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Article



A new species of *Dipsas* Laurenti from the Atlantic Forest of Brazil (Serpentes: Dipsadidae)

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Abstract

Dipsas sazimai **sp. nov.** is described from the Atlantic Forest of Brazil. The new species is distinguished from all congeners by showing anterior portion of body with rounded dorsal blotches wider than interblotches; median and posterior portion of body with blotches higher than long and narrower than interblotches; posterior body blotches lighter than anterior blotches; posterior blotches with conspicuous white edge in paraventral region; tiny and vertically oriented streaks in the interblotches from the posterior half of body; 187–209 ventral scales; 107–129 subcaudal scales; and the first blotch not reaching the rictus. Based on characters of external morphology and color pattern we suggest the new species is related to taxa of the recently proposed *Dipsas incerta* species group.

Key words: Dipsas sazimai new species; altitudinal variation; Dipsas incerta species group; taxonomy

Resumo

Dipsas sazimai **sp. nov.** é descrita da Mata Atlântica do Brasil. A nova espécie é distinta de outras espécies do gênero por apresentar a porção anterior do corpo com manchas dorsais arredondadas mais largas que os interespaços; porção média e principalmente posterior do corpo com manchas mais altas do que largas e mais estreitas que os interespaços; manchas posteriores mais claras que as anteriores, manchas posteriores com os bordos brancos na região paraventral; a partir da metade posterior do corpo interespaços com listras delgadas e orientadas verticalmente; 189–207 ventrais; 107–129 subcaudais; a primeira mancha não alcança região rictal. Baseado em caracteres de morfologia externa e padrão de coloração sugerimos que a nova espécie é relacionada aos táxons do recém proposto grupo de espécies de *Dipsas incerta*.

Introduction

The snail-eating snake genus *Dipsas* Laurenti, 1768 is currently allocated in the family Dipsadidae (Pinou *et al.*, 2004; Vidal *et al.*, 2007; Hedges *et al.*, 2009). Peters (1960) provided an extensive taxonomic revision of the genus recognizing seven species groups based on color pattern. Peters & Orejas-Miranda (1970) recognized 28 species and presented a key to the genus. After this work, several studies focused on different groups of *Dipsas* (Fernandes *et al.*, 2002; Cadle & Myers, 2003; Passos *et al.*, 2004; Passos *et al.*, 2005) in order to clarify the systematics of this taxonomically complex genus. Recently, Harvey (2008) and Harvey & Embert (2008) presented comprehensive revisions of these snakes with emphasis on South American forms providing, among other results, a diagnosis to the genus based on characters of squamation and hemipenis, a redefinition of Peter's (1960) species groups, and a key to South American taxa.

The genus *Dipsas* is speciose in Central America and mainly in Andean South America (MacCulloch & Lathrop, 2004). Considering taxa occurring in Atlantic Forest of South America, the taxonomic status of some

species were reevaluated, including *D. neivai* (Porto & Fernandes, 1996; Harvey & Embert, 2008), *D. alternans* (Passos *et al.*, 2004), and *D. albifrons* (Passos *et al.*, 2005). After an extensive analysis of ninety specimens from the Atlantic Forest of Brazil, previously identified as *Dipsas alternans* (Fischer), we concluded some of them represent a new taxon that is described herein.

Material and methods

Specimens examined are housed in the following collections: Museu Nacional (MNRJ), Rio de Janeiro, Brazil; Instituto Butantan (IBSP), São Paulo, Brazil; Museu de Zoologia da Universidade Estadual de Santa Cruz (MZUESC), Ilhéus, Brazil; Museu de Zoologia da Universidade Federal da Bahia (MZUFBA), Salvador, Brazil; and Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo, Brazil. Referred specimens and localities are listed in the appendix.

Terminology for *Dipsas* cephalic shields follows Peters (1960) and Harvey & Embert (2008), whereas the method of ventral counting follows Dowling (1951). Hemipenial terminology is based on Dowling & Savage (1960), Myers & Campbell (1981), as augmented by Harvey & Embert (2008). Scale counts and measurements of body blotches and interblotches follow Harvey & Embert (2008). A backslash (left/right) is used to separate counts from different sides of the same specimen. Measurements were taken with a dial caliper to the nearest 0.1 mm, except for snout-vent (SVL) and tail (TL) lengths, which were taken with a flexible ruler to the nearest 1.0 mm. Sex was determined through a ventral incision at the base of the tail. Comparisons were made using the specimens examined and literature data from Peters (1960), Peters & Orejas-Miranda (1970), Harvey (2008) and Harvey & Embert (2008). Variation is reported as (mean \pm standard deviation) or the total number of sides (squamation of head) in which a particular scale count was registered.

