

# First record for the state of Rondônia and revised distribution map of *Chiroderma trinitatum* Goodwin, 1958 (Mammalia: Chiroptera: Phyllostomidae) in Brazil

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**ABSTRACT:** In the present work we report the first record of *Chiroderma trinitatum* Goodwin, 1958 for the state of Rondônia, northern Brazil. A map with all known records of *C. trinitatum* from Brazil is also presented. The record is based on a fluid preserved specimen with skull removed. The new record, though expected, fills a distributional gap in the Amazonic region of Brazil.

The Neotropical genus *Chiroderma* Peters, 1860 comprises six species that occur in Mexico, southward to continental Central America and the Antilles to southern South America (Gardner 2008; Taddei and Lim 2010). The five South American species, *Chiroderma doriae* Thomas, 1891, *C. salvini* Dobson, 1878, *C. trinitatum* Goodwin, 1958, *C. villosum* Peters, 1860 and *C. vizottoi* Taddei and Lim, 2010, all have a small to medium-sized forearm (38-54 millimeters) and a skull length that varies between 20 and 29 mm (Gardner 2008; Taddei and Lim 2010).

The only South American species not known in Brazil is *C. salvini*, although it has been recorded on the Bolivian border, in the department of Pando, near the northern bank of the Madre de Dios river (Anderson 1997). *C. villosum* is widely distributed in the Brazilian territory, occurring in 19 states in northern, central, eastern and southern Brazil (Gardner 2008, Peracchi *et al.* 2011). The remaining three species have a more restricted distribution: *C. doriae* occurs in Atlantic Forest, Cerrado and Pantanal habitats, and is known to occur only in eastern and central Brazil and southern Paraguay (Gregorin 1998; Gardner 2008); the recently described *C. vizottoi* is considered to be endemic to the Caatinga biome in northeastern Brazil (Taddei and Lim 2010); and *C. trinitatum* is endemic to the Amazon basin (Baker *et al.* 1994; Taddei and Lim 2010; Bernard *et al.* 2011), where it occurs sympatrically with *C. villosum* (Gardner 2008).

Two subspecies of *C. trinitatum* were recognized by Gardner (2008): *C. t. gorgasi* Handley, 1960 and *C. t. trinitatum* Goodwin, 1958. These subspecies represent two allopatric populations, with *C. t. gorgasi* distributed west of the Andes, in Colombia Ecuador, and Panama, and *C. t. trinitatum* occurring in eastern Ecuador, eastern Colombia, Venezuela, Surinam, Guianas, Peru, Bolivia, and in the Amazon basin of Brazil. Although *C. trinitatum* has been reported to occur on a number of localities from South

America (*e.g.* Gardner 1976; Anderson 1997; Simmons and Voss 1998; Lim and Engstrom 2000; Montenegro and Romero-Ruiz 2000), only eight locality records are known in Brazil (Pine *et al.* 1970; Reis and Peracchi 1987; Taddei *et al.* 1990; Nogueira *et al.* 1999; Kalko and Handley 2001; Bernard and Fenton 2002; Sampaio *et al.* 2003; Martins *et al.* 2006; review in Bernard *et al.* 2011). This study aims to report the first record of *C. trinitatum* for the state of Rondônia, northern Brazil, and to provide a map showing all known locality records for this species in Brazil.

