

## A New Species of *Riama* from Ecuador Previously Referred to as *Riama hyposticta* (Boulenger, 1902) (Squamata: Gymnophthalmidae)

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### ABSTRACT

We describe *Riama crypta*, new species, from the western slopes of the Cordillera Occidental, Ecuador. This taxon was formerly referred to as *Riama hyposticta*, a rare species described on the basis of an adult male from northern Ecuador and here recorded from southwestern Colombia. The new species differs principally from *Riama hyposticta* by an incomplete superciliary series, formed just by the anteriormost superciliary scale (superciliary series complete in *R. hyposticta*, formed by five or six scales), no nasoloreal suture [= loreal absent] (complete [= loreal present] in *R. hyposticta*), distinct dorsolateral stripes at least anteriorly (scattered brown spots dorsally without dorsolateral stripes in *R. hyposticta*), and ventral coloration composed of small cream or brown spots or longitudinal stripes (dark brown with conspicuous transverse white bars and spots). Additionally, we document the presence of distal filiform appendages on the hemipenial lobes of both species.

### INTRODUCTION

Although the diversity of *Riama* in Ecuador has been reviewed (Kizirian and Coloma, 1991; Kizirian, 1995, 1996; also see Reyes-Puig et al., 2008), some taxonomic uncertainties

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remain to be resolved. One of these problems is the taxonomic status of a series of specimens collected at or near Pilaló, province of Cotopaxi, referred to as *Riama hyposticta* in the literature (e.g., Hillis, 1985; Kizirian and Coloma, 1991; Kizirian, 1995, 1996; Doan, 2003; Doan and Castoe, 2005). Boulenger (1902) described *Proctoporus hypostictus* based on a single adult male from [Hacienda] Paramba [Imbabura], Ecuador, near the border with Colombia. Later, Kizirian (1996) redescribed the species based on the holotype and 39 additional specimens, most of which were from Pilaló. Kizirian noted several differences between the holotype and the specimens that he tentatively allocated in this taxon and cautioned that multiple species may have been confounded under the same name, but he concluded that additional key specimens were required to allow more than one species to be recognized.

Recently, we discovered a new specimen of *Riama hyposticta* deposited in the Museo de Historia Natural of the Universidad de Nariño that was collected in extreme southwestern Colombia near the type locality. This new specimen is virtually identical to the holotype, which supports Kizirian's (1996) hypothesis and enables us to propose an emended diagnosis for *Riama hyposticta* and formally name and describe the specimens from Pilaló and adjacent areas as a new species.

#### MATERIALS AND METHODS

We made measurements with dial calipers read to the closest 0.1 mm. If sex could not be determined based on the presence of everted hemipenes, it was determined by subcaudal incision. Hemipenis preparation follows Myers and Cadle (2003) and Zaher and Prudente (2003). The calcified structures of the hemipenis of KU 135104 were stained in alcoholic solution of alizarin red, in an adaptation of the procedures described by Uzzell (1973) and Harvey and Embert (2008). Terminology for the everted hemipenis follows Kizirian (1996). To facilitate comparisons with other species of *Riama* the characters and the head-scale nomenclature are those of Kizirian (1996). When scale counts are given for both sides, they are indicated thus: 00/00 (left and right, respectively). For comparative purpose, we examined specimens from all the species known from Ecuador and eight taxa from other countries where *Riama* are known (see appendix). Data for *R. inanis*, *R. laudahnae*, and *R. rhodogaster* were obtained from the literature (Doan and Schargel, 2003; Köhler and Lehr, 2004; and Rivas et al., 2005). We adopt Kluge's (1990) definition of the species category as the class whose members are the smallest historical individuals within which there is a parental pattern of ancestry and descent. The following abbreviation pertains to measurement made on each specimen: SVL = snout-vent length.

Specimens examined are in the following collections (listed alphabetically by institutional abbreviation): AMNH (American Museum of Natural History, New York), BMNH (The Natural History Museum, London, U.K.), CAS (California Academy of Sciences, San Francisco, California), FMNH (Field Museum, Chicago, Illinois), IAvH (Instituto de Investigación de los Recursos Biológicos Alexander von Humboldt, Villa de Leiva, Colombia), ICN (Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia), KU (University of Kansas, Museum of Natural History, Lawrence), MCZ (Museum of Comparative Zoology, Harvard University,

Cambridge, Massachusetts), MVZ (University of California, Museum of Vertebrate Zoology, Berkeley), MHNG (Muséum d'Histoire Naturelle, Geneva, Switzerland), MHNUC (Museo de Historia Natural, Universidad de Caldas, Manizales, Colombia), MUJ (Museo de Historia Natural Lorenzo Uribe, Pontificia Universidad Javierana, Bogotá, Colombia), NRM (Naturhistoriska Rijk-museet, Stockholm, Sweden [Swedish Museum of Natural History]), PSO-CZ (Museo de Historia Natural de la Universidad de Nariño, Pasto, Colombia), QCAZ (Museo de Zoología, Pontifica Universidad Católica del Ecuador, Quito, Ecuador), UMMZ (University of Michigan, Ann Arbor); USNM (National Museum of Natural History, Washington, D.C.), and UV-C (Museo de Vertebrados, Universidad del Valle, Cali, Colombia).

## SYSTEMATICS

### *Riama hyposticta* (Boulenger, 1902)

Figures 1–3, 7

*Proctoporus hypostictus* Boulenger, 1902: 55–56. Original description. Holotype, male

(BMNH 1946.8.31.31) from Paramba [Imbabura], Ecuador; Kizirian and Coloma, 1991: 428 [part (for holotype)]; Kizirian, 1995: 72 [part (for holotype)]; Kizirian, 1996: 108 [part (for holotype)].

