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# A new species of *Dipsas* (Squamata: Colubridae) from Guyana

Ross D. MacCulloch & Amy Lathrop
Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, Canada; rossm@rom.on.ca; amyl@rom.on.ca

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**Abstract:** A new species of *Dipsas* is described from the Pakaraima Mountains of Guyana. The new species is characterised by 15 dorsal scale rows with the middorsal row slightly enlarged, four pairs of chinshields with the first pair elongate, elongate loreal entering orbit, one preocular, six upper labials, and head narrow anteriorly, increasing in width posteriorly. It could not be determined to which of Peters' (1960) species groups the new species belongs. The new species is known only from 1490 m elevation on Mount Ayanganna, a tepui in the Guiana Shield, where it was found in high-tepui low-canopy habitat, in bromeliads or branches. This is the first record of *Dipsas* as a member of the Guiana Shield high-tepui herpetofauna.

**Key words:** Colubridae, *Dipsas*, new species, Guyana, Pakaraima Mountains, tepuis.

Dipsadine snakes constitute a morphologically unique group of the Neotropical Colubridae. The members of this group exhibit a number of characters specialised for an arboreal malacophagous life such as lateral compression of the body, reduction or loss of the mental groove and inward angling of the maxillary teeth.

The most recent thorough review of the genus *Dipsas* Laurenti 1768 was by Peters (1960), who recognized 32 species, and divided them into seven species groups based primarily on colour pattern. Peters and Orejas-Miranda (1970) revised the genus to 28 species. More recently, a new species of *Dipsas* from Bolivia was described by Reynolds and Foster (1992). Mexican species of *Dipsas* were examined by Kofron (1982), and Costa Rican species were reviewed by Savage (2002).

Of the 29 species of *Dipsas*, most occur in Central America or Andean South America. Five species (*D. catesbyi*, *D. copei*, *D. indica*, *D. pavonina* and *D. variegata*), as well as the dipsadine *Sibon nebulata*, occur in the Guiana region of northeastern South America (Peters 1960, Roze 1966, Peters and Orejas-Miranda 1970, Chippaux 1986, Starace 1998, Kornacker 1999).

Recent collections from Mount Ayanganna, in the Pakaraima mountains of western Guyana, included specimens of a new species of *Dipsas*.

## MATERIALS AND METHODS

Collecting activities were concentrated on the northeast plateau of Mount Ayanganna (05º24' N, 059º57' W), at an elevation of 1490 m. Mount Ayanganna is one of the easternmost tepuis in the highlands of the Guiana Shield. The habitat was described in MacCulloch and Lathrop (2001, 2002). Specimens were euthanized by injection with sodium pentobarbitol, and then fixed in formalin, while tissue (liver) was removed and preserved in 95% ethanol. Specimens were compared with published

descriptions or museum specimens (Appendix). Descriptions follow the format used by Peters (1960) to facilitate intrageneric comparisons. Scale reductions are expressed using the method devised by Dowling (1951), as modified by Peters (1960). Hemipenes are described using terminology established by Dowling and Savage (1960). Dentition was determined from x-rays of specimens.

All specimens of the species described herein are in the collections of the Royal Ontario Museum (ROM).

## DESCRIPTION

### *Dipsas pakaraima* sp. nov.

(Figs. 1, 2, 3)

**Holotype:** ROM 41233, adult male collected on the northeast plateau of Mount Ayanganna, Guyana, 05º24'N, 059º57'W, elevation 1490 m, 31 October 2000, by Roland Edward.

**Paratypes:** ROM 41234–6, three adult males and ROM 41237, a female, collected in the vicinity of the type-locality, 26–31 October 2000, by Amy Lathrop, Carter Cox and Ross MacCulloch.

**Diagnosis:** A member of the genus *Dipsas* characterised by 15 dorsal scale rows, the middorsal row slightly enlarged; four pairs of chinshields, the first pair elongate; elongate loreal entering orbit; one preocular; six upper labials, with only one elongate upper labial posterior to those that enter the orbit; head narrow anteriorly, increasing in width posteriorly; eye visible from below.

