rez, 25-III-2007, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0036, 1 ♀, Bogotá, C. Quilaguy, 1-XII-2012, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0037, 3 ♂, Bogotá, P. Martínez, 25-V-2013, 04°30.20' N, 074°06.42' W, 2600 m; LIT-0038, 2 ♀, Zipaquirá, S. González, 8-V-2013, 05°01.48' N, 074°00.08' W, 2650 m; LIT-0040, 1 ♀, Anolaima, R. Martínez, 26-III-2005, 04°31.08' N, 074°27.88' W, 1647 m; LIT-0041, 1 ♂, Ricaurte, P. Palacios, 25-IV-2009, 04°16.75' N, 074°46.36' W, 284 m; LIT-0042, 3 ♂, Tibacuy, A. Mesa, 25-III-2006, 04°20.83' N, 074°27.15' W, 1647 m; LIT-0043, 1 ♂, Bogotá, A. Ardila, 12-XII-2008, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0045, 2 ♂, Fusagasuga, Chinauta, J. Montañés, 4-XI-2006, 04°17.65' N, 074°28.07' W, 1500 m; LIT-0046, 1 ♂, Girardot, L. Castillo, 19-XI-2009, 04°18.21' N, 074°48.23' W, 289 m; LIT-0047, 1 ♀, Guasca, J. Ley, 15-IX-2005, 04°51.95' N, 073°52.63' W, 2700 m; LIT-0050, 1 ♀, 1 ♂, Subachoque, C. García, 1-XII-2007, 04°55.48' N, 074°10.10' W, 2663 m; LIT-0051, 1 ♂, Bogotá, D. Huertas, 17-IV-2007, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0052, 1 ♀, Bogotá, F. Quiñones, 30-IX-2005, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0053, 2 ♂, 1 ♀, Bogotá, S. Valbuena, 15-X-2011, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0055, 1 ♀, Chocontá, C. Ramírez, 19-III-2007, 05°08.80' N, 073°40.95' W, 2689 m; LIT-0057, 2 ♀, 1 ♂, Mosquera, C. Prado, 17-XI-2006, 04°42.46' N, 074°13.96' W, 2516 m; LIT-0059, 1 ♀, La Mesa, San José, G. Aldana, 25-V-2005, 04°37.81' N, 074°27.75' W, 1200 m; LIT-0060, 2 ♂, La Vega, C. García, 13-V-2006, 04°59.95' N, 074°20.46' W, 1230 m; LIT-0063, 1 ♂, Bogotá, J. Arias, 18-IX-2008, 04°37.99' N, 074°7.55' W, 2600 m; LIT-0065, 1 ♂, Tobia, F. Florez, 15-V-2010, 05°20.03' N, 074°26.99' W, 715 m; LIT-0067, 1 ♀, Tobia, G. Ordoñez, 25-V-2005, 05°20.03' N, 074°26.99' W, 715 m; LIT-0068, 1 ♂, Guasca, D. Calle, 12-X-2003, 04°51.95' N, 073°52.63' W, 2700 m; LIT-0070, 1 ♂, Villeta, S. García, 25-IV-2009, 05°00.76' N, 074°28.38' W, 500 m; LIT-0072, 1 ♀, Sesquilé, F. Revelo, 12-X-2003, 05°02.71' N, 073°47.83' W, 2600 m; LIT-0073, 2 ♀, Bogotá, P. Moreno, 17-X-2004, 04°37.99' N, 074°7.55' W, 2600 m; LIT-0076, 1 ♂, La Palma, M. Martínez, 11-IV-2006, 05°21.33' N, 074°23.53' W, 1462 m; LIT-0078, 1 ♂, 1 ♀, Bogotá, P. Tabon, 3-VI-2010, 04°37.99' N, 074°7.55' W, 2600 m; LIT-0079, 1 ♀, Apulo, M. Palacios, 16-X-2010, 04°31.25' N, 074°35.91' W, 420 m; LIT-0081, 2 ♂, San Francisco, C. García, 30-X-2007, 04°58.26' N, 074°17.35' W, 1230 