The geographic distribution of *Atractus lehmanni* (Boettger, 1898) (Serpentes, Colubridae, Dipsadinae) in Colombia, and clarification of its status and type locality in Ecuador

John G. Himes¹*, Alejandro Arteaga², Luis Enrique Vera-Pérez³, Kevin M. Enge⁴

¹ Independent researcher, Deville, Louisiana, USA • dibamus1@gmail.com
² Biodiversity Field Lab, Khamai Foundation, Quito, Ecuador • af.arteaga.navarro@gmail.com • https://orcid.org/0000-0002-0014-3728
³ Independent researcher, Popayán, Colombia • dipsadini@gmail.com • https://orcid.org/0000-0001-6294-1517
⁴ Fish and Wildlife and Research Institute, Gainesville, Florida, USA • kevin.enge@myfwc.com

* Corresponding author

Abstract

*Atractus lehmanni* (Boettger, 1898), Lehmann’s Ground Snake, (Serpentes, Colubridae, Dipsadinae), was described by Boettger (1898) from Cuenca, Ecuador. We examined records of snakes labeled as *A. lehmanni* to determine if they fit the original description of this species. The results of our record examinations, in conjunction with long-term field surveys and a review of Friedrich Carl Lehmann’s travel logs, indicate that *A. lehmanni* occurs in the Cordilleras Central and Occidental of Colombia. Conversely, this species is apparently absent from Ecuador, where records of this species are in error or based on misidentifications.

Keywords

Cordillera, Cuenca, Lehmann, Popayán, record, snake

Introduction

Ground snakes (genus *Atractus* Wagler, 1828) comprise the most species-rich genus of modern-day snakes (class Reptilia, order Squamata, suborder Serpentes), consisting of 147 species (Uetz et al. 2021) collectively distributed from Panama (Köhler 2008) to Argentina (Nogueira et al. 2019) and Uruguay (Carreira et al. 2012), with the area of highest diversity in northwestern South America (Uetz et al. 2021). Although collectively widespread, species in this genus are largely fossorial and secretive. Most species, particularly those that inhabit montane areas, are known from limited or remote areas, and thus are rarely observed, collected, or studied. In fact, 64 species have been discovered or described since the turn of this century (Uetz et al. 2021). However, knowledge of the life histories and geographic distributions is incomplete even for some of the more widespread species described over a century ago, including *A. lehmanni* (Boettger, 1898), Lehmann’s Ground Snake. *Atractus lehmanni* was described by Boettger (1898) from a type series consisting of three female and three...
male specimens, from which a syntype was designated (MC 33513) and described in additional detail by Savage (1960). The type series was collected by Friedrich Carl Lehmann, reportedly from Cuenca in southern Ecuador. Although Lehmann visited Cuenca, he lived in and made most of his collections near Popayán, Colombia, over 600 km north of Cuenca, where specimens that fit Boettger’s (1898) and Savage’s (1960) descriptions of *A. lehmanni* have been found almost throughout the entire municipality. All specimens from Ecuador that Arteaga et al. (2017) initially identified as *A. lehmanni* and that Torres-Carvajal et al. (2019) subsequently examined are apparently misidentified. Therefore, we sought to investigate and clarify the status and distribution of this species.

**Methods**

We examined records labeled as *A. lehmanni* to determine those that fit Boettger’s (1898) and Savage’s (1960) descriptions of this species in scale characteristics and color pattern. We obtained vouchered records from the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá (ICN); Museo de Historia Natural, Universidad del Cauca (MHNUC); Museo de Herpetología, Universidad de Antioquia (MHUA); Museo de Historia Natural de La Salle, Bogotá (MLS); Universidad de Caldas (UCALDAS); Universidad del Quindío (ARUQ); and Universidad Valle del Cauca (UV-C). We reviewed unvouchered records from iNaturalist and also examined records of snakes that were identifiable as *A. lehmanni* from our own field surveys. We mapped confirmed records using ArcMap 10.8.1, provided they were ≥2 km from all other confirmed records and associated with specific coordinates, as well as the location of Cuenca from which the type series was reported (Boettger 1898). Besides the type series, we did not map records that we thought represented erroneous locations (e.g., far northern or eastern Colombia) because of georeferencing errors.