*Riama hyposticta* (Boulenger, 1902): Doan and Castoe, 2005: 409 [first use of combination].



FIGURE 1. *Riama hyposticta*. Dorsal and ventral views of holotype (BMNH 1946.8.31.31 [SVL: 82 mm]). Photos courtesy: Colin McCarthy.

HOLOTYPE: BMNH 1946.8.31.31 (fig. 1) from [Hacienda] Paramba [Imbabura], Ecuador. The holotype was redescribed and illustrated by Kizirian (1996).

REFERRED MATERIAL: PSO-CZ 085 (field number BFD 316) (fig. 2), an adult male collected on April 2006 by Belisario Cepeda, Felipe Benavides, and Diana Burbano at Reserva Natural Rio Ñambi, vereda El Barro, corregimiento Altaquer, municipio de Barbacoas, departamento de Nariño, Colombia. PSO-CZ 085 represents the second specimen known of the species and the first record from Colombia.

MORPHOLOGY OF THE NEW SPECIMEN: SVL: 82.0 mm. Relevant scale counts and traits for PSO-CZ 85 are: nasoloreal suture complete; supraoculars four, none in contact with ciliaries; superciliaries five, series complete; postoculars three; postparietals two; supratympanic temporals three; genials three; dorsal scales on body with a faint central rounded keel, smooth on the neck; longitudinal dorsal scale rows 16; transverse dorsal scale rows 32; transverse ventral scale rows 20; lateral scale rows six; femoral pores six per hind limb; scales between femoral pores two.

The specimen PSO-CZ 85 is in general agreement with Kizirian's (1996) redescription of the holotype, except that the number of superciliary scales is one less, the number of transverse dorsal scale rows and transverse ventral scale rows are one more, and the number of longitudinal dorsal scale rows is two more than the holotype.

DIAGNOSIS: *Riama hyposticta* can be distinguished from *R. crypta* by the following (condition for *R. crypta* in parentheses): frontonasal equal to or slightly longer than frontal (shorter than frontal); nasoloreal suture complete [= loreal present] (usually absent [= loreal absent], exceptionally complete); superciliary series complete, composed of five or six scales (incomplete, one); dorsally with scattered brown spots (distinct dorsolateral stripe present at least anteriorly) and ventrally dark brown with conspicuous transverse white bars and spots [yellow in life] (small cream or brown spots or longitudinal narrow lines); maximum SVL in males 82 mm (69 mm).

*Riama hyposticta* can be distinguished from Colombian congeners, except *R. columbiana*, by



FIGURE 2. *Riama hyposticta*. Ventral and lateral views of PSO-CZ 85 in life [SVL: 82 mm]. Photos courtesy: Cristian Florez and Belisario Cepeda.

the texture of the dorsal scales (keeled vs. strongly striated in *R. striata*, rugose in *R. stellae*, smooth in *R. laevis* and *R. afrania*, and smooth, at least anteriorly, in *R. simotera*). From *Riama columbiana*, *R. hyposticta* can be distinguished by the number of transverse dorsal scale rows (31–32 vs. 41–49 in *R. columbiana*). Additionally, it can be distinguished by the following (condition for *Riama hyposticta* in parentheses): *R. striata* has 33–39 (31–32) transverse dorsal scale rows in males and the nasoloreal suture usually absent (complete [= loreal present]); *R. laevis* has 11 (16–18) longitudinal dorsal scale rows and two (three) genials; *R. afrania* has 38–42 (31–32) transverse dorsal scale rows, 21–23 (19–20) transverse ventral scale rows and 7–9 (six) femoral pores per hind limb in males; *R. stellae* has 21–23 (19–20) transverse ventral scale rows, 7–8 (six) femoral pores per hind limb in males, and 3–4 (six) lateral scale rows. *Riama simotera* occurs on the Colombian-Ecuadorian border. *Riama simotera* has one or two (six) lateral scale rows and one or two (three) genials.

Similarly, *Riama hyposticta* can be distinguished from congeners occurring in Ecuador and Peru by meristic characters (condition for *Riama hyposticta* in parentheses). *Riama anatoloros* has 4–12 (two) scales between femoral pores; *R. cashcaensis* has 3–6 (two) scales between femoral pores in males, the nasoloreal suture absent [= loreal absent] (complete [= loreal present]) and the superciliary series incomplete, usually one scale (complete, 5–6); *R. colomaroni*, *R. meleagris*, and *R. stigmatoral* have the superciliary series incomplete (complete); in *R. labionis* the supralabial-subocular fusion is present (absent); *R. orcesi*, *R. raneyi*, *R. unicolor* and *R. vespertina* have usually three (four) supraoculars; in *R. balneator* and *R. petrorum*, the nasoloreal suture is absent [= loreal absent] (complete [= loreal present]); *R. vieta* has rugose (keeled) dorsal scales; *R. oculata* has 34–36 (31–32) transverse dorsal scale rows in males and 7–11 (six) lateral scale rows. Additionally, *Riama hyposticta* can be distinguished from congeners occurring in Venezuela and the island of Trinidad by the following: in *Riama rhodogaster* the differentiated lateral scale rows is absent (present), and the scales between femoral pores in males are absent (two); *R. inanis* has 11–12 (six) femoral pores per hind limb in males; *R. achlyens* has 37–40 (31–32) transverse dorsal scale rows; *R. shrevei* has zero (two) scales between medialmost femoral pores; *R. luctuosa* has 9–14 (six) femoral pores per hind limb.