The new species can be referred to *Dipsas* because it possesses the following suite of characters: head distinct from neck; mental groove absent; tertiary temporals present; four pairs chinshields; posterior chinshields separated from lower labials by other scales; maxillary teeth angled inwards; pterygoids parallel, not diverging posteriorly; occurring in northern South America (Peters 1960).

*Dipsas pakaraima* can be distinguished from *D. catesbyi* by its 15 dorsal scale rows (13 in *D. catesbyi*), six upper labials (8-9), loreal entering orbit (not); from *D. copei* by four pairs of chinshields (three in *D. copei*), six upper labials (10-11), loreal entering orbit (not); from *D. indica* and *D. pavonina* by 15 scale rows (13 in *D. indica* and *D. pavonina*), six upper labials (9-11), four pairs of chinshields (three); from *D. variegata* by one preocular (none in *D. variegata*), six upper labials (7-10), four pairs of chinshields (two or three). No other described species of *Dipsas* occurs in the Guiana region.

**Description of holotype:** Rostral as broad as long, visible from above; internasals wider than long, much smaller than prefrontals; prefrontals pentagonal, as wide as long; frontal bell-shaped, 1.3 times as long as wide; supraoculars 1; parietals 1.4 times as long as wide; occipital region with three transverse rows of scales (Fig. 1, top).

Nasal partially divided dorsally; loreal elongate, in contact with nasal, prefrontal, preocular, 2nd, 3rd and 4th labials, enters orbit; preocular 1, narrowly in contact with frontal; suboculars absent; postoculars 1; primary temporal 1, enters orbit; secondary temporals 2; tertiary temporals 2; upper labials 6, 4th and 5th entering orbit, 6th longest. Pupil vertical (Fig. 1, centre).

Lower labials 8, first pair in contact behind mental, 4 pairs in contact with first pair of chinshields; 4 pairs of chinshields, the first elongate, crescent-shaped, the second in contact with 4th and 5th labials, the third and fourth separated from labials. Ventral headscales with pores scattered across the surface of the scales. Mental groove absent (Fig. 1, bottom).

Head narrow anteriorly, widest at temporal region, maximum width 55% of length. Maxillary teeth 17; palatine teeth 9; pterygoid teeth 7. Snout-vent length 435 mm, tail 190 mm.

Ventrals 191; anal entire; subcaudals 117. Dorsal scale rows 15, vertebral scale row slightly enlarged, 1.1 times the width of the paravertebral scales at midbody, vertebral scales blunt-tipped. Scales without apical pits.

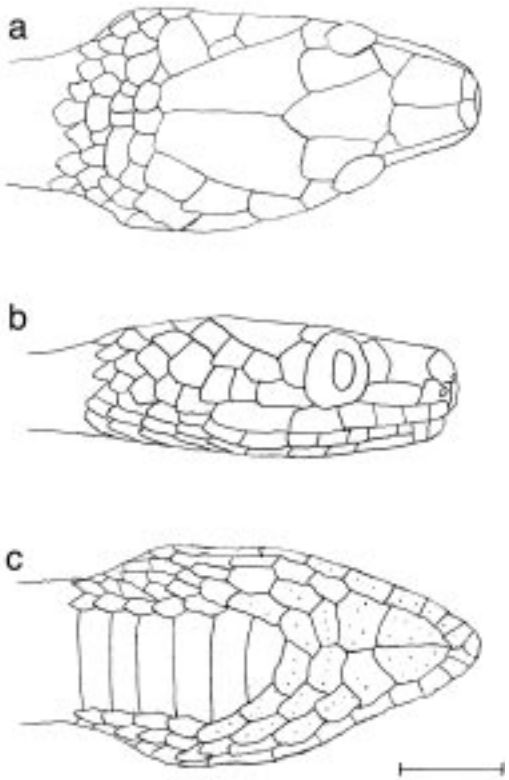


Fig. 1. Head of *Dipsas pakaraima* holotype: top, dorsal view; centre, lateral view; bottom, ventral view. Scale bar = 5 mm.