The present record is based on a fluid preserved specimen with skull removed that is deposited in the Museu de Zoologia da Universidade de São Paulo (MZUSP), under the collection number MZUSP 35026 and field number MC 018. It is an adult female and was captured with mist nets on July 14, 2001, between the municipalities of Monte Negro and Cacaupônia, at the right bank of the Jamari river (10°17'40" S 63°19'31" W, 143 m a.s.l.), in an Amazon forest area (Figure 1). The specimen was considered adult based on the fused epiphyses of the metacarpals and phalanges. The following cranial and external measurements were taken (following Vizotto and Taddei 1973) using a digital caliper: greatest length of the skull (GLS), postorbital breadth (PB), maxillary toothrow length (C-M), mandibular toothrow length (c-m), lower molar series length (lm), width across upper molars (M-M), width across upper canines (C-C), length of mandible (LMA), forearm length (FA), length of the first phalanx of the third digit (1P3) and length of the second phalanx of the third digit (2P3). We measured a total of 38 specimens of *C. doriae*, *C. salvini*, *C. villosum*, and *C. trinitatum* for comparison. Measurements of the holotype of *C. trinitatum* were obtained from Goodwin (1958). The measured specimens are deposited in the MZUSP and Museo de la Salle, Bogotá (MLS) collections.

**TABLE 1.** Selected external and craniodental measurements (in mm) of adult specimens of *Chiroderma doriae* from Brazil, *C. salvini* from Colombia, *C. trinitatum* from Trinidad, Venezuela, and Brazil, and *C. villosum* from Venezuela and Brazil. Average and range values are presented when more than one specimen is available for each sex. See text for character acronyms. \* Values taken from Goodwin (1958).

CHARACTERS	<i>C. trinitatum</i>	<i>C. trinitatum</i> *	<i>C. trinitatum</i>		<i>C. doriae</i>		<i>C. villosum</i>		<i>C. salvini</i>	
	NEW RECORD	HOLOTYPE								
	1 ♀	1 ♀	2 ♂	1 ♀	7 ♀	6 ♂	11 ♀	8 ♂	1 ♂	1 Ind.
<b>FA</b>	37.99	40.5	36.99 (36.71-37.27)	37.70	51.78 (50.39-53.12)	50.56 (47.47-51.59)	45.68 (43.92-51.17)	44.95 (42.06-49.17)	44.26	46.79
<b>1P3</b>	13.63	-	13.24 (12.97-13.51)	14.01	19.81 (19.19-20.60)	19.81 (18.74-20.76)	16.17 (14.97-16.93)	16.08 (14.54-16.77)	-	-
<b>2P3</b>	21.00	-	19.75 (19.56-19.94)	21.64	29.04 (27.27-30.00)	28.59 (26.09-31.50)	24.57 (22.14-26.40)	24.10 (21.86-26.22)	-	-
<b>GLS</b>	20.97	22.5	21.15 (20.81-21.42)	21.50	28.44 (27.87-28.67) n=4	28.38 (27.82-29.11) n=5	24.55 (24.39-24.71) n=2	24.39 (24.11-24.70) n=3	25.20	25.67
<b>LMA</b>	13.86	-	13.79 (13.48-14.10)	14.02	20.18 (19.51-20.79) n=4	20.01 (19.67-20.35) n=5	16.96 (16.79-17.13) n=2	16.36 (16.14-16.66) n=3	-	-
<b>c-m</b>	7.71	-	7.66 (7.57-7.75)	7.85	11.27 (10.70-11.58) n=4	11.36 (11.13-11.60) n=5	9.60 (9.51-9.69) n=2	9.39 (9.33-9.57) n=3	9,7	10,07
<b>lm</b>	3.86	-	3.97 (3.91-4.04)	3.95	5.88 (5.59-6.12) n=4	5.96 (5.81-6.26) n=5	4.95 (4.95-4.95) n=2	4.74 (4.51-4.84) n=3	-	-
<b>C-M</b>	7.17	7.7	7.22 (7.15-7.29)	7.18	10.21 (9.80-10.75) n=4	10.42 (10.26-10.68) n=5	8.93 (8.89-8.97) n=2	8.53 (8.40-8.69) n=3	8.98	9.45
<b>PB</b>	5.46	-	5.06 (4.97-5.16)	5.38	6.46 (6.40-6.50) n=4	6.56 (6.31-6.70) n=5	5.91 (5.85-5.97) n=2	5.90 (5.72-6.04) n=3	5,83	6,13
<b>C-C</b>	4.24	-	4.22 (4.08-4.37)	4.61	6.03 (5.98-6.16) n=4	5.94 (5.62-6.50) n=5	5.65 n=1	4.99 (4.87-5.13) n=3	-	-
<b>M-M</b>	9.24	-	9.45 (9.17-9.73)	9.38	13.16 (12.90-13.45) n=4	13.13 (12.91-13.35) n=5	11.46 n=1	11.08 (10.87-11.35) n=3	11,26	11,89