**Results**

We confirmed 66 records of *A. lehmanni* that were associated with specific coordinates and appeared to be properly georeferenced (Table 1). We mapped all 31 of these records that were ≥2 km from all other confirmed records.
Table 1. Confirmed locality records ≤2 km apart of *Atractus lehmanni* in Colombia. Reference and voucher/evidence data on all specimens <2 km apart are listed within the same record. For records represented by specimens from multiple sites < 2 km apart, the specific specimen(s) to which the listed locality data pertain is (are) indicated with an asterisk (*). Only records for which scale characteristics and color pattern matched Boettger’s (1898) and Savage’s (1960) description of this species were considered valid. ARUQ: Universidad del Quindío, GBIF: Global Biodiversity Information Facility; ICN: Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá; MHNUC: Museo de Historia Natural, Universidad del Cauca; MHUA: Museo de Herpetología, Universidad de Antioquia; MLS: Museo de Historia Natural de La Salle, Bogotá; UCALDAS: Universidad de Caldas; UF Herp: University of Florida, Herpetology Collection; UV-C: Universidad Valle del Cauca.

| Department | Locality | Latitude   | Longitude  | Altitude (m) | Reference | Voucher/evidence | iNaturalist ID |
|------------|----------|------------|-----------|--------------|-----------|-----------------|---------------|
| Caldas     | Manizales | 05.056786  | -075.498528 | 2100         | GBIF Secretariat 2021 | Multiple photos | https://www.inaturalist.org/observations/45110739*; https://www.inaturalist.org/observations/40220020 |
| Caldas     | Manizales | 05.055485  | -075.426126 | 2510         | GBIF Secretariat 2021 | Single photo    | https://www.inaturalist.org/observations/40330376 |
| Caldas     | Pácora: Las Coles vereda | 05.488710 | -075.469480 | 2216         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Caldas     | Risucio   | 05.419260  | -075.730093 | 2030         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Caldas     | Salamina: Boquerón vereda, Chagualito farm | 05.354267 | -075.443975 | 2000         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Caldas     | Salamina: La Quebra vereda, La Palma farm | 05.387877 | -075.483428 | 1700         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Caldas     | Salamina: La Quebra vereda, La Palma farm | 50.364841 | -075.481488 | 2029         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Caldas     | Villamaría | 05.008433  | -075.423903 | 2427         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Caldas     | Villamaría | 04.991737  | -075.405495 | 2785         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Cauca      | Piendamó: Centro Educativo Escuela Juan XXIII | 02.643595 | -076.531885 | 1855         | This work | Multiple photos | Multiple photos |
| Cauca      | Popayán: Ego River near Puent de Chune | 02.449823 | -076.625803 | 1720         | This work; Passos et al. 2009a, GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Cauca      | Popayán: El Refugio neighborhood | 02.442556 | -076.600794 | 1750         | This work; GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Cauca      | Popayán: Molino River (“Río Molino”) | 02.462269 | -076.578764 | 1785         | Passos et al. 2009a, GBIF Secretariat 2021 | MLS 2593 |
| Cauca      | Popayán: Puerenje township | 02.418056 | -076.630278 | 1814         | Passos et al. 2009a, GBIF Secretariat 2021 | ICN 10635*, 10636*, USNM 151633 |
| Cauca      | Popayán: Clarette vereda | 02.483333 | -076.510565 | 2040         | Passos et al. 2009a, GBIF Secretariat 2021 | ICN 1794 |
| Cauca      | Sílvia   | 02.615573  | -076.382060 | 2535         | Passos et al. 2009a, GBIF Secretariat 2021 | MLS 2595, 2681 |