DESCRIPTION: *Riama hyposticta* possesses the following characteristics: (1) Maximum SVL in males 82 mm ( $n = 2$ ), females unknown; (2) frontonasal equal to or slightly longer than frontal; (3) prefrontal scales absent; (4) nasoloreal suture complete [= loreal present]; (5) supraoculars four, none in contact with ciliaries; (6) superciliary series complete, 5–6; (7) supralabial-subocular fusion absent; (8) postoculars three; (9) postparietals two; (10) supratympanic temporals three; (11) genials three; (12) dorsal scales rectangular, juxtaposed, with a low, weak, rounded and central keel; (13) nuchal scales smooth; (14) longitudinal dorsal scale rows 16–18; (15) transverse dorsal scale rows 31–32; (16) ventral scales smooth, in 19–20 transverse scale rows; (17) lateral scale rows six; (18) femoral pores per hind limb six, located proximally (scales between medialmost femoral pores two); (19) subdigital scales on toe I 7–8; (20) anterior cloacal plate scales two and posterior five; (21) dorsum brown with dark brown to black spots (approximately equal in size to 1–3 dorsal scales); ventral surfaces of head and body dark

brown with conspicuous transverse white bars and spots (yellow in life) mostly on scales sutures; (22) hemipenis tapering proximally, with elongate protuberances distally.

**HEMIPENIAL MORPHOLOGY:** In order to supplement the brief description of the holotype's hemipenis that Kizirian (1996) provided, we describe the hemipenial morphology of *Riama hyposticta* based on PSO-CZ 085 (fig. 3).

Left organ detached and completely everted, with 11 mm total length and 6 mm across its widest point. Hemipenis tapers proximally; centrally expanded, with two rounded and symmetrical lobes. Body of the hemipenis with two columns of spinulate flounces chevronlike (15 per side). These columns do not cover the asulcate side medially because an expansion pleat separates the flounces on the asulcate side. Proximal region of the asulcate side with two medial

isolated columns of small spinulate flounces (three per side). Sulcus spermaticus single, straight, bordered by a narrow naked expansion pleat and divided before reaching lobes' base by a middle bulbous structure. The branches of the sulcus spermaticus are slightly displaced with respect to the sulcate (or ventral) faces of the lobes and end on the lobular apices, just proximal to the distal appendages. Lateral edges of the sulcus spermaticus in the basal region naked. Asulcate side of lobes without ornamentation, smooth. Sulcate side of lobes with thin, elongate soft-tissue papilla distally.

**DISTRIBUTION:** *Riama hyposticta* occurs in extreme northern Ecuador near the border with Colombia and on the Pacific versant of the Andes in extreme southwestern Colombia (fig. 7). More information about the type locality can be found in Kizirian (1996: 112).

### *Riama crypta*, new species

Figures 4–7

*Proctoporus hypostictus* Boulenger, 1902: Hillis, 1985: 109–126 [for KU 196386–88 from Pilaló, Cotopaxi, Ecuador]; Kizirian and Coloma, 1991: 428 [part (for 33 specimens from Pilaló, Cotopaxi, Ecuador)]; Kizirian, 1995:72 [part (for 36 specimens from near or at Pilaló, Cotopaxi, Ecuador)]; Kizirian, 1996: 108 [part (for 38 specimens from near or at Pilaló, Cotopaxi, Ecuador)]; Doan, 2003: 372 [for 12 specimens from Pilaló, Cotopaxi, Ecuador].

*Riama hyposticta* (Boulenger, 1902): Doan and Castoe, 2005: 409 [for 12 specimens from



FIGURE 3. Hemipenis of *Riama hyposticta* (PSO-CZ 85): **A**, asulcate and **B**, sulcate sides. Total length: 11 mm. Photos courtesy: Juan Camilo Arredondo.

Pilaló, Cotopaxi, Ecuador].

**HOLOTYPE:** KU 135103 (Original number “FIELD SERIES THF 003055”; figs. 4 and 5) from Pilaló, Cotopaxi, Ecuador, 2320–2700 m; collected by Thomas H. Fritts on July 3, 1970.

**PARATYPES:** KU 121153–54, 135100–02, 135104–115, 179455–65 and 196386–89, a series collected at Pilaló, Cotopaxi, Ecuador, 2320–2700 m; USNM 229638–39, a series collected at 3 km W Pilaló on Quevedo-Latacunga road, Cotopaxi, Ecuador.

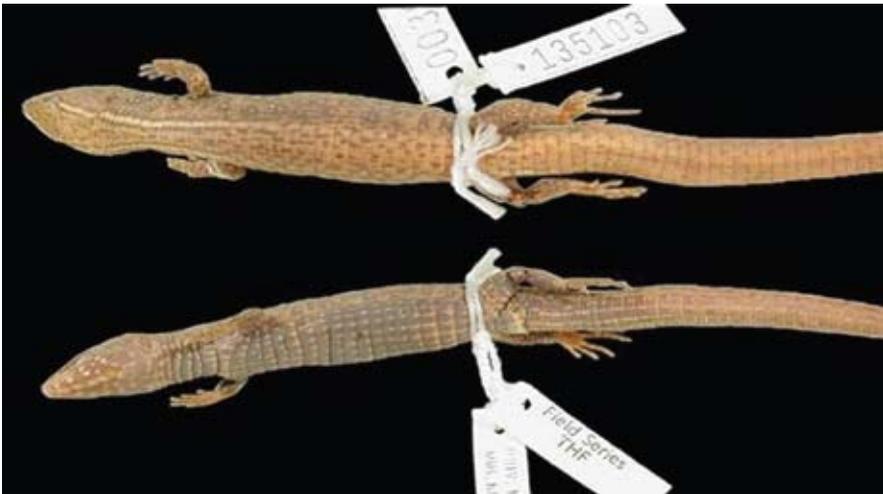


FIGURE 4. *Riama crypta*, new species. Dorsal and ventral views of holotype (KU 135103 [SVL: 60 mm]).