**TABLE 2.** Brazilian records of *Chiroderma trinitatum*. The records are plotted on the map of Figure 1.

NUMBER	LOCALITY	COORDINATES	REFERENCE
1	Amapá: Floresta Nacional do Amapá	01°18' N, 51°35' W	Martins et al. (2006); Martins et al. (2011)
2	Pará: Belém	01°27' S, 48°30' W	Kalko and Handley (2001)
3	Pará: rio Xingu, LT Jurupari	02°11' S, 52°17' W	This study
4	Amazonas: Projeto Dinâmica Biológica de Fragmentos Florestais (PDBFF), Manaus	02°24' S, 59°43' W	Sampaio et al. (2003)
5	Pará: Alter do Chão	02°30' S, 54°57' W	Bernard and Fenton (2002)
6	Amazonas: Reserva Ducke, Manaus	03°00' S, 59°52' W	Reis and Peracchi (1987)
7	Acre: Parque Nacional da Serra do Divisor, rio Moa and serra da Jaquirana	07°23' S, 73°41' W	Nogueira et al. (1999), Nogueira et al. (2004)
8	Acre: rio Juruá, Cruzeiro do Sul	07°40' S, 72°40' W	Taddei et al. (1990)
9	Rondônia: rio Jamari, Monte Negro	10°17' S, 63°19' W	This study
10	Mato Grosso: Serra do Roncador	12°40' S, 51°46' W	Pine et al. (1970)