| Quindío    | Finlandia | 04.687530  | -076.614936 | 2005         | GBIF Secretariat 2021, Quintero-Angel et al. 2012 | Multiple photos | Multiple photos |
| Quindío    | Finlandia: near Barbás–Bremen | 04.700685 | -076.599338 | 2025         | GBIF Secretariat 2021, Quintero-Angel et al. 2012 | ARUQ-592, 593 | Multiple photos |
| Quindío    | Génova   | 04.174200  | -075.811590 | 1772         | GBIF Secretariat 2021 | single photo | http://www.inaturalist.org/observations/87431322 |
| Quindío    | Génova   | 04.205580  | -075.792240 | —            | GBIF Secretariat 2021 | single photo | http://www.inaturalist.org/observations/105227575 |
| Quindío    | Hacienda San Antonio / Armenia | 04.509580 | -075.755734 | —            | Valencia-Zaleta pers. comm. 2021 | UV-C 5275 | Multiple photos |
| Quindío    | Salento  | 04.637707  | -075.489374 | 2387         | GBIF Secretariat 2021 | Single photo | Multiple photos |
| Quindío    | Salento: 5 km east of Calarcá | 04.528230 | -075.591080 | 2292         | this work, GBIF Secretariat 2021 | Single photo | http://www.inaturalist.org/observations/18599370 |
| Risaralda  | Pereira  | 04.742075  | -076.601045 | 1754         | GBIF Secretariat 2021 | Single photo | http://www.inaturalist.org/observations/58291279 |
| Risaralda  | Pereira: Parque Regional Natural Ukumari | 04.741010 | -075.487770 | 2450         | GBIF Secretariat 2021 | ARUQ-300 |
| Risaralda  | Pereira: Santuario de Fauna y Flora Otún Quimbaya | 04.725694 | -075.571389 | 1913         | GBIF Secretariat 2021 | Multiple photos | Multiple photos |
| Valle del Cauca | Chicoral | 03.581055  | -076.599722 | 1738         | Valencia-Zaleta et al. 2014 | UV-C 15293 |
| Valle del Cauca | finca Zingara | 03.51666  | -076.600000 | 1694         | Valencia-Zaleta et al. 2014 | UV-C 7352, 7351 |
| Valle del Cauca | Peñas Blancas, Pichindé | 03.428419 | -076.653866 | 1958         | Valencia-Zaleta et al. 2014 | UV-C 5272, 7351 |
| Valle del Cauca | Reserva Natural El Cero de los Inglés | 04.752698 | -076.281408 | 2129         | Valencia-Zaleta pers. comm. 2021 | UF Herp 192666 |
| Valle del Cauca | Sevilla | 04.268900  | -075.936100 | 1620         | Passos et al. 2009a, GBIF Secretariat 2021 | MHUA 1407 |

*Made to match Boettger’s (1898) and Savage’s (1960) description of this species were considered valid.*
All confirmed records were confined to the Cordillera Central (central branch of the northern Andes) and Cordillera Occidental (western branch of the northern Andes) of western Colombia. Within the Cordillera Central, from north to south by department, the number of confirmed records was 25 (8 of which were ≥ 2 km from all other confirmed records) from Caldas, 3 (3) from Risaralda, 9 (6) from Quindío, 1 (1) from Valle del Cauca, and 21 (6) from Cauca, for a maximum north–south distance of 363 km. The southernmost record in Cauca was approximately 645 km north of Cuenca, Ecuador, which is the reported type locality of *A. lehmanni*. Within the Cordillera Occidental, the number of confirmed records was 1 (1) from Caldas in the north and 5 (3) from Valle del Cauca in the south, for a maximum north–south distance of 152 km. Confirmed records ranged at altitudes of 1620–2785 m in the Cordillera Central and 1694–2129 m in the Cordillera Occidental.

**New record.** COLOMBIA – Department of Quindío

- Municipality of Salento, 5 km (straight line distance) east of Calarcá, northern side of Route 40; 04.5282, −075.5911; 2330 m alt.; 08.1.2018; JG Himes, KM Enge obs.; 1 adult ♀; found during the day under artificial (non-woody) debris among ruderal vegetation near an abandoned building surrounded by pine-hardwood forest; UF Herp 192663; snout to vent length, 290 mm, tail length, 30 mm (Fig. 2A).