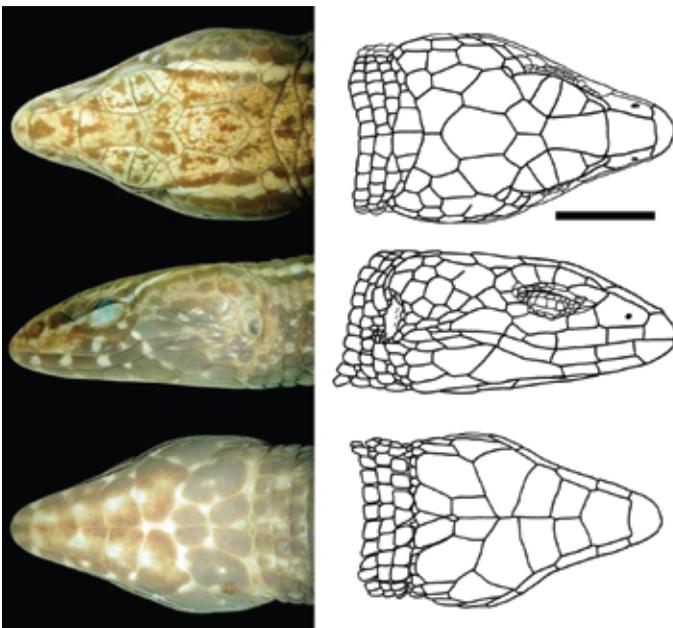


FIGURE 5. *Riama crypta*, new species. Dorsal, lateral, and ventral views of head of holotype (KU 135103 [SVL: 60 mm]).

REFERRED SPECIMENS: MHNG 2361.54, collected at Las Pampas, Cotopaxi, Ecuador; MHNG 2361.78–79, collected at Tandapi, Pichincha, Ecuador.

ETYMOLOGY: The specific epithet *crypta* is used as an indeclinable word and refers to the fact that this species was long confused with another one.

DIAGNOSIS: *Riama crypta* can be distinguished from *R. hyposticta* by the following (condition for *R. hyposticta* in parentheses): frontonasal shorter than frontal (equal to or slightly longer than frontal); nasoloreal suture usually absent [= loreal absent], exceptionally complete (complete [= loreal present]); superciliary series incomplete, formed by just the anteriormost scale (complete, five or six scales); distinct dorsolateral stripe present at least anteriorly (dorsally with scattered brown spots) and ventral coloration composed of small cream or brown spots or longitudinal narrow stripes (dark brown with conspicuous transverse white bars and spots [yellow in life]); maximum SVL in males 69 mm (82 mm).

In addition, *Riama crypta* (characters in parentheses) can be distinguished from Ecuadorian and Peruvian congeners by meristic characters. *Riama anatorlos*, *R. balneator*, *R. oculata*, *R. orcesi*, *R. simotera*, *R. stigmatoral*, *R. unicolor*, *R. vespertina*, *R. laudahnae*, and *R. vieta* have two or more (one) superciliaries. All known specimens of *Riama meleagris* and *R. petrorum* have just the anteriormost superciliary scale. From these species, *Riama crypta* can be distinguished by the following: *R. meleagris* has the frontonasal distinctly longer than, or equal to, frontal (shorter than frontal), the dorsal scales smooth (keeled) and two (three) genials; *R. petrorum* has two (three) genials, and the dorsal scales striated (keeled). Most of the known specimens of *Riama cashcaensis*, *R. labionis*, and *R. raneyi* and some of *R. colomaromani* have just the anteriormost superciliary scale. From these species, *Riama crypta* can be distinguished by the following: *R. cashcaensis* has the frontonasal much longer than frontal (shorter than frontal), and two or three (4–7) lateral scale rows; *R. labionis* has the supralabial-subocular fusion present (absent), and two (three) supratympanic temporals; *R. raneyi* has two or three supraoculars, usually three (four) and the frontonasal distinctly longer than to equal to frontal (shorter than frontal); *R. colomaromani* has two (three) genials and 22–32 (13–18) longitudinal dorsal scale rows; *R. vieta* has the dorsal scales rugose (keeled), and 8–10 (4–7) femoral pores per hind limb in males.

Similarly, *Riama crypta* can be distinguished from congeners occurring in Colombia, Venezuela, and the island of Trinidad, except *Riama inanis*, by the following (condition for *R. crypta* in parentheses): superciliaries two or more (one). *Riama inanis* has two (three) genials and the differentiated lateral scales absent or with a single, irregular row present (lateral scale rows 4–7).

DESCRIPTION: *Riama crypta* possesses the following characteristics: (1) maximum SVL in males 69 mm ( $n = 14$ ), in females 68 mm ( $n = 24$ ); (2) frontonasal shorter than frontal; (3) prefrontal scales absent; (4) nasoloreal suture usually absent (= loreal absent), exceptionally complete; (5) supraoculars four, second, third, and fourth in contact with ciliaries; (6) superciliary series incomplete, one; (7) supralabial-subocular fusion absent; (8) postoculars 2–4; (9) postparietals two; (10) supratympanic temporals three; (11) genials three; (12) dorsal scales rectangular, juxtaposed, with a low, rounded keel; (13) nuchal scales smooth; (14) longitudinal dorsal scale rows 13–18 in males, 13–16 in females; (15) transverse dorsal scale rows in males

30–35, in females 31–37; (16) ventral scales smooth, in 18–21 transverse scale rows; (17) lateral scale rows 4–7; (18) femoral pores per hind limb in males 4–6 (one specimen with seven on the left hind limb), in females one or two, located proximally in both sexes (scales between medialmost femoral pores two); (19) subdigital scales on toe I 4–7; (20) anterior cloacal plate scales paired; (21) distinct dorsolateral stripe present at least anteriorly, irregularly arranged small and large ocelli laterally in males, and ventral coloration composed of white and brown longitudinal stripes; (22) hemipenis acapitate; flounces bearing calcified spines, forming two chevrons separated by asulcate expansion pleat; elongate protuberances distally.