Data on habitat use and diet were obtained during fieldwork and by examining data in museum collections or literature. Data of abundance of *Dipsas* were obtained in Herpetological collections of IBSP, MZUESC, and MZUFBA.

Dipsas sazimai, new species

(Figs. 1-5)

Holotype: MNRJ 15136, adult male, Brazil, state of Rio de Janeiro, municipality of Casimiro de Abreu (22° 28'S, 42° 12'W, ca. 80 m), collected by C. C. Siqueira and W. C. Kiefer on 30 October 2005.

Paratypes: MZUESC 8199, young female, Brazil, state of Alagoas, Fazenda Bananeira, municipality of Murici (09° 18'S, 35° 57'W, ca. 550 m), collected by Marco A. Freitas, February–March 2010; MZUFBA 1800, adult male, Brazil, state of Bahia, Parque Estadual das Sete Passagens, municipality of Miguel Calmon (11° 26'S, 40° 36'W, ca. 530 m), no collector data, February 2006; MZUESC 6134, adult male, Brazil, state of Bahia, Sítio de Maria das Neves, municipality of Camacan (15° 23'S, 39° 33'W, ca. 450 m), collected by Maria das Neves, January–June 2007; MZUESC 7848, adult female, Brazil, state of Bahia, Serra Bonita, municipality of Camacan (15° 23'S, 39° 33'W, ca. 400 m), collected by Iuri Dias, 16 November 2009; MZUESC 8466, adult male, Brazil, Bahia State, Serra Bonita, municipality of Camacan (15° 23'S, 39° 33'W, ca. 400 m), collected by Iuri Dias, 05 June 2010; MZUESC 7988, adult male, Brazil, state of Bahia, municipality of Jequié (13° 57'S, 39° 59'W, ca. 650 m), collected by Juliana Rodrigues, 05 January 2010; MNRJ 19275, adult female, Brazil, state of Espírito Santo, Estação Biológica Santa Lúcia, municipality of Santa Teresa (19° 56'S, 40° 36'W, ca. 650 m), collected by A. Giupponi, T. Souza, and M. Milleri, 11–12 May 2005; IBSP 77835, adult female, Brazil, state of Espírito Santo, Fazenda Bandarra, municipality of Mimoso do Sul (21° 04'S, 41° 22'W, ca. 270 m), collected by J. L. Gasparini, 16 December 2007; IBSP 69143, adult male, Brazil, state of São Paulo, Picinguaba, municipality of Ubatuba (23° 23'S, 44° 50'W, ca. 40 m), collected by P. A. Hartmann, 01 March 2004.

Diagnosis (Figs. 1–3). Distinguished from all congeners by the following combination of characters: (1) 15-15 dorsals; (2) temporals not entering orbit; (3) loreal enters orbit; (4) prefrontals generally enter orbit; (5) one pair of infralabials in contact behind symphysial; (6) infralabials contact second pair of chinshields; (7) 187–209 ventral scales in males, 193–202 in females; (8) 107–129 subcaudal scales in males, 107–116 in females; (9) 17–21

maxillary teeth; (10) anterior portion of body with rounded dorsal blotches generally wider than interblotches; (11) median and mostly posterior portion of body with blotches higher than long and narrower than interblotches; (12) posterior body blotches lighter than anterior blotches; (13) posterior blotches with conspicuous white edge in paraventral region; (14) tiny and vertically oriented streaks in the interblotches from the posterior half of body; (15) labial scales not heavily pigmented; (16) head mostly immaculate; (17) the first blotch not reaching the rictus.



FIGURE 1. Dorsal and ventral views of the holotype of Dipsas sazimai (MNRJ 15136).