m; LIT-0083, 1 ♀, Villeta, N. Salazar, 17-X-2004, 05°00.76' N, 074°28.38' W, 500 m; LIT-0084, 2 ♂, Bogotá, C. Martínez, 5-IV-2010, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0085, 2 ♂, Bogotá, Alameda de Venecia, C. Murcia., 26-XI-2005, 04°35.59' N, 074°08.53' W, 2600 m; LIT-0087, 2 ♀, Bogotá, M. Alvarez, 30-V-2011, 04°37.99' N, 074°07.55' W, 2600 m; LIT-0088, 1 ♂, Villeta, P. Abril, 19-VIII-2005, 05°00.76' N, 074°28.38' W, 500 m; LIT-0089, 1 ♂, Tobia, A. Romero, 22-X-2010, 05°20.03' N, 074°26.99' W, 500 m; LIT-0090, 1 ♂, Tobia, A. Diaz, 12-XII-2012, 05°20.03' N, 074°26.99' W, 500 m; LIT-0092, 1 ♀, Tobia, W. Ojeda, 2-XI-2008, 05°20.03' N, 074°26.99' W, 500 m; LIT-0094, 1 ♂, Útica, C. Sierra, 31-III-2009, 05°11.31' N, 074°28.86' W, 479 m; LIT-0095, 1 ♂, Villeta, C. Herrera, 10-X-2010, 05°00.76' N, 074°28.38' W, 779 m; LIT-0096, 1 ♂, Bogotá, Engativá, M. Alvarez, 30-V-2011, 04°42.91' N, 074°7.55' W, 2600 m; LIT-0097, 1 ♂, Bogotá, Universidad Distrital Francisco José de Caldas (UDFJC), Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0098, 1 ♂, Bogotá, UDFJC, Forest of "La Macarena" A, C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0099, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0100, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0101, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0102, 1 ♂, Bogotá, UDFJC Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0103, 1 ♂, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0104, 1 ♂, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0105, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0106, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0107, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0108, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0109, 1 ♀, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0110, 1 ♂, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0111, 1 ♂, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0112, 1 ♂, Bogotá, UDFJC, Forest of "La Macarena A", C. Castillo, 15-X-2015, 04°36.85' N, 074°03.78' W, 2630 m; LIT-0113, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°8.67' W, 2600 m; LIT-0114, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0115, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0116, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0117, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0118, 1 ♀, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0119, 1 ♀, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0120, 1 ♀, Bogotá, Engativá,

