Brazilian Distribution of *Amblyomma varium* Koch, 1844 (Acari: Ixodidae), a Common Parasite of Sloths (Mammalia: Xenarthra)

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Species of the genus *Amblyomma* Koch are among the largest and most ornamented ticks. The genus includes 102 species of which 32 are found in Brazil (Guimarães et al. 2001). Aragão and Fonseca (1961) listed 33 species for the country. However, according to Jones et al. (1972) and Keirans (1992), *A. concolor* Neumann was synonymized with *A. auricularium* (Conil), a species commonly found on armadillos (*Xenarthra: Dasypodidae*).

*Amblyomma varium* Koch, commonly known in Brazil as the “carrapato-gigante-da-preguiça” (sloth’s giant tick), is found almost exclusively on mammals from the families Bradypodidae and Magalonychidae (*Xenarthra*). Robinson’s comments (1926) on the types of *A. varium* and on the material deposited in some collections are cited bellow:

“The type came from Brazil. Stoll’s *A. crassipunctatum* from Nicaragua, Central America. Neumann (1899, p. 247) records a male from Nicaragua, Freycinet coll. (Paris Mus.); a male off a sloth, Zoological Gardens, Hamburg (Hamburg Mus.); a male from Pará, Brazil (Trouessart collection); a male (var. *albida*), Chile, S. America (Berlin Mus.); also (1901, p. 304) a female, Corrientes, Argentine Republic, S. America (Carlos Berg collection); also (1911, p. 76) Neumann mentions *Bradyops tridactylus* L. and *B. cuculliger* Wagl. as hosts, and adds Guiana to the countries of origin”.

This same author also examined the material deposited in the Cambridge University collection, from which he gathered the following data:

“Two females of *B. tridactylus* (Ex. Rothschild coll, N. 253 and 993); a male of *B. variegatus*, Condoto, Colombia, S. America, 1913, H.F. Spurrell coll. (N 2618): a male of large cavy, Bonasica, British Guiana, IV 1912 (N 1738); (?) of sloth, Panama, Central America, IV 1911, O. Garlepp coll. (N 2808); a female, of *Choloepus hoffmanni*, Ancon, Panama, 31.X.1913, S.T. Darling coll. (N 3156)”.

The Cambridge tick collection, initiated by GHF Nuttall in 1904, was donated to the British Museum in 1939. In the beginning of the 80’s, all the material, as well as all the type specimens from Nuttall’s collection were revised by Keirans (1984). According to Nuttall’s collection catalogue (Keirans 1984), vials N 253 and N 999 included other species of ticks but not *A. varium* and vial N 2808 was lost. On the other hand, this author verified that the specimens included in vial N 1738, were not *A. varium*, but *A. geayi* Neumann and *A. pictum* Neumann. The specimens in the vials N 2618, N 3156 to date, are deposited in the US National Tick Collection (USNTC) under the numbers RML 111398 and RML 112019, respectively.

Unfortunately, the male original description made by Koch (1844) is incomplete, lacking data on host and locality.

In Argentina, the distribution range of *A. varium* comprises the setentrional zone, between northwestern Chaco and the lower northwestern regions of Salta (Boero 1957). As such, the female originally described from Corrientes (Robinson 1926) might be the most southern record for this species.

Fairchild et al. (1966) revised the *A. varium* material from Panama, including records for this species on *C. hoffmanni* (16 vials, 30 males and 16 females), on *B. tridactylus* (= *B. infuscatus*) (12 vials, 30 males and 9 females), on unidentified sloth (4 vials, 10 males and 2 fe-
males), no host (1 vial, 5 males) and one female on a marsupial “Eaton’s opossum” (probably *Didelphis marsupialis*) from Canal Zone, Panama. Although Vargas (1955) included Mexico in the geographical distribution of *A. varium*, Fairchild et al. (1966) considered this a doubtful record, since sloths of the genera *Bradypus* and *Choloepus*, do not occur in Mexican forests.

Jones et al. (1972) studied ticks from 82 localities in Venezuela between 1965 and 1968. However, no *A. varium* specimen was found on the collected hosts. Nevertheless, these authors referred to one male and one female, collected on *B. tridactylus* from Rancho Grande (3500 m elev.), on May 5, 1945, and deposited in the “Rocky Mountain Laboratory” collection (RML). This collection was donated to the US National Museum of Natural History (Smithsonian Institution) in 1983 (Durden & Keirans 1996).