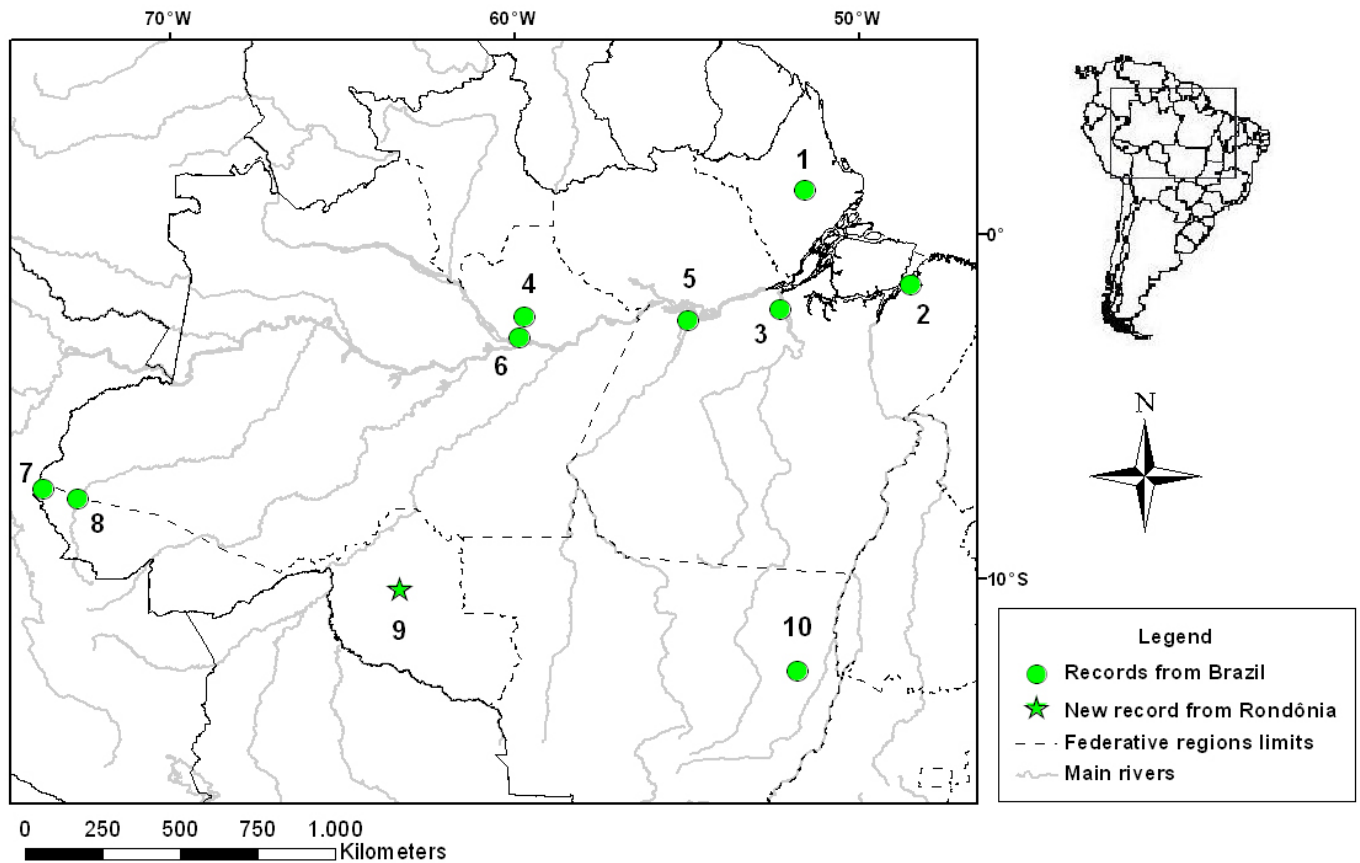


FIGURE 1. Brazilian records of *Chiroderma trinitatum*. Numbers indicate localities listed in Table 2.

The genus *Chiroderma* is easily diagnosed by its greatly reduced nasal bones, which form a notch between the two halves of the maxillary and premaxillary bones (Figure 2; Vizotto and Taddei 1973; Straney 1984). *Chiroderma trinitatum* is readily distinguishable from its congeners by forearm size and length of upper tooththrow (Goodwin 1958; Table 1), with no overlap with the larger species (Gardner 2008; Taddei and Lim 2010; Table 1). The upper inner incisors are convergent on their distal third, touching each other near the tip (Figure 2). This feature is similar with the condition found in *C. doriae* and *C. vizottoi* and different from the parallel upper inner incisors of *C. villosum* (Taddei and Lim 2010). A phylogenetic analysis based on molecular data has established a sister-group relation between *C. doriae* and *C. trinitatum* (Baker et al. 1994), which suggests that this dental character has a good phylogenetic signal.

A total of ten locality records can now be recognized for *C. trinitatum* in Brazil (Figure 1). Apart from the eight localities previously assigned in the literature, and the new record for Rondônia, an additional record for the state of Pará is registered here. Detailed information about these localities is provided in Table 2. The selected external and craniodental measurements for the specimen MZUSP 35026 fell between the expected values for *C. trinitatum* and there was no overlap with the same measurements for the larger species of *Chiroderma* (Table 1).

The record of *C. trinitatum* from Rondônia, though expected, fills a distribution gap for the species in Brazil. Nevertheless, the known Brazilian records are widely spaced from one another, and in two additional states in the Amazônia Legal Brasileira (Roraima and Maranhão) the species has not been recorded yet (Bernard et al. 2011).