Table 1. Plectotaxy of *Lithobius (Lithobius) forficatus* (Linnaeus, 1758). In parenthesis spine variation present on the legs.

Leg	Ventral				Dorsal				
	Tr	P	F	T	C	P	F	T	
1	—	mp	Amp	Am	—	mp	Ap	a(p)	
2	—	mp	Amp	Am	—	(a)mp	Ap	ap	
3–7	—	mp	Amp	Am	—	amp	Ap	ap	
8–9	—	(a)mp	Amp	Am	—	amp	Ap	ap	
10–11	—	amp	Amp	Am	(a)	amp	Ap	ap	
12	—	a(m)p	Amp	am(p)	a	amp	Ap	ap	
13	m	amp	Amp	Am	a	amp	P	(a)p	
14	m	amp	Amp	Am	a	amp	p	(a)p	
15	m	amp	Amp	Am	a	amp	p	-	

Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 74°08.67' W, 2600 m; LIT-0121, 1 ♀, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0122, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; LIT-0123, 1 ♂, Bogotá, Engativá, Humedal El Jaboque, C. Castillo, 10-X-2015, 04°43.37' N, 074°08.67' W, 2600 m; MPUJ-CHI-003 1 ♀, Bogotá, Parque Nacional, J. Quinto, 15-V-2006, 04°37.37' N, 074°03.74' W, 2620 m; LIT-0066, 1 ♀, Córdoba, Planeta Rica, C. Aya, 17-V-2011, 08°24.53' N, 075°34.91' W, 87 m. Boyacá: ICN-M.Ch-0797, 1 ♀, Sogamoso, Barrio Valdes, D. Triana, 19-VIII-2015, 05°44.85' N, 072°55.23' W, 2600 m; ICN-M.Ch-0800, 1 ♂, Sogamoso, Villa del Sol, Área Urbana, D. Triana, 8-VIII-2015, 05°47.81' N, 072°56.13' W, 2600 m; ICN-M.Ch-0801, 1 ♀, Sogamoso, Villa del Sol, Área Urbana, D. Triana, 24-III-2015, 05°47.81' N, 072°56.13' W, 2600 m; LIT-0071, 1 ♀, Pauna, S. Montaña, 29-IX-2005, 05°39.36' N, 073°58.73' W, 1250 m. Tolima: ICN-M.Ch-0218, 1 ♀, Cunday, biology students (BS), 12-III-1976, 04°03.66' N, 074°41.55' W, 475 m; LIT-0035, 1 ♀, Melgar, Las Guacamayas, S. Bustamante, 4-V-2013, 04°12.23' N, 074°38.56' W, 323 m; LIT-0039, 3 ♂, Mariquita, C. Angarita, 5-XI-2005, 05°11.9' N, 074°53.61' W, 495 m; LIT-0082, 1 ♀, Icononzo, Cafreñas, J. Arias, 22-X-2003, 04°10.55' N, 074°31.96' W, 1300 m. Meta: ICN-M.Ch-0224, 1 ♂, Villavicencio, C. Botero, 04°8.55' N, 073°37.76' W, 350 m; LIT-0006, 1 ♀, San Martín, C. Urbano, 14-X-2005, 03°41.81' N, 073°41.91' W, 330 m; LIT-0015, 2 ♀, Cubaral, J. Pacheco, 3-II-2006, 04°16.16' N, 073°29.18' W, 452 m; LIT-0031, 1 ♂, Restrepo, K. Diaz, 8-XI-2008, 04°15.7' N, 073°33.85' W, 570 m; LIT-0034, 1 ♂, 1 ♀, Villavicencio, F. Palacino, 18-IV-2008, 04°08.55' N, 73°37.76' W, 467 m; LIT-0048, 1 ♀, Restrepo, J. Iregui, 22-X-2009, 04°15.7' N, 073°33.85' W, 570 m; LIT-0056, 1 ♀, 1 ♂, Villavicencio, Los Naranjos, A. Marín, 10-I-2004, 04°8.55' N, 073°37.76' W, 467m; LIT-0062, 1 ♀, Villavicencio, M. Cortez, 22-III-2004, 04°08.55' N, 073°37.76' W, 467 m; LIT-0064, 1 ♂, 1 ♀, Restrepo, R. Guerrero, 3-II-2007, 04°15.7' N, 073°33.85' W, 570 m; LIT-0075, 1 ♀, Villavicencio, Los Naranjos, D. Luka, 9-IV-2004, 04°8.55' N, 073°37.76' W, 467 m; LIT-0077, 1 ♀, Restrepo, L.

Sánchez, 9-V-2008, 04°15.7' N, 073°33.85' W, 570 m; LIT-0086, 1 ♀, 1 ♂, Restrepo, C. García, 6-VI-2008, 04°15.7' N 073°33.85' W, 570 m. Valle del Cauca: MPUJ-CHI-011, 1 ♂, Tuluá, E. Campos, 24-X-1996, 05°11.08' N, 076°11.91' W, 966 m.

Description. Adults: general body colour brown (Fig. 1), body length 23–30 mm. Antennae of 30–55 articles. Ocelli 19–34 in 5 to 6 rows (Fig. 2). Anterior edge of forcipular coxosternite with 4+5 to 8+8 teeth, normally 5+5 to 6+6 teeth (Figure 3). Coxal pores 7775, 7776, 7886, 8986, 8885, 6675, 9996, 6765, 8875, 8886, 9876 and 5776, almost always oval; only 1 individual had 4 pores at leg pair XV (Figs 4 and 5). Plectotaxy in Table 1: 72 specimens had the following variations leg XII with VPm and VTamp, the leg X with DCa, the leg IX with DCa and the leg XIV with Dap. Most individuals had a variation at leg pair I D Pamp. Anterior and posterior accessory spine on legs I–XIV.

Juvenile: Body length 15–21 mm, lighter in coloration than adults. 14–27 small ocelli in 4–6 rows. Antennae with 36–43 articles, posterior margin of forcipular coxosternite with 5+5 to 7+7 teeth. Coxal pores 5555, 6565, 6776, 6775, 6665, 7886, 9987.