In 1990, all ticks from the Smithsonian Institution were transferred to the Institute of Arthropodology and Parasitology, Georgia University, and incorporated to the USNTC. This collection is, to date, the world’s largest tick collection (Durden et al. 1996).

There is a record of *A. varium* (variety *albida*) on *B. tridactylus* from Chile by Neumann (1899). However, Chile is outside the distribution range of Bradypodidae (Wilson & Reeder 1993, Eisenberg & Redford 1999) and this record of *A. varium* is questionable. This specimen (a male, ZMB 1054) was deposited in Berlin Museum (Moritz & Fischer 1981). Neumann was apparently aware of this unusual locality record for *B. tridactylus* because Chile was not included in Neumann (1911), a fact that has been overlooked by several authors (Robinson 1926, Fairchild et al. 1966, Jones et al. 1972). Therefore we consider the presence of *A. varium* in Chile as doubtful.

Other records for this species include Guatemala, Costa Rica, Guiana and Peru (Floch & Abonnenc 1940, Floch & Fauran 1959, Jones et al. 1972, Need et al. 1991).

Except for the few observations in Aragão (1911, 1936), Robinson (1926), Osorno-Mesa (1940), Boero (1957), Fairchild et al. (1966), Jones et al. (1972), and Sinkoc et al. (1997), nothing is known on the biology and ecology of this tick species.

The present study aims to add new information on the geographical distribution of *A. varium* in Brazil, as well as on the tick/host relationship, based on material deposited in Brazilian collections and on the available literature.

**MATERIALS AND METHODS**

Twenty-two Brazilian institutions that had arthropod collections were contacted. From these, five collections including tick material were examined, since some curators enabled the study by sending the material to the Butantan Institute for identification and data compilation. From the vials, the following data was compiled: number of specimens, host species, locality, including geographical coordinates, collection date and collector.

Sloth distribution range was based on Wetzel (1982), Emmons (1990), Nowak (1991), Wilson and Reeder (1993), and Eisenberg and Redford (1999).

The maps were obtained from the Excel program, Microsoft version 5.0/95.

Material examined (Curator or person in charge in parenthesis):
IBSP – Acari Collection of the Butantan Institute (Instituto Butantan, São Paulo, SP) (DM Barros-Battesti);
FMVZ/USP-CNC – National Tick Collection (Coleção Nacional de Carrapatos da Faculdade de Medicina Veterinária e Zootecnia da Universidade de São Paulo, São Paulo, SP) (MB Labruna);
MZUSP – Arthropod Collection of the Zoology Museum (Museu de Zoolgia da Universidade de São Paulo, São Paulo, SP) (EM Cancello);
INPA – Arthropod Collection of the National Institute of the Amazon Research (Instituto Nacional de Pesquisas da Amazônia, Manaus, AM) (C Magalhães);
MPEG – Arthropod Collection of the Emilio Goeldi Museum (Museu Paraense Emilio Goeldi, Belém, PA) (AY Harada).

**RESULTS**

A total of 82 vials, containing 191 *A. varium* specimens, were examined. The Brazilian distribution of *A. varium*, according to the collection material and literature records, is shown in Fig. 1A.

**IBSP – Butantan Institute**

The IBSP collection includes 44 vials with 117 specimens from the states of São Paulo (SP), Rio de Janeiro (RJ), Bahia (BA), Amazonas (AM), and Alagoas (AL) (94 males, 19 females and 4 nymphs).

Municipalities with *A. varium* records: SP – Cubatão (23°89’S 46°42’W); Mogi das Cruzes (23°52’S 46°18’W); Praia Grande (24°05’S 46°40’W); São Paulo (23°54’S 46°63’W); São Vicente (23°96’S 46°39’W); Ubatuba (23°43’S 45°07’W); RJ – Campos dos Goytacazes (21°75’S 41°32’W); Casimiro de Abreu (22°48’S 42°20’W); Campo Grande and Floresta da Tijuca, Rio de Janeiro (22°90’S 43°20’W); BA – Camacan (15°41’S 39°49’W); Ubatã (14°21’S 39°52’W).