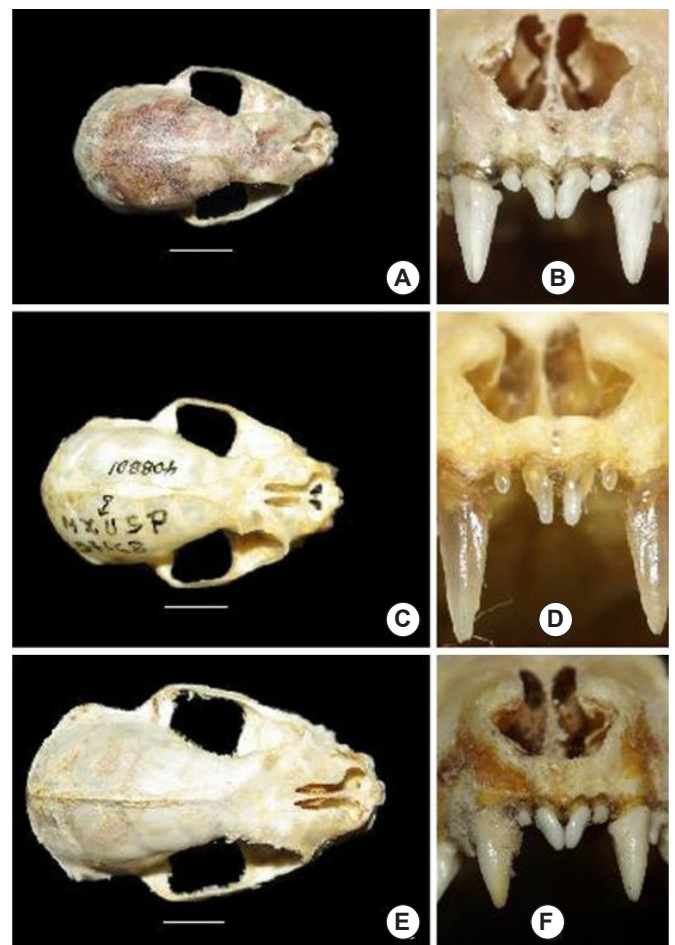


FIGURE 2. Dorsal and frontal views of skulls of *Chiroderma trinitatum* (MZUSP 35026) (A-B), *C. villosum* (MZUSP 27168) (C-D), and *C. doriae* (MZUSP 35029) (E-F). Scale = 5mm. Photo: P. Bernardo.