**DESCRIPTION OF HOLOTYPE:** Male (figs. 4 and 5). SVL 60 mm. Tail length 95 mm. Head scales smooth, glossy. Rostral wider than long, higher than adjacent supralabials, in contact with frontonasal, nasals, and anterior supralabials. Frontonasal trapezoidal, widest posteriorly, longer than wide, shorter than frontal. Prefrontals absent. Frontal longer than wide, widest posteriorly, anterior suture straight, lateral sutures concave, posterior sutures form obtuse angle with point directed posteriorly. Frontonasals form asymmetrical pentagons. Supraoculars four; second, third, and fourth in contact with ciliaries. Second supraocular largest. Superciliary series incomplete. Anterior superciliary barely extends onto dorsum, extends posteriorly one-third the length of the second supraocular. Loreal absent. Central palpebral disc (that portion covering pupil) divided, translucent; on lower eyelid there are four large translucent palpebrals, the central two are unpigmented. Circumorbital scales between supraoculars and nasal five. Large subocular scale present directly below orbit. Postoculars three. Supralabials five. Supratympanic temporals three. Parietals and interparietal polygonal. Interparietal larger than parietals. Postparietals two. Mental and postmental present. Postmental pentagonal, in contact with second infralabial. Infralabials four. Genials in three pairs; sutures weakly asymmetrical; transverse sutures subperpendicular with respect to midline. Postgenials large, two pairs at midline anterior to gulars. Gulars rounded squares, in seven rows on venter. Posteriormost gular row enfolded concealing 1–3 rows of small scales. Lateral neck scales rounded, weakly rugose. Dorsals on neck square, smooth or with broad, low keel. Dorsals on body rectangular, with rounded keel, longer than wide, subimbricate, in 33 transverse rows (between postparietals and posterior edge of cloaca), in 12 longitudinal rows at fifth ventral row, in 14 longitudinal rows at tenth ventral row, in 14 longitudinal rows at 15th ventral scale row. Midbody dorsal scales irregular posteriorly. Lateral scales heterogenous, in irregular rows. Ventralmost laterals small, circular to oval, form shallow sulcus between lateral and ventral scales. Preaxial and postaxial scales on forelimbs small to granular, circular to oval, rugose. Ventral scales on abdomen smooth, rectangular to square, subimbricate, in 20 transverse rows (between gular fold and cloacal plate), in 10 longitudinal rows at 10th transverse row. Anterior cloacal plate scales triangular, two. Posterior cloacal plate scales three. Median posterior cloacal plate subtriangular, in contact with anterior row. Scales on tail rectangular, with low round keel anterodorsally. Subcaudals nearly square, smooth, in pairs posteriorly. In general, limb squamation as described for congeners (e.g., Kizirian, 1996).

**COLORATION OF HOLOTYPE:** In preservative (70% ethanol). Overall color pattern pale brown dorsally, dark brown laterally and ventrally, with distinct dorsolateral lines anteriorly,

scattered small dark spots on head and trunk, and numerous small irregular ocelli laterally. Dorsum of head brown with scattered dark brown markings. Distinct bicolored dorsolateral line composed of central beige line bordered by two dark brown lines, extends from eye posteriorly to approximately dorsal scale row 15, similar indistinct short line above hind limbs. Small irregular ocelli laterally on neck and flanks in two irregular lines. Chin and labials dark brown with white to cream lines, especially on sutures. Throat and abdomen dark brown to black with small cream spots or narrow lines on posterior ends of longitudinal sutures. Tail brown, cream stripes on scale sutures on anterior subcaudals.

**HEMIPENIAL MORPHOLOGY:** The hemipenial morphology of *Riama crypta*, based on KU 135103 (holotype), was described and illustrated by Kizirian (1996: 111) under the name *Proctoporus hypostictus*. The distal appendages seen in *R. hyposticta* (PSO-CZ 085; fig. 3) are not evident in *R. crypta* (KU 135103).

However, the description by Kizirian (1996) was based on an incompletely everted organ, which is supported by the fact that dimples are present in the distal end of KU 135103. The examination of the completely everted organ of KU 135104 (paratype; fig. 6) corroborates the presence of such structures in the hemipenes of *R. crypta*. Therefore, the differences between *R. hyposticta* and *R. crypta* in hemipenial morphology are minimal.



FIGURE 6. *Riama crypta*, new species. A. Sulcate, B. lateral, and C. asulcate views of the left hemipenis of KU 135104 (paratype).