Description of the holotype (Figs. 1–2). Adult male, SVL 498 mm; TL 245 mm (49% SVL); head length 13.9 mm (3% SVL) from tip of snout to corner of the mouth; head width 7.3mm (53% head length) taken at broadest point; interocular distance 6.2 mm; snout-orbit distance 3.8 mm (1.6 times interocular distance); head broadly distinct from body; rostral 3.2 mm wide, broader than high, sub-triangular in frontal view, slightly visible from above; internasals 2.0 mm wide, broader than long; internasal suture slightly sinistral with respect to prefrontal suture; prefrontals 2.6 mm wide, broader than long, enter the orbit; supraocular 3.5 mm long, longer than broad; frontal 3.8 mm long, longer than broad, with a pentagonal shape in dorsal view; parietals 5.0 mm long, about as long as broad; nasal entire; loreal 1.9 mm long, slightly longer than high, enters the orbit; eye diameter 3.1 mm; pupil semi-elliptical; no preoculars; on the right side, between supraocular and prefrontal, the later entering the orbit, there is an azygous; 1/2 postoculars; upper postocular higher than lower; temporals 1+3; upper posterior temporal elongate, about twice as long as high; 9/8 supralabials, 4–6/3–5 contacting orbit; symphysial 1.9 mm wide, about two times broader than long, separated from chinshields by the first infralabial on the left side and two infralabials on the right side; only the first pair of infralabials in contact behind symphysial; 10 infralabials, 1–5/1–6 contacting chinshields; three pairs of chinshields, first pair longer than broad, second pair slightly broader than long; the third pair of chinshields is present but the sulcus is incomplete; 1 preventral separating chinshields from

first ventral; dorsal scales in 15-15-15 rows, smooth, without apical pits; 209 ventrals; 129 divided subcaudals; 17 maxillary teeth; cloacal plate entire.

Color in preservative of holotype (Figs. 1–3) Dorsal ground color of head uniformly brown except for two small dark-brown, white bordered spots on the frontal and a pair of dark-brown, white bordered spots on the parietals connected to each other medially, with divergent anterior and posterior edges; supralabials light-brown; infralabials and gular region uniformly creamish; dorsal ground colour of body beige; first blotch 10 vertebral scales long, extending to the level of the 10th ventral scale, with a thin white border; dorsum of body with 27/26 blotches; anterior third of body with well defined, dark-brown rounded blotches with a thin white border; anterior blotches wider (7–8 scales long) than interblotches (4–5 scales long); median and posterior portion of body with well defined, brown and narrower blotches (4–5 scales long), especially in the paraventral region; blotches are 1.5–2 and interblotches are 4–5 scales long; blotches contacting the opposite one in the vertebral region, only in the first half of body; blotches along the body extending through the paraventral region; tiny and vertically oriented (less than 1 scale long and 4–5 dorsal scales high) brown to dark-brown streaks appear from the second half of body in the interblotches, at the level of paravertebral region; ground color of anterior part of belly creamish, posteriorly becoming light-brown, with irregular streaks of different sizes along the venter; tail with 25/23 blotches with the same pattern as that on posterior portion of body and with some streaks in the interblotches.

Hemipenis of holotype (Fig. 4). Everted organ extends to the level of the seventh subcaudal, single with a bulbous shape, unicapitate; capitulum completely encircles the organ on the sulcate side and occupies more than the distal half of the hemipenial body; on the asulcate side, capitulum occupies less than the distal half of the hemipenial body and a capitular crotch is present; capitulum covered with papillate calyces; sulcus spermaticus divides approximately on the basal region of capitulum; branches have centrolineal orientation terminating on distal region of the organ; on the asulcate side the free capitular flap partially overlaps the most distal row of spines; five asulcate spine rows, most proximal ones with curved spines; asulcate patch not conspicuous and basal hooks with distinct asymmetry; sulcate side with two rows of spines; basal naked pocket present next to the lateral hook terminating at the level of spine rows; basal portion of hemipenial body with spinules, mostly on the sulcate side.