Remarks. The morphological characters of the individuals examined agree with the descriptions provided by Brölemann (1930: 257, figs 378–380, 393–397) and Farzalieva and Eshyunin (2008: 602–604, fig. 3).

Distribution. Widely spread throughout West Asia, Europe and North Africa, and introduced into North and South America; recorded in several states in the USA (Hoffman and Crabill 1953, Eason 1977c, Zapparoli and Iorio 2012). Bahia, Brazil is the only record of this species in the Neotropical region until now (Eason 1972, Farzalieva and Eshyunin 2008).

Lithobius (Lithobius) obscurus Meinert, 1872

Figures 6–9

Material examined. Boyacá: ICN-M.Ch-0311, 1 ♀, Sogamoso, Vereda la Chorrera, D. Triana, 5-VIII-2003, 05°42.95' N, 072°56.0' W, 2700 m; ICN-M.Ch-0303, 1 ♀, Sogamoso, Vereda la Chorrera, D. Triana, 7-VII-2012, 05°42.95' N, 072°56.0' W, 2700 m.



Figures 6–10. *Lithobius (Lithobius) obscurus* Meinert, 1872, female. Collected in Sogamoso, Vereda la Chorrera. **6.** Habitus. **7.** Posterior accessory spine of the leg XV. **8.** Cephalic plate. **9.** Forcipular coxosternite. **10.** Postpedal segments. Photographs by Camilo Prado.

Description. The specimens examined was characterized by the following set of morphological features: dark brown or grey yellowish colour, body length 13–18 mm. This species is characterized by having triangular projections on the posterior angles of TT 9, 11 and 13 (Figure 6) and having a posterior accessory spine on the 15th leg (Fig. 7). Antennae of 25 to 26 articles, ocelli 9–12 arranged in 3 rows (Fig. 8) and forcipular coxosternite with 2+2 teeth over the anterior edge (Fig. 9). Only 2

individuals had coxal pores from leg pairs XII to XV, coxal pores circular, 5655, 4564. Two variations in plecotaxy were recorded: ventrally, the prefemur of leg pair XII had a medial spine and another posterior one (Fig. 10, Table 2).

Distribution. *Lithobius obscurus* is a species from the western Mediterranean region. It has been dispersed by humans in South Africa, Australia and New Zealand (Eason 1991, Voigtländer and Reip 2013). This species

Table 2. Plectotaxy of *Lithobius (Lithobius) obscurus* Meinert, 1872. In parenthesis spine variation present on the legs.

Leg	Ventral				Dorsal				
	Tr	P	F	T	C	P	F	T	
1	-	mp	Amp	M	-	mp	ap	a	
2	-	mp	Amp	Am	-	mp	ap	a	
3–12	-	mp	Amp	Am	-	mp	ap	ap	
13	m	amp	Amp	Am	(a)	amp	ap	p	
14	m	amp	Amp	A	a	amp	p	p	
15	m	amp	Am	A	a	amp	p	-	

has been also reported in some countries in the Caribbean Sea and South America: Bermuda, Ecuador, Peru, Chile, Uruguay, and Argentina (Eason 1973, 1991). In the material reviewed from the collections in Bogotá, only two females from this species were collected from the rural area of Sogamoso, Boyacá.

Discussion

Previous work (Botina et al. 2012, Wilches et al. 2013) has recognized the order Lithobiomorpha in high mountain forest and disturbed areas in the Colombian Andes; however, none of these studies gave a full identification of the species. The 2 species here recognized from Colombia for the first time, *L. forficatus* and *L. obscurus*, are now recorded from 36 localities (Fig. 11). The former was recorded between 87 m to 2746 m asl, mostly in the Andean region (31 localities from Cundinamarca, Boyacá, Valle del Cauca, Tolima departments). Other records come from the Orinoquia (4 localities, Meta department) and Atlantic region (1 locality, Córdoba department). The department where *L. forficatus* has the most records was Cundinamarca, with observations from 25 municipalities. *Lithobius obscurus* was only found in a single locality from the Boyacá department.