Dorsal scale reduction formula **17** 3+4 (6) **15** –8 (189) **14** 7+7 (191) **13**. Caudo-dorsal scale reduction formula **6** 1+2 (12) **4** 1+2 (76) **2** (117).

**Hemipenial Morphology:** The hemipenis is single, slightly wider at apex, capitate. The everted organ is five subcaudals or 8 mm in length. The demarcation of the capitate region is evident on both the sulcate and asulcate sides, at about the level of the third subcaudal. The capitate region is covered in spines which decrease slightly in size distally. On the sulcate side, the midsection has spinose longitudinal plicae, the spines increasing in size distally. The capitate region has a patch of large spines medially with smaller spines laterally and distally. Asulcate midsection with spinose plicae laterally and basally; capitate region with larger spines medially, decreasing in size distally. Basal section plicate, naked but for a few small spinules. The sulcus spermaticus bifurcates near the apex. The intrasulcar surface is smooth. Hemipenes and adjacent tissue are white. (Fig. 2).

**Colour in life:** Dorsolateral ground colour light brown anteriorly, darkening posteriorly. A series of 22 pairs of medium brown dorsolateral blotches, outlined in black, between neck and vent. Anteriorly the blotches are each about five scales long middorsally, lengthening to 8–9 scales dorsolaterally, then tapering to five scales on the first dorsal scale row. Posteriorly the blotches become shorter. Anteriorly the blotches are separated by one or two lateral scales; toward midbody this separation diminishes, and the black borders of adjacent blotches are in contact. In the five posteriormost blotches the black borders are reduced laterally, present only middorsally and on the ventrals. This results in a continuous uniform medium brown lateral colouration.

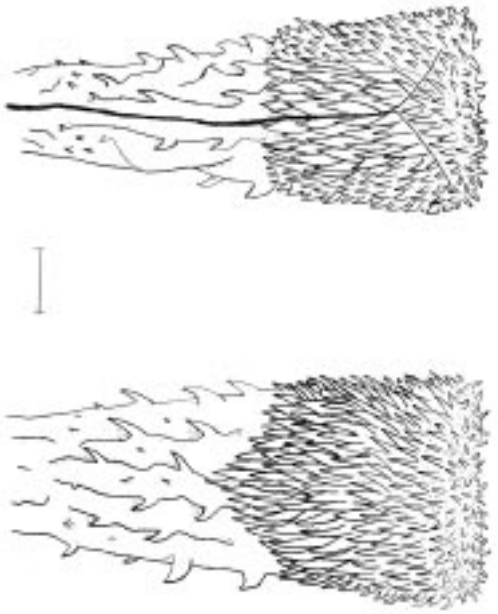

Fig. 2. Hemipenis of *Dipsas pakaraima* holotype, left organ. Sulcate side (top) and asulcate side (bottom). Scale bar = 1 mm.

Many pairs of blotches are not exactly opposite or symmetrical but rather alternating, creating a pattern of staggered blotches along the back. This asymmetry is caused by a blotch being a different length from its corresponding opposite blotch. In the holotype the blotch pairs change from opposite to alternating to opposite twice along the length of the body (Fig. 3).

Within the dorsal blotches the scales appear to have dark tips, the result of overlapping the next posterior scale. However, the lighter-coloured scales outside the blotches do not appear dark-tipped where they overlap the next scale. Between the blotches the light brown background creates a middorsal pattern of diamond shapes (or half-diamond where the blotches are not symmetrical); these diamonds contain small dark brown spots. The dorsal background colour becomes progressively darker posteriorly, converging with the blotch colour.

Ventral background colour pale brown, the dorsolateral blotches extending to the mid-ventral point, each covering two or three ventrals. Ventrals otherwise immaculate anteriorly, posteriorly with small black patches consisting of several juxtaposed or narrowly separated squarish to half-moon-shaped marks. The ventral dark markings become more intense posteriorly (Fig. 3).