Variation. Largest male the holotype. Largest female IBSP 77835, SVL 375 mm, TL 165 mm. Ventrals 187– 209 (197.5±7.1; *n*=6) in males, and 193–202 (196.8±3.9; *n*=4) in females; subcaudals 107–129 (119.7±8.3; *n*=6) in males, and 107-116 (111.7±4.5; n=3) in females; specimen MNRJ 19275 shows prefrontals that do not enter the orbit due to the presence of a preocular above the loreal; no preoculars (n=8), 1 preocular above the loreal (n=1), 1 preocular below the loreal (n=1); postoculars 1 (n=2 sides), 2 (n=12 sides) or 3 (n=4 sides); temporal formula 1+2 (n=4 sides), 1+3 (n=4 sides), 2+2 (n=1 side), 2+3 (n=4 sides), 1+2+2 (n=1 side) or 1+2+3 (n=2 sides), 2+2+3 (n=1 side), 2+3 (n=1 side), 3+3 (n=1 side), 3+3side), 3+3+3 (n=1 side); supralabials 8 (n=5 sides), 9 (n=12 sides) or 10 (n=1 side); supralabials touching the orbit $3-5^{\text{th}}$ (n=4 sides), $3-6^{\text{th}}$ (n=2 sides), $4-5^{\text{th}}$ (n=1 side), $4-6^{\text{th}}$ (n=9 sides), $4-7^{\text{th}}$ (n=1 side) or $5-6^{\text{th}}$ (n=1 side); infralabials 8 (n=1 side), 9 (n=5 sides), 10 (n=9 sides) or 11 (n=3 sides), up to fourth (n=1 side), fifth (n=9 sides) or sixth (n=8 sides) touching chinshields; two (n=4) or three (n=5) pairs of chinshields with complete sulci; number of maxillary teeth 17–21 (18.4 \pm 1.5; n=8); first blotch 7.5–11.5 vertebral scales long (9.6 \pm 1.2; n=10); number of dorsal blotches along the body 20–30 (25.9 \pm 3.0; n=10); number of caudal blotches 16–25 (20.4 \pm 3.3; n=6); size of anterior dorsal blotches 5–8 scales long (6.6 \pm 1.0; n=10); size of anterior interblotches 2.5–7 scales long (4.4 \pm 1.2; n=10; size of midbody dorsal blotches 1–4 scales long (2.7±1.0; n=10); size of midbody dorsal interblotches 4–6 $(5.2\pm0.8; n=10)$; size of posterior dorsal blotches 0.5-2.5 scales long $(1.6\pm0.7; n=10)$; size of posterior dorsal interblotches 4–6 (5.0±0.8; n=10); retracted hemipenis extends 8–10 subcaudals scales (8.8±1.0; n=4). The remaining characters are invariable with respect to the holotype.

Etymology. The specific epithet honors Ivan Sazima for his relevant contributions to herpetology in Brazil and his immense contributions to the knowledge of the Brazilian vertebrate fauna.

Distribution (Fig. 6).The new species is known from the state of Alagoas (09° 18'S) to the north of São Paulo (23° 23'S). It occurs in lowland areas (0–270 m) near the coast at higher latitudes (above 20°S, in the states of São Paulo, Rio de Janeiro and southern Espírito Santo). In lower latitudes (below 20°S, in the states of Espírito Santo, Bahia and Alagoas), this snake was found in elevations up to 700 m. In the northern Atlantic Forest (Bahia), it occurs on isolated and distinct mountainous complexes, such as Chapada Diamantina and upland regions near to coast (SEI, 2003).



FIGURE 2. Dorsal, lateral, and ventral views of the head of the holotype of Dipsas sazimai (MNRJ 15136).



FIGURE 3. Color pattern and size of the blotches of *Dipsas sazimai*: anterior (top); midbody (middle); and posterior portion (bottom) of the body.



FIGURE 4. Sulcate, asulcate, and lateral views of the hemipenis of the holotype of *Dipsas sazimai* (MNRJ 15136). Scale bar=1 mm.

Natural history and conservation. One individual (IBSP 69143) had remains of a slug in the stomach (Hartmann *et al.*, 2009). Three individuals were found on vegetation (1.5–2.0 m above ground) at night: two specimens (IBSP 69143 and MZUESC 7848) were moving whereas another (IBSP 77835) was coiled among vines. Another individual was found run over, which suggests that it was crawling on the ground (cf. Hartmann *et*