The material of *L. forficatus* examined from Colombia were mostly collected from altitudes above 2000 m asl. The municipality of La Calera (2,746 m asl) had the highest recorded altitude for *L. forficatus* in Colombia. This is also the highest recorded altitude for *L. forficatus* worldwide, as previously the highest altitude reported for this species was 2600 m asl in the Swiss Alps (Voigtländer 2011). Little information was recorded in the material examined about the habitats or microhabitats of *L. forficatus*, but many specimens were almost exclusively collected inside cities and places with anthropic disturbance, such as urban parks and gardens. Some specimens were also recorded from *Pinus patula* Schiede ex Schltdl. & Cham, 1831 plantations and transition zones such as the wetland “El Jaboque,” located in the city of Bogotá, D.C.

Lithobius forficatus is recognized in Europe as a eurytopic species as it has been found in a wide range of habitats and under different types of vegetation, like forests, grasslands, and areas with little to no vegetation, like buildings, parks, or crops (Voigtländer 2005). This species also shows high tolerance to low humidity (Lewis 1997, Zapparoli 2003, Voigtländer 2005, Iorio 2007, Tuf

and Tufová 2008, Dunger and Voigtländer 2009, Iorio et al. 2015). The same habitat preferences have been recorded for *L. forficatus* in the USA, as this species has greater abundance in urban habitats and in xerophytic forests (Auerbach 1951, Hickerson et al. 2005). Although they fail to compete with other centipedes of larger size, in the absence of other predators of the same assembly or when competing with some smaller ones, *L. forficatus* can invade a certain ecosystem (Hickerson et al. 2005, Ferlian et al. 2012). This probably occurs in some forests where native species of Henicopidae and geophilomorphs are smaller. Even though records of *L. forficatus* quoted in this paper were mostly associated with areas that have high anthropic intervention, it is necessary to determine with more certainty whether *L. forficatus* can colonise areas with native vegetation in Colombia.

Although no males have been recorded, the features of the females here assigned to *L. obscurus* agree with the description of the species given by Eason (1974) and Voigtländer and Reip (2013). The male of this species shows modifications on the femur of the last leg pair. Until now, *L. obscurus* was only known in the Colombian countryside near Sogamoso (2,700 m asl), in *P. patula* and *Eucalyptus globulus* Labill, 1800 artificial forest. Even though *L. obscurus* has been reported from other South American countries (Voigtländer and Reip 2013), this was the only record of this species in Colombia. This species is native to the Western Mediterranean area and has probably become distributed worldwide by trade over the centuries (Eason 1991). *Lithobius obscurus* has been found in arid places under rocks, on tree trunks, and at the base of palm trees in Spain (Voigtländer and Reip 2013). This species also has been reported in Chile in apple orchards having traditional and organic management (Moya-Hernández et al. 2015).

It is hard to know how *L. forficatus* and *L. obscurus* arrived in the New World. In some cases, it is presumed that they began to disperse because of trade associated with the discovery of America by Europeans (Crabill 1958). There is evidence that these centipedes arrived in plants of commercial interest and some even managed to inhabit inhospitable sites (Eason 1970, 1977a, 1977b). In South America, the first records of these 2 species date back to the mid-19th century; however, these identifications were wrong or inadequate, due to taxonomic synonyms between various species, which were clarified by Eason (1972). In Colombia, despite several expeditions and works that inquire about the diversity