Host: *Bradypus variegatus* Schinz – 8 vials with 20 specimens (IBSP 6848, 2 males and 1 female from Parque Morumbi, São Paulo, 14/IV/1998, A Joppert coll.; IBSP 6916, 1 female from Parque Morumbi, São Paulo, 14/IX/1998, A Joppert coll.; IBSP 7072, 7 males and 1 female,

Host: Bradypus torquatus Illiger – 13 vials with 45 specimens (IBSP-7071, 1 male and 1 female from Ubatã, 30/VII/2000, A Joppert coll.; IBSP 7074, 2 males from Camacan, 27/VII/2000, A Joppert coll.; IBSP 7082, 1 male from Reserva Biológica Poço das Antas, Casimiro de

Fig. 1: Brazilian distribution range of A. varium and sloths, according to collections material and literature. A: A. varium; B: Bradypus torquatus; C: B. tridactylus; D: B. variegatus; E: Choloepus hoffmanni; F: C. didactylus. Key to States of Brazil: AC = Acre, AL = Alagoas, AM = Amazonas, AP = Amapá, BA = Bahia, CE = Ceará, ES = Espírito Santo, GO = Goiás, MA = Maranhão, MG = Minas Gerais, MS = Mato Grosso do Sul, MT = Mato Grosso, PA = Pará, PB = Paraíba, PE = Pernambuco, PI = Piauí, PR = Paraná, RJ = Rio de Janeiro, RN = Rio Grande do Norte, RO = Rondônia, RR = Roraima, RS = Rio Grande do Sul, SC = Santa Catarina, SE = Sergipe; SP = São Paulo, TO = Tocantins

Host: Choloepus hoffmanni Peter – 1 vial with 5 specimens (IBSP-1174, 5 males, locality unknown, from the State of Amazonas, 01/XI/1937, P Savoya coll.).


Undetermined host – 3 vials with 3 specimens (IBSP 1275, 1 male, locality coll. unknown, donated by A Prado in 1914; IBSP 4501, 1 male from Northeast, 12/XII/1951, Oliveira Lima coll.; IBSP 7121, 1 female, locality unknown, 23/IX/1942, coll. unknown).

FMVZ/USP-CNC National Tick Collection

The FMVZ/USP-CNC includes 6 vials with 9 specimens (4 males and 5 females) from the states of São Paulo (SP) and Rondônia (RO).

Municipalities with A. varium records: SP – São Bernardo do Campo (23º69’S 46º56’W) and Sorocaba (23º50’S 47º45’W); RO – Monte Negro (10º17’S 63º14’W).


Host: B. variegatus – 1 vial with 4 specimens (FMVZ/USP-CNC 497, 2 males and 2 females from Sorocaba Zoological Gardens, 08/VI/2001, MB Labruna coll.).

Host: Choloepus sp. – 1 vial with 1 specimen (FMVZ/USP-CNC 562, 1 male from Monte Negro, 10/VIII/2001, MB Labruna coll.).

Host: sloth – 1 vial with 1 specimen (FMVZ/USP-CNC 269, 1 female from Sorocaba Zoological Gardens, XI/1999, MB Labruna coll.).

Free in the environment – 1 specimen (FMVZ/USP-CNC 540, 1 male from Monte Negro, 19/VI/2001, MB Labruna coll.).

The female from vial FMVZ/USP-CNC 269 was collected alive. It weighted 4100 mg, and layed 2100 mg of eggs in the laboratory. The male from vial FMVZ/USP-CNC 282 was collected as an engorged nymph that posteriorly molted in the laboratory and the male from vial FMZV/USP-CNC 540 was collected as a nymph, by dragging on the vegetation. This nymph molted into a male after feeding on a rabbit (MB Labruna, personal communication).

MZUSP – Zoology Museum of the Universidade de São Paulo

The MZUSP collection includes only one vial with two specimens.

Host: sloth – A vial with two specimens from Caraguatatuba (SP) (23º62’S 45º41’W) (MZUSP 17067, 2 males, 1957, coll. unknown).

INPA – National Institute of the Amazon Research

The INPA collection includes 26 vials with 38 specimens (32 males and 6 females) identified by JE Keirans from the Georgia University, Statesboro, GA, USA. All vials are from Manaus (03º10’S 60º02’W), State of Amazonas (AM).