al., 2009). The semi-arboreal habits are characteristic within the *Dipsas* genus (Marques et al., 2004). These snakes are usually found resting on vegetation but can forage for snails and slugs on the ground (Sazima, 1989). The new species inhabits dense umbrophilous forests within the Atlantic Forest domain (every *Dipsas* species inhabits forests). The sampling data suggest *D. sazimai* is the rarest species of *Dipsas* in the Atlantic Forest domain. We found only ten preserved specimens of *D. sazimai* in herpetological collections in contrast with higher number of other *Dipsas* from the Atlantic Forest region (*D. albifrons*, n=285; *D. bucephala*, n=170; *D. catesbyi*, n=262; *Dipsas i. indica*, n=82; *D. i. petersi*, n=162; *D. neivai* (*sensu* Porto & Fernandes, 1996), n=506; *D. alternans*, n=96). The Atlantic Forest of Brazil has been identified as one of the five global biodiversity hotspots (Myers *et al.*, 2000). Deforestation has reduced the Atlantic Forest to 12% of its original coverage (Ribeiro *et al.*, 2009). The remaining forest is severely perturbed or fragmented particularly in the northern portion as well as in coastal plain in southern areas where *D. sazimai* was recorded (Foury, 1972; Gonzaga *et al.*, 1995; Ribeiro *et al.*, 2009). In Atlantic Forest, the populations of arboreal snakes are more susceptible to perturbation or loss of their habitat than terrestrial taxa (Marques & Sazima, 2004). Thus, the new species due to its natural history traits, low abundance, and loss of habitat may be considered potentially threatened.



FIGURE 5. Specimen of Dipsas sazimai (IBSP 77835) from Mimoso do Sul, ES, Brazil.

Discussion

Considering the species groups of Harvey (2008), *D. sazimai* resembles species of the *Dipsas incerta* group by having its head mostly immaculate, the first blotch not reaching the rictus, 15 dorsal scales, and loreal entering orbit. Besides, the hemipenis of *D. sazimai* resembles that of *D. alternans* (—see Passos *et al.*, 2004), except for the asulcate spine rows that cover most of the hemipenial body in *D. sazimai* and are more restricted to the region adjacent to the capitulum in *D. alternans*. It differs from *D. alternans*, *D. incerta*, and *D. praeornata* by prefrontals generally entering the orbit (vs. prefrontals not entering the orbit), and anterior portion of body with rounded dorsal dark brown blotches generally wider than interblotches and median and mostly posterior portion of body with light brown blotches higher than long and narrower than interblotches (vs. rounded dorsal blotches throughout the body and narrower than interblotches from the posterior half of body (vs. interblotches throughout body with no tiny and vertically oriented streaks). It also differs from *D. praeornata* by showing dorsal pattern not fading on posterior portion of body and 11–14 infralabials). It further differs from species of *Dipsas articulata* group by having no complete blotches across the belly and infralabials separated from preventrals and first ventral by sublabials (vs. complete blotches across the

belly and infralabials contacting preventrals and often first ventral). It is distinguished from D. catesbyi group by having no black-cap covering the head and extending below the eye (vs. black-cap covering the head and extending below the eye). Differs from D. indica group by having 15 dorsal scales at midbody and dorsal blotches not widest ventrally (vs. 13 dorsal scales at midbody and dorsal blotches widest ventrally). It is distinguished from D. ellipsifera and D. elegans by having loreal not noticeably longer than high (vs. loreal noticeably longer than high) and from D. oreas by showing 107-129 subcaudal scales and anterior blotches narrowing dorsally (vs. 70-91 and anterior blotches squarish). Differs from D. pratti group by having no labial scales heavily pigmented frequently forming a regular pattern of bars or blotches (vs. labial scales heavily pigmented frequently forming a regular pattern of bars or blotches). The new species is distinguished from species of D. temporalis group by showing no temporals entering orbit and loreal not noticeably longer than high (vs. temporals usually entering orbit and loreal noticeably longer than high). It differs from D. variegata group by showing no sublabials separating second pair of chinshields from infralabials, interblotches not heavily streaked or spotted, and at least anterior portion of body with rounded dorsal blotches wider than interblotches (vs. sublabials separating second pair of chinshields from infralabials, interblotches usually heavily streaked or spotted, dorsal blotches throughout the body higher than long and generally narrower than interblotches). It is distinguished from D. perijanensis (Plesiodipsas perijanensis sensu Harvey et al., 2008) by having 15 dorsal scales (vs. 17 or more) and from D. gaigeae by having no complete blotches across the belly, 187-209 ventral and 107-129 subcaudal scales (vs. complete blotches across the belly and 155-169 and 53-72, respectively -see Kofron, 1982).