**VARIATION:** Longitudinal rows of dorsal scales at 10th ventral scale row in males 13–18 ( $n = 14$ ), in females 13–16 ( $n = 24$ ), longitudinal rows of dorsal scales at 15th ventral scale row in males 13–16 ( $n = 14$ ) in females 13–20 ( $n = 24$ ). Transverse dorsal scale rows in males 30–35 ( $n = 14$ ), in females 31–37 ( $n = 24$ ). Number of gular rows in males 6 ( $n = 3$ ), 7 ( $n = 10$ ); in females 6 ( $n = 9$ ), 7 ( $n = 11$ ). Supraoculars four, in contact with ciliaries 2, 3, and 4 ( $n = 38$ ). Transverse ventral scale rows 18–21 ( $n = 38$ ). Longitudinal ventral scale rows 8 ( $n = 1$ ), 9 ( $n = 7$ ), 10 ( $n = 30$ ). Supralabials five ( $n = 22$ ), infralabials four ( $n = 29$ ), 4/5 ( $n = 1$ ), 4/3 ( $n = 1$ ), 3/4 ( $n = 1$ ), 6/4 ( $n = 1$ ). Scales between femoral pore series 2 ( $n = 34$ ). Subdigital lamellae on finger I 3–5 (mode = 4). Subdigital lamellae on toe I 4–7 (mode = 5). Postoculars three ( $n = 30$ ), 3/2 ( $n = 3$ ), 2/3 ( $n = 1$ ), 3/4 ( $n = 1$ ), 4/3 ( $n = 1$ ). Genials three ( $n = 34$ ), 3/2 ( $n = 1$ ). Among 38 specimens of the type series and referred material, there is just one (KU 196387) with a complete nasoloreal suture (= loreal present). Femoral pore number is the most pronounced

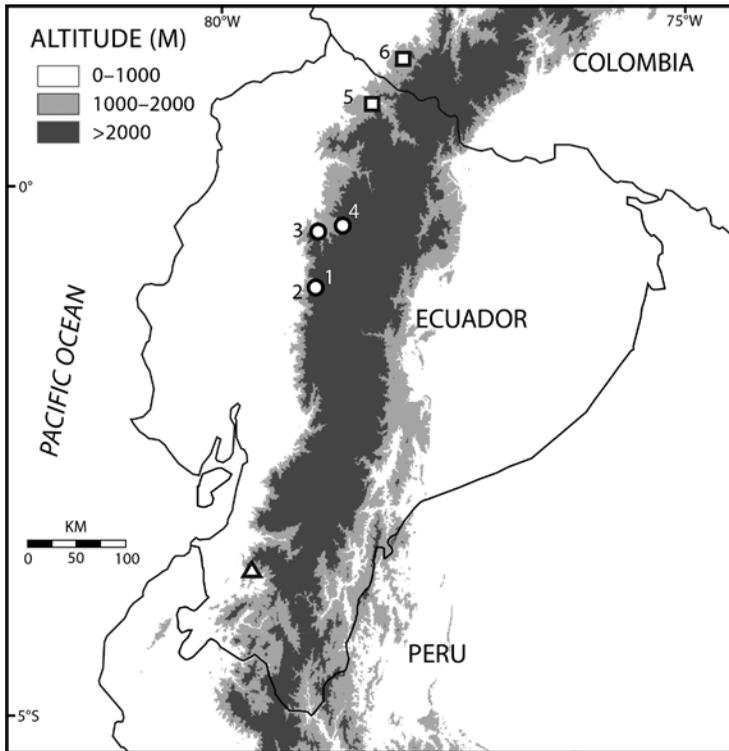


FIGURE 7. Distribution of *Riama crypta* in the western slope of the Cordillera Occidental, Ecuador. Circles: 1 = type locality, Pilaló, Cotopaxi; 2 = 3 km W Pilaló on Quevedo-Latacunga road, Cotopaxi; 3 = Las Pampas, Cotopaxi; 4 = Tandapi, Pichincha. Distribution of *Riama hyposticta* in northern Ecuador and southwestern Colombia: Squares: 5 = Type locality, [Hacienda] Paramba [Imbabura], Ecuador; 6 = Reserva Natural Rio Ñambi, vereda El Barro, corregimiento Altaquer, municipio de Barbacoas, departamento de Nariño, Colombia. Distribution of *Riama* sp. in southern Ecuador: triangle: El Oro, El Chiral. Shading indicates areas above 1000 and 2000 m.

sexually dimorphic character with males having 4–6 (seven on the left hind limb of KU 121153) per hind limb, while females have 1–2.

Ventral color pattern varies from predominately white with brown lines to predominately dark brown with small cream spots. Females tend to exhibit the former and males tend to exhibit the latter.

**DISTRIBUTION:** *Riama crypta* is known from Pilaló, Cotopaxi, and adjacent areas on the western slope of the Cordillera Occidental between 2320–2700 m, Ecuador (fig. 7).

## DISCUSSION

One specimen from El Chiral (fig. 7), El Oro, Ecuador (represented by only a severed head and anterior portion of the body), AMNH 18310, has been referred to *Riama oculata* (Burt and Burt, 1931), and *R. striata* (Uzzell, 1958), and tentatively assigned to *R. hyposticta* (Kizirian, 1996). We have examined the specimen again and believe that it may represent another undescribed species, agreeing with the conclusions of Peters (1967) and Kizirian (1996). Therefore, we prefer to refer it to *Riama* sp. until additional material from that region is collected and the question about its taxonomic status is settled.

The distal filiform appendages on the hemipenial lobes of *Riama hyposticta* and *R.*

*crypta* are presumably a unique synapomorphy within the genus, suggesting that these species are closely related. Nevertheless, the unequivocal detection of such structures requires that the hemipenial lobes be fully everted, which may not have been done for other putatively related species (e.g., *R. afrania*). Among Gymnophthalmidae, single distal filiform appendages on the hemipenial lobes are also present, at least, in *Cercosaura manicata* and in some populations of *Iphisa elegans* (Nunes and Rodrigues, unpubl. data), attesting to the homoplastic occurrence of these elongated structures. In other gymnophthalmids (e.g., *Anadia ocellata* and *Anadia blakei*; see Myers et al., 2009), similar apical soft-tissue papillae are present atop each lobe; however, these protuberances are paired and markedly more robust.