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#### LITERATURE CITED

- Anderson, S. 1997. Mammals of Bolivia: Taxonomy and distribution. *Bulletin of the American Museum of Natural History* 231: 1-652.
- Baker, R.J., V.A. Taddei, J.L. Hudgeons and R.A. van den Bussche. 1994. Systematic relationships within *Chiroderma* (Chiroptera: Phyllostomidae) based on cytochrome *b* sequence variation. *Journal of Mammalogy* 75(2): 321-327.
- Bernard, E. and M.B. Fenton. 2002. Species diversity of bats (Chiroptera: Mammalia) in forest fragments, primary forests and savannas in Central Amazonia, Brazil. *Canadian Journal of Zoology* 80: 1124-1140.
- Bernard, E., V.C. Tavares and E. Sampaio. 2011. Compilação atualizada das espécies de morcegos (Chiroptera) para a Amazônia Brasileira. *Biota Neotropica* 11(1): in press.
- Gardner, A.L. 1976. The distributional status of some Peruvian mammals. *Occasional Papers of the Museum of Zoology, Louisiana State University* 48:1-18.
- Gardner, A.L. 2008. Genus *Chiroderma* W. Peters, 1860; p. 321-326 In A.L. Gardner (ed.). *Mammals of South America Vol. 1, Marsupials, Xenarthrans, Shrews and Bats*. Chicago: The University of Chicago Press.
- Goodwin, G.G. 1958. Three New Bats from Trinidad. *American Museum Novitates* 1877: 1-6.
- Gregorin, R. 1998. Extending geographic distribution of *Chiroderma doriae* Thomas, 1891 (Phyllostomidae, Stenodermatinae). *Chiroptera Neotropical* 4(2): 98-99.
- Kalko, E.K.V. and C.O. Handley Jr. 2001. Neotropical Bats in the Canopy: Diversity, Community Structure, and Implications for Conservation. *Plant Ecology* 153(1/2): 319-333.
- Lim, B.K. and M.D. Engstrom. 2000. Preliminary survey of bats from the Upper Mazaruni of Guyana. *Chiroptera Neotropical* 6: 119-23.
- Martins, A.C.M., E. Bernard and R. Gregorin. 2006. Inventários biológicos rápidos de morcegos (Mammalia, Chiroptera) em três unidades de conservação do Amapá, Brasil. *Revista Brasileira de Zoologia* 23(4): 1175-1184.
- Martins, A.C.M., E. Bernard, R. Gregorin and W.A.S. Silva. 2011. Filling data gaps on the diversity and distribution of Amazonian bats (Chiroptera): The case of Amapá, easternmost Brazil. *Zoologia* 28(2): 177-185.
- Montenegro, O.L. and M. Romero-Ruiz. 2000. Murciélagos del sector sur de la Serranía de Chiribiquete, Caquetá, Colombia. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 23(Supl. Esp.): 641-649.
- Nogueira, M.R., A. Pol and A.L. Peracchi. 1999. New records of bats from Brazil with a list of additional species for the chiropteran fauna of the state of Acre, western Amazon basin. *Mammalia* 63(3): 363-368.
- Nogueira, M.R., S.P. de Fabio and A.L. Peracchi. 2004. Gastrointestinal helminth parasitism in fruit-eating bats (Chiroptera, Stenodermatinae) from western Amazonian Brazil. *International Journal of Tropical Biology and Conservation* 52(2): 387-392.
- Peracchi, A.L., I.P. Lima, N.R. dos Reis, M.R. Nogueira and H. Ortêncio-Filho. 2011. Ordem Chiroptera; p.155-234 In N.R. dos Reis, A.L. Peracchi, W.A. Pedro and I.P. Lima (ed.). *Mamíferos do Brasil*. 2 ed. Londrina: Nelio Roberto dos Reis.
- Pine, R.H., I.R. Bishop and R.L. Jackson. 1970. Preliminary list of mammals of the Xavantina/Cachimbo expedition (Central Brazil). *Transactions of the Royal Society of Tropical Medicine and Hygiene* 64: 668-670.
- Reis, N.R. dos and A.L. Peracchi. 1987. Quirópteros da região de Manaus, Amazonas, Brasil (Mammalia, Chiroptera). *Boletim do Museu Paraense Emílio Goeldi: Zoologia* 3: 161-182.
- Sampaio, E.M., E.K.V. Kalko, E. Bernard, B. Rodríguez-Herrera and C.O. Handley Jr. 2003. A Biodiversity assessment of Bats (Chiroptera) in a Tropical Lowland Rainforest of Central Amazonia, including methodological and conservation considerations. *Studies on Neotropical Fauna and Environment* 38(1): 17-31.
- Simmons, N.B. and R.S. Voss. 1998. The Mammals of Paracou, French Guiana, a Neotropical lowland rainforest fauna. Part 1, Bats. *Bulletin of the American Museum of Natural History* 237: 1-218.
- Straney, J. 1984. The nasal bones of *Chiroderma* (Phyllostomidae). *Journal of Mammalogy* 65(1): 163-165.
- Taddei, V.A. and B.K. Lim. 2010. A new species of *Chiroderma* (Chiroptera, Phyllostomidae) from Northeastern Brazil. *Brazilian Journal of Biology* 70(2): 381-386.
- Taddei, V.A., I.M. Rezende and D. Camora. 1990. Notas sobre uma coleção de morcegos de Cruzeiro do Sul, Rio Juruá, Estado do Acre (Mammalia: Chiroptera). *Boletim do Museu Paraense Emílio Goeldi: Zoologia* 6: 75-88.
- Vizotto, L.D. and V.A. Taddei. 1973. Chave para determinação de quirópteros brasileiros. *Revista da Faculdade de Filosofia, Ciências e Letras de São José do Rio Preto, Boletim de Ciências* 1: 1-72.