Tail with a narrow cream middorsal stripe flanked by narrow black stripes. Background colour is dark brown laterally and ventrally, with a few small cream-and-black lateral blotches proximally.

Head dark brown dorsally and laterally. Lower labials with a narrow white band at lip. Chin medium brown with light brown mottling increasing posteriorly. In preservative the colour has changed only slightly.

**Variation:** The male paratypes vary in SVL from 381–557 mm and in tail length from 158–237 mm. The single female has a SVL of 375 mm and tail length of 157 mm.

There is considerable variation in scale counts, as is often encountered in *Dipsas* (Peters 1956, 1960). Among the males ventrals range from 178–193, subcaudals 103–117. The longest male has the fewest subcaudals and the second-fewest ventrals, while the shortest male has the most ventrals. The female has 175 ventrals and 98 subcaudals. There was no correlation between SVL and number of ventrals, subcaudals, blotches or maxillary teeth among the males (Table 1).

Other than the holotype, only one male (ROM 41234) has scale row reduction anterior to the anus. This specimen has 178 ventrals and a reduction formula of **15** –8 (175) **14** 7+7 (177) **13**. In two males and the female, the neck reduction involves rows four and five instead of rows three and four. Among the males the caudo-dorsal scale reduction formula is **6** 1+2 (12–18) **4** 1+2 (54–82) **2** (103–117). Caudo-dorsal scale row reduction is 1+2 in all males, but is 2+3 in the female, and occurs closer to the vent. The female's caudo-dorsal scale reduction formula is **6** 2+3 (7) **4** 1+2 (60) **2** 98.

The smallest male has two postoculars, so the primary temporal does not enter the orbit. This male also has the most temporals, 3+3+3. The female has fused temporals on both sides, creating a temporal formula of (left/right) 1+1+3/1+1+2. The female has only three pairs of chinshields and lacks pores on the ventral

TABLE 1
*Meristic Counts of* Dipsas pakaraima

| Catalogue Number | Sex | SVL (mm) | TL (mm) | Ventrals | Subcaudals | Dorsal Blotches | Maxillary Teeth |
|---|---|---|---|---|---|---|---|
| 41233 | M | 435 | 190 | 191 | 117 | 22 | 17 |
| 41234 | M | 465 | 216 | 178 | 106 | 32 | 16 |
| 41235 | M | 381 | 158 | 193 | 111 | 31 | 20 |
| 41236 | M | 557 | 237 | 190 | 103 | 27 | 17 |
| 41237 | F | 375 | 157 | 175 | 98 | 27 | 15 |