With the description of *Riama crypta*, 17 of the 28 species currently assigned to the genus occur in the Ecuadorian Andes. Although the distributions of most taxa are poorly known, based on the available evidence Kizirian (1996) noted that most species have restricted geographic distributions and occupy narrow elevational ranges. *Riama hyposticta* and *R. crypta* appear to inhabit different elevational zones (and consequently different habitats). The type locality of *R. hyposticta* is between 777–1050 m and the Colombian locality is between 1100–1600 m, while the type locality and adjacent areas where *R. crypta* occurs are between 2320–2700 m. Although the data for *R. hyposticta* are not precise, we presume that, among the Andean *Riama*, this species inhabits lower elevations.

The formal recognition of *Riama crypta* has consequences in *Riama* systematics. Doan (2003) used specimens of *R. crypta* to score morphological characters for *R. hyposticta* in her phylogenetic study of *Proctoporus* sensu lato, thus morphological evidence for the relationships of *R. hyposticta* sensu stricto is lacking. Due to lack of material most of the species allocated to *Riama* (including the species treated herein) were not included in the molecular-based phylogenetic analysis of Castoe et al. (2004), but their placement in the genus was supported by morphological affinities (Doan and Castoe, 2005).

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## APPENDIX

MATERIAL EXAMINED<sup>4</sup>

***Riama achlyens***: VENEZUELA: Aragua: Rancho Grande (AMNH 137260, 137267–69, 137271–76, 137278–82, 137297). ***Riama afrania***: Antioquia: Municipio de Urrao, 13 km northeast on Urrao–Cai-cedo Road, Valle Real, 2350 m (MHNC SJ 1048 holotype, MHNC SJ 801–03, 1044, 1051–52, IAvH-R 3957, 3959–60 paratypes), vereda El Chuscal, quebrada Las Juntas, 2430–2490 m (ICN 9513). ***Riama anatoloros***: ECUADOR: Napo: La Bonita (USNM 229706–45); Napo–Pastaza [= Napo]: Abitagua (AMNH 38821–22). ***Riama cashcaensis***: ECUADOR: Bolivar: Guaranda, 2640 m (KU 135019–21 paratypes); 4.0 km E Guanujo, 2870 m (QCAZ 877 paratype). ***Riama colomaromani***: ECUADOR: Pichincha: 19.8 km W Chillo Gallo, ca Quito–Chiriboga rd (KU 221737 paratype); Carchi: 26.9–27.3 km from Maldonado on Road to Tulcan (KU 217209); 58 km E Tulcán, 2900 m (QCAZ 4250, 4252). ***Riama columbiana***: COLOMBIA: Probably Antioquia: municipio de Sonsón (NRM 1631 Lectotype, NRM 1633, 1634, 6168 paralectotypes); Caldas: municipio de Villa María, vereda Montaña, 2450 m (MHNUC 0088), predio La Mesa, Bosques de la CHEC, 2640 m (ICN 11295–98), 2600 m (ICN 11299–01); municipio de Neira, vereda La Cristalina, finca La Cristalina, 2300 m (ICN 11302); Quindío: between the haciendas El Brillante and San Julian, vereda San Julian, municipio de Calarcá, 2100 m (ICN 6479); Risaralda: Santuario de Fauna y Flora Otún Quimbaya (IAvH-R 4941); Parque Municipal Campo Alegre, municipio de Santa Rosa de Cabal (IAvH-R 5194). ***Riama crypta***: ECUADOR: Cotopaxi: Las Pampas (MHNG 2361.54). Pichincha: Tandapi (MHNG 2361.78, 2361.79). Cotopaxi: Pilaló, 2700 m (KU 121153, 121154 paratypes); 2500 m (KU 135100–02 paratypes, 135103 holotype, 135104–15 paratypes); 2400 m (KU 179455–65 paratypes); 2320 m (KU 196386–89 paratypes); 3 km W Pilaló on Quevedo–Latacunga Road (USNM 229638–39 paratypes). ***Riama hyposticta***: ECUADOR: “Paramba, 3500 ft.” (BMNH 1946.8.31.31 holotype). COLOMBIA: Nariño: municipio de Barbacoas, corregimiento Altaquer, Vereda El Barro, Reserva Natural Rio Nambí (PSO-CZ 085). ***Riama laevis***: COLOMBIA: Valle del Cauca: municipio Cumbre, 2000 m (IAvH 4916), vereda Chicoral (UV-C 11266); 15 km al oeste del Cairo, base cerro del Ingles, ca. 2000 m (UV-C 10103). ***Riama luctuosa***: VENEZUELA: Aragua: Rancho Grande (AMNH 137270, 137277, MCZ 100410, USNM 196336), Parque Nacional Henry Pittier, Rancho Grande (USNM

<sup>4</sup>Additional specimens examined are listed in Kizirian (1996).