An unsexed juvenile (unvouchered) was also observed onsite by JG Himes on 27 XI 2018. Other reptile and amphibian species observed onsite were *Lampropeltis micropholis* (Ecuadorian Milk Snake), *Pholidobolus vertebrales* (Brown Mountain Tegu), *Pristimantis achatinus* (Chachabi Robber Frog), and *Pristimantis w-nigrum* (Zurucuchu Robber Frog).

**Identification.** Identification was made by comparing the scale characteristics and color pattern of the Quindío specimen (Fig. 2A) to the descriptions by Boettger (1898) and Savage (1960). The Quindío specimen matched Boettger’s (1898) and Savage’s (1960) descriptions of scale characteristics as follows: 17 middorsal scale rows; a small rostral and internasals; long prefrontals; 2 postoculars; 3 (1 + 2) temporals; third, fourth, and seventh supralabials in contract with the orbit; third, fourth, and sixth infralabials in contract with the chin shields; 150 ventrals and 20 subcaudals.

The Quindío specimen matched Boettger’s (1898) and Savage’s (1960) descriptions of color pattern as follows: dorsum dark brown; each dorsal scale above rows 1 and 2 darkest on lower and posterior margins, and with minute black markings; indistinct dark vertebral stripe present; light nuchal collar suffused with dark pigment; top of head mostly dark, but prefrontal–internasal region with some light areas; supralabials and postnasals mainly dark, but lower portions light; throat and chin light, but with large brown spots on infralabials, mental, and chin shields; lateral part of ventrals and dorsal scale rows 1

---

**Figure 2.** Individuals of *Atractus lehmanni* from Colombia. **A.** Adult ♀ from 5 km east of Calarcá, Department of Quindío (UF Herp 192663). Photographed by KM Enge. **B–D.** Unsexed and unvouchered juvenile, adult, and subadult, respectively, from the Department of Cauca, Municipality of Popayán. Photographed by LEV Pérez.
and 2 light; medial portion of ventrals dark brown; anal plate brown; underside of tail light, with irregular brown mottling on median portion.

Similar identifications were made by comparing the other vouched and unvouched specimens that were labeled as *A. lehmanni* to the descriptions by Boettger (1898) and Savage (1960). The variation in scation and color pattern among the specimens that we examined and confirmed as *A. lehmanni* falls well within the ranges reported in the descriptions by these authors (Fig. 2B–D). However, we did not confirm any specimens that exhibited variation outside these ranges as *A. lehmanni*. Moreover, no species of *Atractus* that has been described subsequent to Boettger (1898) and Savage (1960) exhibits the same suite of scale characteristics and color pattern as described for *A. lehmanni* by these authors.

**Discussion**

Several surveys and taxonomic studies on *Atractus* have recently been conducted across the cordilleras of Colombia and Ecuador, resulting in the documentation and description of numerous species to the north and south of where specimens that fit Boettger’s (1898) and Savage’s (1960) descriptions of *A. lehmanni* occur, exclusive of the reported type locality of Cuenca (e.g., Passos et al. 2009a; Passos and Lynch 2010; Arteaga et al. 2017; Torres-Carvajal et al. 2018). As a result, although still incomplete, knowledge of the distributions of *Atractus* across these areas has increased substantially. Therefore, the collective area over which *A. lehmanni* has been found in the Cordilleras Central and Occidental of western Colombia probably constitutes the vast majority of this species’ actual extent of occurrence.