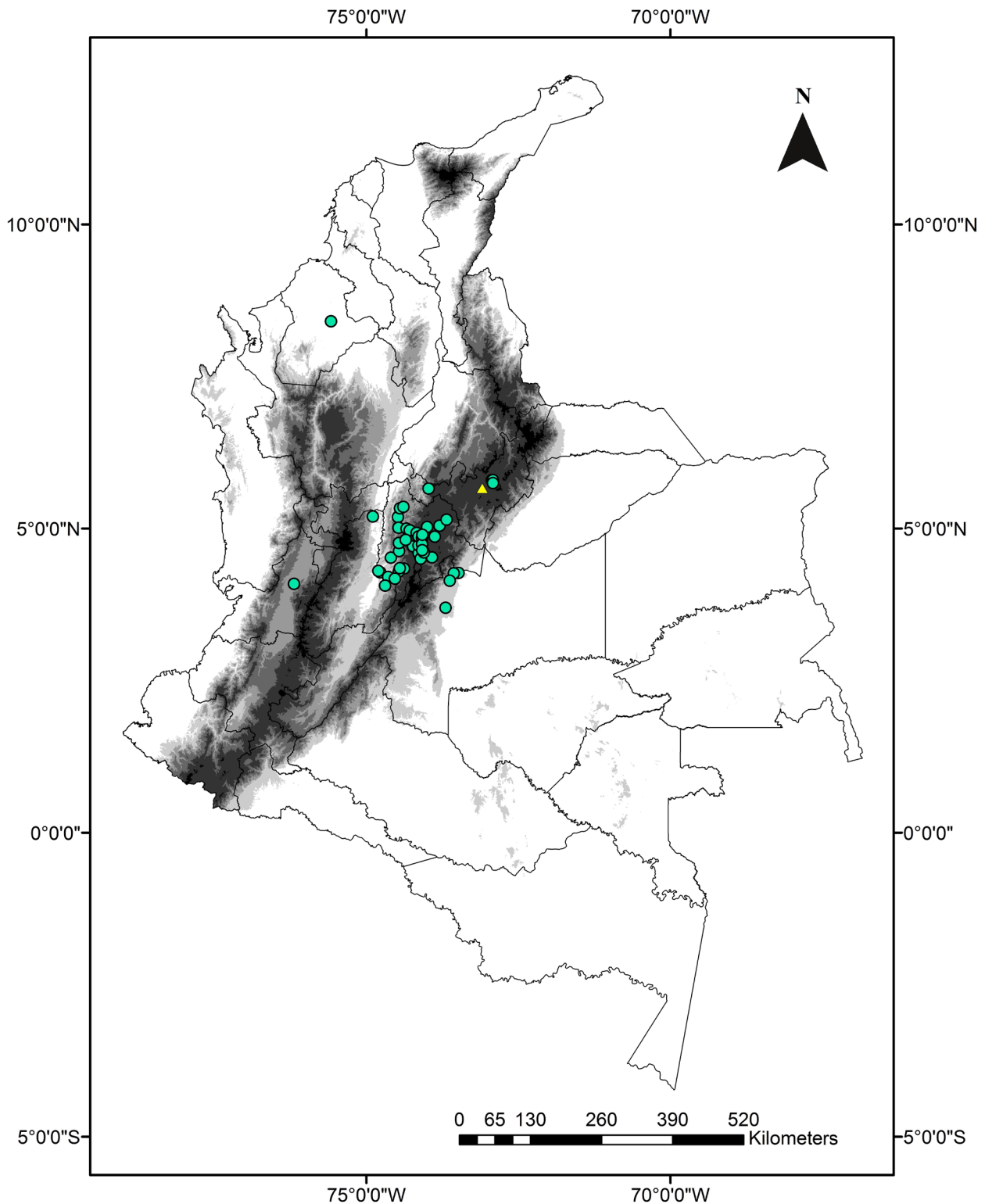


Figure 11. Locality records of *Lithobius (Lithobius) forcatus* (Linnaeus, 1758) (green circles) and *Lithobius (Lithobius) obscurus* Meinert, 1872 (yellow triangle) in Colombia based on material examined in zoological collections kept in Bogotá: Museo Javeriano de Historia Natural “Lorezo Uribe, S.J.” and the Universidad Distrital Francisco José de Caldas.

of centipedes, no species of Lithobiomorpha had been recorded (Chamberlin 1921, Bücherl 1942, Chagas-Jr et al. 2014). Possibly this indicates that their introduction was very recent or that these centipedes remain restricted to synanthropic areas that give them the necessary conditions for their survival.

Little is known about the native fauna of centipedes in Colombia. Some species have been documented recently, highlighting the great diversity of some regions, such as the Andean region (Chagas-Jr et al. 2014, Prado et al. 2016). However, forests in some of these regions are currently under threat by deforestation and other anthropic

activities (Etter et al. 2006). Such activities might be exploited by alien centipede species such as *L. forficatus*, which can easily colonise fragmented habitats. The population dynamics of these introduced species and their interaction with the native centipede fauna of Colombia should thus be monitored and assessed.

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Authors' Contribution

CP, HT and ET collected the data, CP, HT, CC and ET wrote the paper.

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