Host: C. didactylus Linnaeus – 2 vials with 4 specimens (RML 112799, 1 male, 11/IV/1979, Robin C Best coll.; RML 112866, 3 males, 01/II/1979, Robin C Best coll.).

Host: sloth – 1 vial with 1 specimen (RML 112968, 1 male, 24/IV/1978, Robin C Best coll.).

MPEG – Emilio Goeldi Museum

The MPEG collection includes 5 vials with 25 specimens (21 males and 4 females) from Jacundá (04º45’S 49º11’W), Belém (01º45’S 48º50’W) and Parauapebas (06º06’S 49º90’W), State of Pará (PA).

Host: sloth – 3 vials with 4 specimens (MPEG 1h, 1 male from margem direita do Rio Tocantins, Jacundá, 12/V/1984, WL Overal, coll.; MPEG 3, 2 females from parque of the Museum Paraense Emilio Goeldi, Belém, 13/III/1984, A Muniz coll.; MPEG 37, 1 female from of the Museum Paraense Emilio Goeldi, 6/III/1992, José Arnaldo coll.).
Host: Three-toed sloth – 1 vial with 20 specimens (MPEG 24a, 20 males from Serra Norte, Paraúpebas, 5/VI/1983, RB Neto coll.).

Undetermined host – 1 vial with 1 specimen (MPEG 4, 1 female from Parque of the Museum Paraense Emílio Goeldi, Belém, 13/VII/1984, A Muniz coll.).

Literature records
Host: B. tridactylus – A. varium males and females from Rio de Janeiro, Xerém and Iguaí (RJ), Lassance and Teixeira Soares (MG), Brasilia (Distrito Federal), Belém (PA) and São Paulo (SP) (Aragão 1911, 1936); males from the Parque Zoológico of the Emílio Goeldi Museum, Belém (PA) (Serra-Freire et al. 1995); and one female recorded by Amorim and Serra-Freire (1996) from the Fundação RIO/ZOO, Rio de Janeiro (RJ).

Host: B. variegatus – 5 males and 4 females of A. varium from Ilha de Itamaracá (PE). According to Sinkoc et al. (1997), one of the females was completely engorged and weighed 3.92 g.

Distribution range for sloths in the national territory

Bradyopodidae family - The “preguiça-de-coleira” (maned three-toed sloth), B. torquatus (Fig. 1B) occurs in the coastal Atlantic Forest, from south Amapá to southern São Paulo states. The “preguiça-de-bentinho” (pale-throated three-toed sloth), B. tridactylus (Fig. 1C) is just found in the northern region, from the proximities of the rivers Negro, Amazonas and Solimões to Belém (PA), occurring in Amapá (AP), Amazonas (AM), Pará, and Roraima (RR) states. The “preguiça-ai-ai” (brown-throated three-toed sloth), B. variegatus (Fig. 1D), is well distributed within the country, mainly in the Center-west region, with the exception of the states of Amapá, Roraima, Maranhão (MA), Piauí (PI), Ceará (CE), Rio Grande do Norte (RN), Paraíba (PB), Pernambuco (PE), Amapá (AL), Sergipe (SE), eastern Bahia (BA) and Minas Gerais (MG), Espírito Santo (ES), and southern region (Paraná, Santa Catarina, and Rio Grande do Sul).

Megalonychidae family - The species C. hoffmanni “unau” or “preguiça real” (Hoffmann’s two-toed sloth) (Fig. 1E) is distributed in northern Mato Grosso (MT), Rondônia (RO), Acre (AC), and Amazonas states, while C. didactylus “preguiça real” (southern two-toed sloth) (Fig. 1F) is found in the northern region forests, mainly in the proximities of the rivers Amazonas and Solimões (Amazon Basin). Its distribution includes Acre, Rondônia, Roraima, Amapá, Amazonas, Pará, Maranhão, Piauí, Tocantins (TO), and possibly the northern Mato Grosso states.

DISCUSSION

The states of Rondônia, Amazonas, Amapá and Bahia are newly assigned to the distribution range of A. varium. For the remaining Brazilian states, where A. varium was not reported (Fig. 1A), no specimen was found in the examined collections, neither are there any records for this species in the available literature.