Although much of the area in which *A. lehmanni* occurs is remote and difficult to access, and thus its area of occupancy is still incompletely known, this species is common in urban areas and can survive in heavily disturbed habitat, as was readily evident at the locations where J.G. Himes, K.M. Enge, L.E.V. Pérez, and J.A. Rojas-Morales (2012; listed as “*Atractus sp.*”) found it. Moreover, over 12 years of field surveys for snakes by A. Arteaga and colleagues have failed to find any specimens that fit the description of *A. lehmanni* in or near the reported type locality of Cuenca (Boettger 1898) or elsewhere in Ecuador. Instead, specimens from Ecuador identified as *A. lehmanni* (Arteaga et al. 2017) have subsequently been identified as *A. roulei* in a more recent work (Passos et al. 2022) that includes a more comprehensive taxon sampling. These specimens have dorsal scales arranged in 15 rows at mid-body, as opposed to the diagnostic 17 rows of *A. lehmanni*. Therefore, the occurrence of *A. lehmanni* in or near Cuenca, which is over 600 km south of all other records of this species, is highly improbable. Far more likely, the type locality of *A. lehmanni* is in or near Popayán, where Lehmann made most of his herpetological collections, and this species is confined to the portions of the Cordilleras Central and Occidental of western Colombia where all other specimens of *A. lehmanni* have been found.

Besides the fact that it is unlikely that *A. lehmanni* occurs in or near Cuenca or elsewhere in Ecuador, its presence in both the Cordillera Central and Occidental of Colombia is exceptional among other montane-inhabiting species of *Atractus*, most of which are restricted to a single side of one of the three cordilleras (Central, Occidental, or Oriental) (Passos et al. 2009a; Vanegas-Guerrero et al. 2014). Only six other species are definitively known from multiple cordilleras, with only *A. nicefori* being known from both the Cordilleras Central and Occidental; all others are known from the Cordilleras Central and Oriental (Passos and Lynch 2010; Passos et al. 2009b). Thus, although specimens from the Cordillera Occidental fit Boettger’s (1898) and Savage’s (1960) descriptions of *A. lehmanni* in terms of scale characteristics and color pattern, genetic analyses and comparisons between specimens from the Cordilleras Occidental and Central are necessary to further determine their taxonomic identities and relationships. In fact, the portion of the Cauca River valley that is located between the confirmed records of *A. lehmanni* in the Cordillera Central and Oriental drops to under 1000 m alt., whereas the lowest records of *A. lehmanni* were at 1620 and 1694 m alt. within these respective cordilleras. Therefore, gene flow has probably ceased between populations within the different cordilleras, and thus each population may be currently evolving along separate trajectories.

**Acknowledgements**

We would like to thank Alejandro Valencia-Zuleta and Raul Ernesto Sedano Cruz for providing us with detailed information on and photographs of the specimens of *A. lehmanni* from the Cordillera Occidental in Valle del Cauca. We would also like to thank Brittany Bankovich for producing the map on which the locations of *A. lehmanni* records confirmed in this paper were plotted, and Sebastian Lotzkat and Konrad Mebert for providing critical reviews of the manuscript.

**Authors’ Contributions**

Conceptualization: AA. Data curation: JH, KE, LEVP. Formal analysis: JH. Project administration: JH. Resources: LEVP, AA, KE, JH. Writing – original draft: JH. Writing – review and editing: KE, AA, JH, LEVP.

**References**

Arteaga A, Mebert K, Valencia JH, Cisneros-Heredia DF, Peñafel N, Reyes-Puig C, Vicera-Fernandes JL, Guayasamin JM (2017) Molecular phylogeny of *Atractus* (Serpentes, Dipsadidae), with emphasis on Ecuadorian species and the description of three new taxa. ZooKeys 661: 91–123. https://doi.org/10.3897/zookeys.661.11224