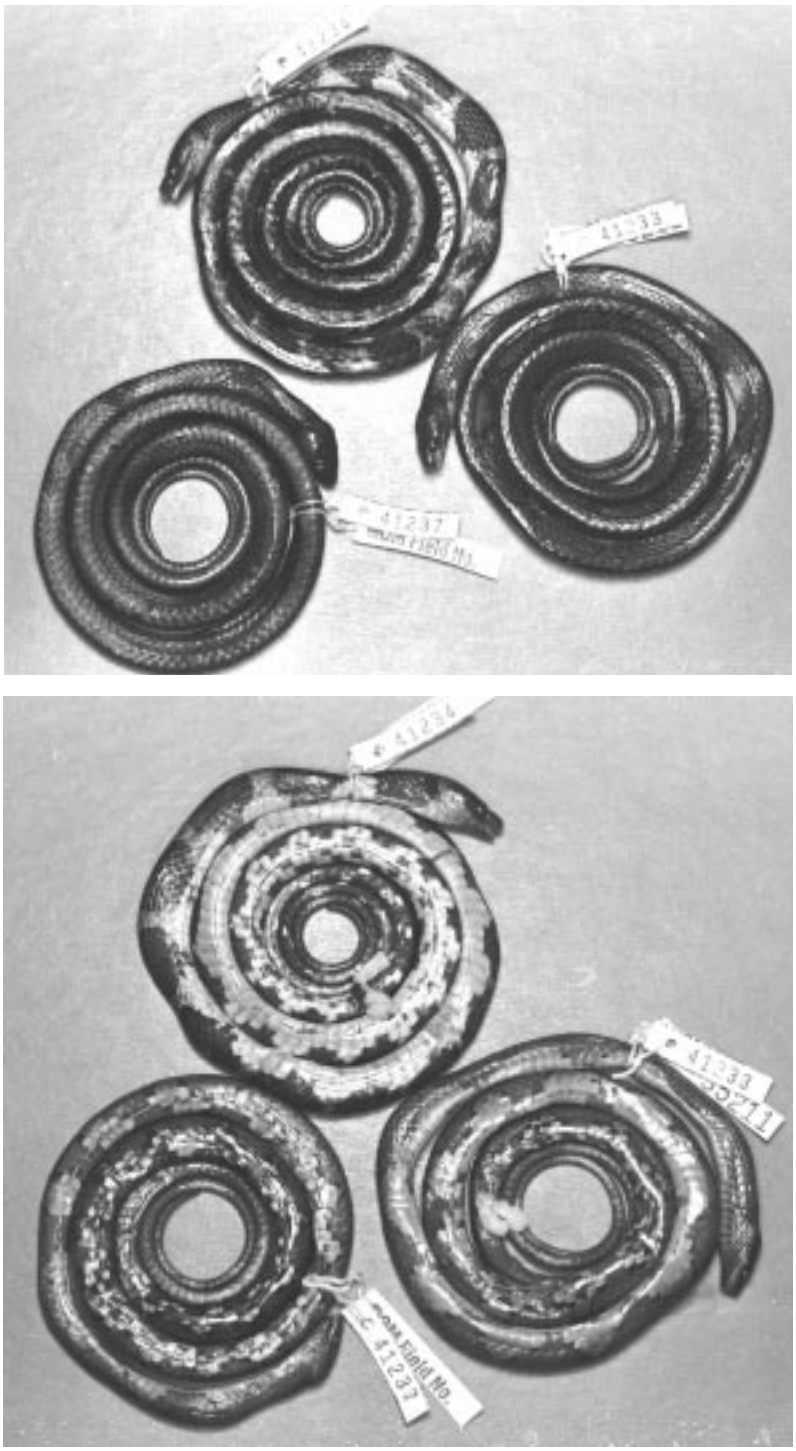

Fig. 3. Colour pattern variation in *Dipsas pakaraima*. Dorsal view (above) and ventral view (below). Top: ROM 41234, male, 465 mm SVL; lower left: ROM 41237, female, 375 mm SVL; lower right: holotype, male, 435 mm SVL.

head scales. One male has a few divided ventral scales, of types 1 and 6 of Peters (1960).

Maxillary teeth are 16–20 in males, 15 in the female (Table 1). Palatine teeth are 7–8 in males, five in the female. Pterygoid teeth are 7–9 in males, six in the female.

**Colour variation:** The dorsal background colour varies from light brown to cream, and the blotches range from medium brown to very dark brown (Fig. 3). In most paratypes the majority of the dorsal blotches are symmetrically paired, but all exhibit a pattern of alternating blotches or asymmetry at some point along the body. Asymmetry is caused by a blotch being a different length from its corresponding opposite blotch. In some individuals the blotches change from symmetrical pairing to asymmetrical (alternating) and back again, along the length of the body, sometimes more than once. In all paratypes the blotches become progressively shorter posteriorly, from 6–7 to 4–5 scales in length. In all individuals the dorsal and ventral background colour becomes progressively darker posteriorly, and the tail pattern is much less obvious than the body pattern. Peters (1960) found that older individuals exhibited less colour contrast, but there was no correlation between size and colour contrast among the four males of *D. pakaraima*.