Currently sloths do not occur in southern Brazil (Fig. 1B-F) (Wetzel 1982, Emmons 1990, Nowak 1991, Wilson & Reeder 1993, Eisenberg & Redford 1999). However they existed in this region in the first half of 20th century (Vieira 1955, Cimardi 1996). Considering the A. varium presents high host specificity, it is probable this tick was not observed in the Southern region due to a complete absence of their hosts in the area.

Although B. tridactylus is restricted to the states of Roraima, Amapá, Amazonas, and Pará (Fig. 1C), several A. varium specimens were collected on this host in the Southeastern region, according to the data labels of the examined material and in the Central-western region (Aragão 1936). Disconsidering the zoological records, it is possible that there was a misidentification of the host, since only B. torquatus and B. variegatus are recorded for these regions (Fig. 1B, D). The species B. variegatus is widely distributed throughout Southeastern Brazil, while B. torquatus is just restricted to the eastern coastal areas. Despite the existence of several vials of A. varium collected on B. variegatus, deposited in the IBSP and FMVZ/USP-CNC collections, only one record was found in the available literature, from Ilha de Itamaracá, State of Pernambuco (Sinkoc et al. 1997).

Considering the distribution of the sloths, several specimens of A. varium from the Southeastern region, collected on B. tridactylus, especially those from the coastal areas of the State of São Paulo, could have been collected on B. variegatus (Fig. 1D) or even on B. torquatus (Fig. 1B). This is even more true for those specimens collected in the State of Rio de Janeiro where only these two species of sloth are recorded.

Concerning the biology of A. varium, some egg batches from engorged females collected in parks in the city of São Paulo were maintained in incubators at 27°C and 90-95% humidity. Nevertheless, most eggs were non-viable and those emerging larvae died a few days later. Possibly, higher humidity acts as a limiting factor, as observed for A. longirostre Koch (DM Barros-Battesti, unpublished data), as well as A. aureolatum (Pallas) under laboratory conditions (MB Labruna, pers. commun.), and in the natural environment (M Arzua, pers. commun.). The A. varium female, when engorged, is one of the largest Amblyomma species and lays up to 15,000 eggs (Aragão 1936).

Although the vial contains no information on host, collection locality and collector, the female deposited in IBSP 7121, is the largest specimen of the IBSP collection. The information on the identification label read that, at the time of collection, the specimen was 30 mm long X 25 mm wide X 18 mm high and weighed 8.6 g. Together with this female, other specimens almost as large and as heavy are deposited in IBSP 722, IBSP 6916 and IBSP 7078.

The USNTC from the Arthropodology and Parasitology Institute at the Georgia University includes a female (RLM 112019 from Nuttall collection N 3156) that before laying 9,759 eggs measured 30 X 24 X 15 mm and weighed 5.9 g (Keirans 1984).

According to Fairchild et al. (1966), two females from Panama, when collected weighed 6.4 g. Aragão (1936) referred to a female measuring 30 X 26 mm that was deposited in the Instituto Oswaldo Cruz collection (Fiocruz).

A specimen collected in the French Guiana, measuring 32 X 30 mm and weighing 7.5 g (Floc’h & Fauran 1958) might be the largest specimen registered to date. However, the specimen from IBSP 7121 seems to be the heaviest.
In nature, the hosts for *A. varium* larvae are unknown. Except for the one engorged nymph that molted into a male (FMVZ/USP-CNC 540), collected on *B. tridactylyus* in São Bernardo do Campo Zoo (MB Labruna, pers. communicat.) the only other records of nymph parasitism are those from IBSP 7083 and 7093, both collected on *B. torquatus*. Nevertheless, we are not sure these two specimens are indeed *A. varium* nymphs since there is no available identification key for tick nymphs. However, these specimens were collected together with adult specimens of *A. varium* on hosts that were not infested by any other species of tick.

The collection of a nymph, on vegetation, that engorged on a rabbit (FMVZ/USP-CNC 540) and molted to a male is probably the only case of feeding on a laboratory animal. Nevertheless, the possibility of nymphs infesting other hosts such as small mammals or even birds should not be discarded since little is known on the host parasite relations of this species in nature.

With the exception of probably accidental records of parasitism on a pet dog and on a deer, from Argentina (Boero 1957), on a marsupial from Panama, and on a wild pig from the Peruvian Amazon, Peru (Fairchild et al. 1966), it is suggested that *A. varium* adults are highly specific for sloths.

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**REFERENCES**