FIGURE 6. Geographic distribution of *Dipsas sazimai*. Triangle represents the type-locality (municipality of Casemiro de Abreu, RJ, Brazil).

Considering the records of *Dipsas sazimai*, specimens from the southern limit of distribution occur at elevations lower than 300 m, whereas those from lower latitudes are found at higher elevations (400–700 m). The

snakes of adjacent lower areas of the state of Bahia (northern Atlantic Forest) have already been extensively sampled and this taxon was not recorded (Argôlo, 2004), suggesting that *Dipsas sazimai* might occur at higher elevations northward. This distribution pattern was previously reported for some other vertebrate groups (see Lutz 1972; Gonzaga *et al.* 1995; Argôlo, 2009).

Although this new species may not be considered threatened by official criteria it may be at risk of extinction due to its natural history traits, apparent low abundance, and high fragmentation of its habitat in the Atlantic Forest.

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Appendix. Specimens examined.

Dipsas alternans: BRAZIL: Espírito Santo: Baixo Guandu (IBSP 9280). Minas Gerais: Caratinga (IBSP 306 holotype of Sibynomorphus barbouri). Rio de Janeiro: Getúlio Vargas, Municipality of Volta Redonda (IBSP 8944); Lídice, Rio Claro (IBSP 7664); Petrópolis (IBSP 16699); Parque Nacional da Serra dos Órgãos, Teresópolis (IBSP 10412-13); Teresópolis (IBSP 41056, IBSP 64118-19, MNRJ 703-704); Sítio Sisnelândia, Bairro Teodoro de Oliveira, Municipality of Nova Friburgo (MNRJ 17725-26). São Paulo: Juquitiba (IBSP 64465); Apiaí (IBSP 9301, IBSP 24684); Biritiba Mirim (IBSP 33794); Boraceia (MZUSP 8833); Cananeia (IBSP 72533); Capão Bonito (IBSP 27897, IBSP 32871); Caraguatatuba (IBSP 29359); Eldorado (IBSP 31164); Guapiara (IBSP 34368, IBSP 34373, IBSP 34377); Ilhabela (IBSP 75511, IBSP 75514, IBSP 75995-97); Juquiá (IBSP 42613); Leme (IBSP 8603); Mogi das Cruzes (IBSP 4571, IBSP 4806); Paranapiacaba (MZUSP 1575); Registro (IBSP 41142); Salesópolis (IBSP 44000); Santa Virgínia, Municipality of São Luis do Paraitinga (IBSP 74642); State of São Paulo (IBSP 2733); Sete Barras (IBSP 46534); Tapiraí (IBSP 57120). Paraná: Curitiba (IBSP 4752, IBSP 18051); Antonina (IBSP 24887); Cornélio Procópio (IBSP 9254); Rolândia (IBSP 17766); São João da Graciosa (MZUSP 7339). Santa Catarina: Blumenau (IBSP 5307); Corupá (MZUSP 1574; MZUSP 1576 [holotype of Sibynomorphus garbei], MNRJ 16941, IBSP 6973, IBSP 8173, IBSP 8453, IBSP 8849, IBSP 8997-98, IBSP 9291, IBSP 9689); Jaraguá do Sul (IBSP 5513, IBSP 6787, IBSP 7117, IBSP 7191, IBSP 7460, IBSP 8063, IBSP 8818, IBSP 9446, IBSP 21950-51); Itaiópolis (IBSP 17325); Joinville (IBSP 22823, IBSP 22889, IBSP 34162, IBSP 46542); Mafra (IBSP 8272); São Bento do Sul (IBSP 8602); Serra Alta (IBSP 41269); Rio do Campo (IBSP 49151). Rio Grande do Sul: Caxias do Sul (IBSP 15770); Torres (IBSP 11024).

Dipsas copei: SURINAM: (BMNH 1946.1.21.4 formerly 66.8.14.329, holotype)

Dipsas variegata: BRAZIL: Mato Grosso: Teles Pires River, Municipality of Sinop (IB 56146). Rondônia: Porto Velho: (IB 56146).

Dipsas incerta: BRAZIL: Roraima: Marco da Fronteira Brazil-Venezuela [BV8] (MZUSP 8572).