In the female the blotches are apparent ventrally and laterally, but much less apparent on the upper part of the body, so that the middorsal colouration appears uniformly medium brown (Fig. 3). This specimen has 27 body blotches; its tail has only a few midventral traces of blotches proximally, and is otherwise immaculate medium brown.

**Etymology:** The specific epithet refers to the Pakaraima Mountains of western Guyana, where the type locality is located. It is used as a noun in apposition.

**Distribution:** *Dipsas pakaraima* is known only from the type locality, Mount Ayanganna, Guyana.

**Natural History:** All specimens were collected on the northeast plateau of Mount Ayanganna (05º24' N, 059º57' W), in the Pakaraima Range of western Guyana. Mount Ayanganna is one of the easternmost tepuis in the Guiana Shield. The specimens were collected at 1490 m, in wet, low, evergreen high-tepui forest. The vegetation was described by Fanshawe (1952), Maguire (1970), and Huber *et al.* (1995), and a checklist is available at www.mnh.si.edu/biodiversity/bdg/. All specimens were collected at night, and all were in large terrestrial bromeliads (*Brocchinia*) or on low branches (0.5–2 m height). Stomachs contained no identifiable remains of prey. All individuals have some abdominal fat deposits. The female's ovaries have no enlarged follicles.

Single individuals of two other colubrid species, *Dipsas variegata* and *Liophis miliaris*, were also collected on the plateau.

## DISCUSSION

**Relationships:** Peters (1960) separated *Dipsas* into seven species groups based primarily on colour pattern, although some squamation characters were also used. The *catesbyi* group has 13 scale rows, the loreal seldom enters the orbit and in some species the head narrows anteriorly. The *oreas* group has 15 scale rows, and some have four chinshields. Some members of the *pratti* group (eg. *D. latifrontalis*) have four chinshields. The *variegata* group has 15 scale rows, 3 pairs of chinshields, and no loreal. The *indica* group has three pairs of chinshields, 13 scale rows, one preocular plus loreal entering orbit, and no teeth on the pterygoid.

*Dipsas pakaraima* cannot be assigned to any existing species group because it does not match the characters of any one group. It resembles the *catesbyi* group in colour pattern, but has three squamation characters in common with *D. elegans* (*oreas* group); long loreal, first pair of chinshields slightly elongate, temporals 2+2/3+3. Some characters of Guiana Shield species of *Dipsas* are summarised in Table 2.

**Zoogeography:** Although some of the Andean species of *Dipsas* occur at high elevations, there have been no previous reports of

TABLE 2
*Comparative Characters of* Dipsas *occurring in the Guiana Shield region*

| Species | *D. pakaraima* | *D. catesbyi* | *D. copei* | *D. indica* | *D. pavonina* | *D. variegata* |
|---|---|---|---|---|---|---|
| Scale Rows | 15 | 13 | 15 | 13 | 13 | 15 |
| Chinshields | 4 | 4 | 3 | 3 | 3 | 2–3 |
| Preoculars | 1 | 1 | 1 | 1 | 1 | 0 |
| Loreal enters orbit | yes | no | no | yes | yes | yes |

*Dipsas* from the Guiana Shield tepuis (Roze 1958a, b, 1966, Donnelly and Myers 1991, Myers 1997, Myers and Donnelly 1996, 1997, 2001, Gorzula and Señaris 1999). In addition to *Dipsas pakaraima*, one *D. variegata*, a female, was also collected at 1490 m on Mt. Ayanganna. The highest reported elevations for the latter species have been 300 m (Gorzula and Señaris 1999) and 500 m (Roze 1966), in Venezuela. The only other snake collected on Mt. Ayanganna at 1490 m was a male *Liophis miliaris*. Several other snakes (*Chironius fuscus*, *Oxyrhopus trigeminus*, *Bothrops atrox*) were encountered at the base of the mountain, at 800–850 m elevation.