**APPENDIX 1.** Specimens examined and respective locality information (COUNTRY: **State**, locality, *municipality*, voucher number [latitude/longitude]). See text for Museum acronyms.

*Chiroderma doriae*: BRAZIL: **Rio Grande do Norte**, Mata da Estrela, Usina Pedrosa, *Baía Formosa*, MZUSP 35027 [06°25' S 35°03' W]; **Mato Grosso do Sul**, Fazenda Barma, *Brasilândia*, MZUSP (28591, 28688) [21°35' S 52°07' W]; **São Paulo**, Fazenda Santa Carlota, *Cajuru*, MZUSP 35028 [21°20' S 47°14' W], *São Roque*, MZUSP 15112 [23°31' S 47°07' W], Parque Estadual da Ilha Anchieta, *Ubatuba*, MZUSP (29456, 31852) [23°32' S 45°04' W], Parque Estadual de Ilha Bela, Ilha de São Sebastião, *Ilhabela*, MZUSP 35029 [23°46' 45°20'], Barra do Ribeirão Onça Parda, *Sete Barras*, MZUSP 10632 [24°19' S 47°51' W], Caverna Morro Preto, Parque Estadual do Alto Ribeira, *Iporanga*, MZUSP 34012 [24°31' S 48°41' W], *Iguape*, MZUSP 21082 [24°43' S 47°32' W], *Cananéia*, MZUSP 26354 [25°01' S 47°57' W], Parque Estadual da Ilha do Cardoso, *Cananéia*, MZUSP 28037 [25°08' S 47°56' W].

*Chiroderma salvini*: COLOMBIA: **Norte de Santander**, Bochalema, *Cúcuta*, MLS 2037 [07°36' N 72°39' W]; **Florencia**, *Caquetá*, MLS 2220 [01°36' N 75°36' W].

*Chiroderma trinitatum*: VENEZUELA: **Amazonas**, *Belén*, MZUSP (27166, 27167) [03°39' N 65°46' W]. BRAZIL: **Pará**, rio Xingu, LT Jurupari, MZUSP 35033 [02°11' S 52°17' W]; **Rondônia**, rio Jamari, *Monte Negro/Cacaulândia*, MZUSP 35026 [10°17'40" S 63°19'31" W].

*Chiroderma villosum*: VENEZUELA: **Amazonas**, Chaparito, MZUSP 27168 [05°40' N 67°37' W]. BRAZIL: **Pará**, rio Trombetas, *Lago Leonardo*, MZUSP (13197, 13209) [01°11' S 56°40' W], rio Trombetas, *Lago Jacaré*, MZUSP 13335 [01°27' S 56°01' W], cachoeira do Espelho, rio Xingu, *Altamira*, MZUSP 22677 [03°39' S 52°23' W], rio Tapajós, *Uruá*, MZUSP (12627, 12628, 12629) [04°50' S 56°22' W], Centro Kaiapó de Estudos Ecológicos, *Ourilândia do Norte*, MZUSP (29150, 29151, 29152) [07°41' S 51°52' W]; **Piauí**, Parque Nacional Serra das Confusões, *Guaribas*, MZUSP 33502 [09°13' S 43°49' W]; **Rondônia**, cachoeira de Nazaré, rio Machado, *Vale do Anari*, MZUSP (20200, 20201) [09°45' S 61°55' W], Pedra Branca, *Ariquemes*, MZUSP 22827 [10°03' S 62°07' W]; **Mato Grosso**, *Aricá*, MZUSP (6494) [15°57' S 55°56' W]; **Espírito Santo**, Fazenda Santa Terezinha, *Linhares*, MZUSP (35030, 35031) [19°07' S 39°59' W], Restinga, Aracruz celulose, *Aracruz*, MZUSP 35032 [19°53' S 40°36' W].

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