Boettger O (1898) Katalog der Reptilien-Sammlung im Museum der Senckenbergischen Naturforschenden Gesellschaft in Frankfurt/M. 2.Teil (Schlangen). Gebr. Knauer, Frankfurt, Ger-
many, i–ix + 1–160.
Carreira S, Brazheiro A, Camargo A, da Rosa I, Canavero, A, Maneyro R (2012) Diversity of reptiles of Uruguay: knowledge and information gaps. Boletín de la Sociedad Zoológica del Uruguay 21: 1–87.
Köhler G (2008) Reptiles of Central America. 2nd edition. Herpeton Verlag Elke Köhler, Frankfurt, Germany, 400 pp.
Nogueira CC, Argôlo AJS, Arzamendia V, Azvedo JA, Barbo FE, Bérnils RS, Bolchicio BE, Borges-Martins M, Brasil-Godinho M, Braz H, Buononato MA, Cineros-Heredia DF, Colli GR, Costa HC, Franco FL, Giraudo A, Gonzalez RC, Gueses T, Hoogmoed MS, Marques OAV, Montingelli GG, Passos P, Prudente ACL, Rivas GA, Sanchez PM, Serrano FC, Silva NJ Jr, Strüssmann C, Vieira-Alencar JPS, Zaher H, Sawaya RJ, Martins M (2019) Atlas of Brazilian snakes: verified point-locality maps to mitigate the Wallacean shortfall in a megadiverse snake fauna. South American Journal of Herpetology 14 (sp1): 1–274. https://doi.org/10.2994/sajh-d-19-00120.1
Passos P, Arredondo JC, Fernandes R, Lynch JD (2009a) Three new Atractus (Serpentes: Dipsadidae) from the Andes of Colombia. Copeia 2009: 425–436. https://doi.org/10.1643/ch-08-063
Passos P, Attagratia C, Torres-Carvajal O, Savage JM (2009b) Testing species boundaries within the Atractus occipitalis complex (Serpentes: Dipsadidae). Herpetologica 65: 384–403.
Passos P, Lynch J (2010) Revision of Atractus (Serpentes: Dipsadidae) from middle and upper Magdalena drainage of Colombia. Herpetological Monographs 24: 149–173.
Passos P, Melo-Sampaio PR, Ramos LO, Graziotin FG, Fouquet A, Torres-Carvajal O (2022) When the tail shakes the snake: phylogenetic affinities and morphology of Atractus badius (Serpentes: Dipsadidae), reveals some current pitfalls on the snake’s genomic age. Annals of the Brazilian Academy of Sciences 94: e20191254. https://doi.org/10.1590/0001-376520220191254
Quintero-Ángel A, Osorio-Dominguez D, Vargas-Salinas F, Saavedra-Rodríguez CA (2012) Roadkill rate of snakes in a disturbed landscape of Central Andes of Colombia. Herpetology Notes 5: 99–105.
Rojas-Morales JA (2012) Snakes of an urban-rural landscape in the central Andes of Colombia: species composition, distribution, and natural history. Phyllomedusa 11: 135–154. https://doi.org/10.11606/issn.2316-9079.v11i2p135-154
Savage JM (1960) A revision of the Ecuadorian snakes of the colubrid genus Atractus. Miscellaneous Publication in Zoology, University of Michigan 112: 1–86.
Torres-Carvajal O, Pazmiño-Otamendi G, Salazar-Valenzuela D (2019) Reptiles of Ecuador: a resource-rich portal, with a dynamic checklist and photographic guides. Amphibian & Reptile Conservation 13: 209–229.
Uetz P, Freed P, Aguilar R, Holek J (Eds.) (2021) The reptile database. http://reptile-database.org/. Accessed on: 2021-10-18.
Valencia-Zuleta A, Jarroño-Martínez AF, Echeverry-Bocanegra A, Viáfara-Vega R, Hernández-Córdoba O, Cardona-Botero VE, Gutiérrez-Zúñiga J, Castro-Herrera F (2014) Conservation status of the herpetofauna, protected areas, and current problems in Valle del Cauca, Colombia. Amphibian & Reptile Conservation 8: 1–18.
Vanegas-Guerrero J, Manilla-Castaño JC, Passos P (2014) Atractus titanicus Passos, Arredondo, Fernandes & Lynch, 2009 (Serpentes: Dipsadidae): filling gaps in its geographical distribution. Check List 10: 672–673. https://doi.org/10.15560/10.3.672