*Dipsas* is not a common tepui colubrid genus, unlike *Thamnodynastes*, which has been found on several Venezuelan tepuis (Gorzula and Ayarzagüena 1996, Myers and Donnelly 1996, 1997, 2001, Gorzula and Señaris 1999). The presence of *D. pakaraima* on Ayanganna, but not on other tepuis, does not support the pantepui theory of Guiana Shield zoogeography. Rather, it appears that the ancestor of *D. pakaraima* invaded Ayanganna from the surrounding lowland, and its presence supports the "lowland invader" hypothesis of tepui faunas. This is further supported by the sympatric presence of the lowland species *D. variegata* and *Liophis miliaris.* Myers (1997) and Myers and Donnelly (2001) found little overlap between the fauna of neighbouring Guiana tepuis; these findings, combined with the results of this paper, indicate that opportunistic colonization of the region's highlands by lowland taxa is commonplace, and that tepui herpetofaunas are composed of the descendants of both pantepui and lowland ancestors.

## ACKNOWLEDGMENTS

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## RESUMEN

Se describe una nueva especie del género *Dipsas* de las montañas Pakaraima de Guyana. Esta se caracteriza por presentar 15 hileras de escamas dorsales con las escamas de la hilera vertebral ligeramente agrandadas, cuatro pares de escudos geneiales con el primer par elongado, loreal elongado y en contacto con la órbita, una escama preocular, seis labiales superiores y la cabeza angosta en la partie anterior y más ancha posteriormente. No se determino su ubicación de acuerdo a los grupos de especies de Peters (1960). La nueva especie solo es conocida a 1490 m.s.n.m. en el monte Ayanganna, un tepuy del Escudo Guayanés, en bosque de baja altura, dentro de bromelias o sobre ramas. Es el primer informe del género *Dipsas* como miembro de la fauna altotepuyana del Escudo Guayanés.

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## APPENDIX

### Specimens examined

| | |
|---|---|
| *Dipsas albifrons* (1). | BRAZIL, *Sao Paolo*, Presidente Penna, USNM 79356 |
| *Dipsas catesbyi* (2). | GUYANA, Bartica, USNM 200509-10 |
| *Dipsas copei* (1). | GUYANA, Paramakatoi, ROM 28371 |
| *Dipsas elegans* (2). | ECUADOR, *Pichincha*, Pacto, USNM 210937; Nanegal, USNM 210936 |
| *Dipsas gracilis* (2). | ECUADOR, *Esmereldas*, Santo Domingo, USNM 210945; *Guayas*, Guayaquil, USNM 210947 |
| *Dipsas indica* (3). | PERU, *Amazonas*, Tseasim, USNM 316598; Huampami, USNM 316597; BRAZIL, *Rio de Janeiro*, Teresopolis, USNM 208671 |
| *Dipsas latifrontalis* (2). | ECUADOR, *Napo*, Borja, USNM 210957, 210959 |
| *Dipsas oreas* (1). | ECUADOR, *Guayas*, Guayaquil, USNM 62799 |
| *Dipsas pavonina* (2). | ECUADOR, *Napo*, Loreto, USNM 210967-8 |
| *Dipsas peruana* (2). | PERU, *Puno*, Ollachea, USNM 299232-3 |
| *Dipsas variegata* (2). | GUYANA, Baramita, USNM 535807; Mount Ayanganna, ROM 39440 |
| *Dipsas vermiculata* (1). | PERU, *Amazonas*, Huampami, USNM 316600 |
| *Sibon dimidiata* (3). | HONDURAS, *Copan*, Quebrada Grande, ROM 19987-9 |
| *Sibon nebulata* (5). | TRINIDAD AND TOBAGO, *St. George*, Blanchisseuse, ROM 17085; BELIZE, *Orange Walk*, Lamanai, ROM 12789; GUYANA, Paramakatoi, ROM 28373; Mabaruma, USNM 164202; McKenzie, USNM 84524 |
| *Sibynomorphus turgidus* (2). | ARGENTINA, *La Rioja*, Patquia, USNM 73488, 73492 |
| *Sibynomorphus ventrimaculatus* (1). | PARAGUAY, *Itapua*, El Tirol, USNM 253571 |