259170). *Riama meleagris*: ECUADOR: [Tungurahua]: Baños (FMNH 28037–42, 28049 [six specimens]). In error: El Oro: Machala (USNM 196264–65). *Riama oculata*: ECUADOR: Pichincha: Nanegal (USNM 229640), 3 km E of Nanegal Chico (USNM 229642). Cotopaxi: San Francisco de las Pampas (UMMZ 188630). *Riama orcesi*: ECUADOR: Napo: 12 km W (via road) Baeza (AMNH 124044 paratype); 31 km N Jondachi, 2190 m (QCAZ 2829, 2835); vertiente del volcán Sumaco, 2200 m (QCAZ 931–40). *Riama petrorum*: ECUADOR: Morona-Santiago: trail between Sevilla de Oro and Mendez on E slopes of the mountains between Cerro Negro and Pailas (tambos) (USNM 196266 paratype), San Vicente, slightly S of W of Limon and 35 km E Gualeceo by road (USNM 196268). *Riama raneyi*: ECUADOR: Napo: 3.3 km ESE Cuyuja, 170 m (KU 142903 paratype); Sucumbios: near Santa Barbara (MCZ 175160–62); Napo [= Sucumbios]: immediate environs of Santa Barbara (USNM 229750); 2 km E of Santa Barbara (USNM 229749); 3 km SW Santa Barbara at bridge (covered) over river (USNM 229748). Sucumbios: 32 km E Julio Andrade on road to Santa Barbara, 2610 m (QCAZ 2827). Carchi: Santa Bárbara, Santa Bárbara–Guanderal, 2980 m (QCAZ 1379). *Riama shrevei*: TRINIDAD & TOBAGO: Horne Tucuche (MCZ 62506–07); El Teluche [in error, probably Tucuche] (MCZ 100466–68); Mt. Tucuche (MCZ 160065–66). *Riama simotera*: ECUADOR: Carchi: 14.6 km NW El Carmelo, 3130 m (KU 179478); km 13 carretera a El Carmelo, 3300 m (ICN 9823–34); km 16 Tulcán-Tufino, 3130–3160 m (ICN 9835–36); 15.3 km W Tulcán on road to Tufino, 3080 m (QCAZ 915, 918); km 13 desvío carretera Panamericana, El Ángel (ICN 9837). COLOMBIA: Nariño: municipio de Pupiales (IAvH [formerly IND-R] 1553); municipio de Túquerres, km 10 carretera Túquerres–Guachucal, hacienda Alsacia, 3140 m (ICN 9817); municipio de Cumbal, km 4 Cumbal–volcán Cumbal, 3260 m (ICN 9818–22). *Riama stellae*: COLOMBIA: Nariño: municipio de Barbacoas, corregimiento de Ricaurte, Reserva La Planada (PSO-CZ 102 holotype; PSO-CZ 103 and 109, ICN 12068 [formerly PSO-CZ 108] paratypes). *Riama stigmatoral*: ECUADOR: Azuay: Sevilla de Oro (USNM 229644); Morona-Santiago: Pailas, a tambo on trail between Sevilla de Oro and Mendez, on E or NE facing slope (USNM 229648 paratype); between tambos called Cerro Negro and Pailas on trail Sevilla de Oro and Mendez (USNM 229643 paratype); between Pailas and Mirador, on trail between Sevilla de Oro and Mendez (USNM 229645 paratype), Pailas, a tambo on trail between Sevilla de oro and Mendez, on E or NE facing slope (USNM 229647 paratype); San Juan Bosco, a posada on trail between Limon (General Plaza) and Gualeceo, slightly S of W of Limon (USNM 229649); El Cruzado, a posada on trail between Limon (General Plaza) and Gualeceo, slightly S of W of Limon (ca. 0.5 hour up trail from San Juan Bosco) (USNM 229650). No other data (AMNH 32778). San Jose (AMNH 38820). *Riama striata*: COLOMBIA: Boyacá: Municipio de Villa de Leyva, sector rural vereda el Roble (IAvH 4895); Pesca (IAvH [formerly IND-R] 0665–66); municipio de Turmequé, vereda Joyagua (MUJ 816); Toquilla, Vadohondo, km 71 carretera Sogamoso–Pajarito (ICN 2800). Cundinamarca: Bogotá (CAS-SUR 8280, MCZ 14166–67, 16979–80, 16982–83, 17129, 110415–16, USNM 75969, 153974–82, 194744, ICN 2181); Bogotá, salón de clases de la Pontificia Universidad Javeriana (MUJ 229); Bogotá, instalaciones del laboratorio de fauna “Venado de Oro,” vivero Inderena (IAvH [formerly IND-R] 1100–01, 1499, 1602, 3006); Bogotá, laboratorio de fauna Unifem Inderena (IAvH [formerly IND-R] 3130–31, 3934, 4163, 4262); Bogotá, ladera del cerro Guadalupe (IAvH [formerly IND-R] 3503, ICN 2436, 2535, 2537, 2541, 2543–44, 2546); Mt. Guadalupe (FMNH 177075–81, 177243–47); Salto del Tequendama (IAvH [formerly IND-R] 3985); municipio de San Francisco, vereda Sabaneta (ICN 5991), cerro Cueva Grande, 2590 m (ICN 5737), finca La Quebrada, quebrada El Vino, 2540–2560 m (ICN 9759–65); Páramo Cruz Verde, 3100 m (ICN 675–76); municipio de Fómeque (ICN 2232); between Alban and Sasaima, 50 NW Bogotá, D.C. (MVZ 191880); 6 km S Alban on road to Bogotá D.C. (MVZ 191878); represa del Hato, south of Usme, ca 2800 m (FMNH 165800–03, ICN 2371, 2373, 2375); Municipio de Suesca, vereda El Hatillo, microcuenca Santa Helena, 2950 m (MUJ 644–48), 3 km al sur de la laguna Suesca, 2860 m (ICN 7276); no other data (UMMZ 56448, 56760 [1

specimens], 89417 [seven specimens], 123315, 203767–70, ICN 2362); PNN Chingaza, 3300 m (IAvH [formerly IND-R] 4241–42), sitio Monteredondo, 3035 m (MUJ 906–09), sector de Chuza (IAvH [formerly IND-R] 3891–94), embalse cerca del Casino (MUJ 228). Santander: SFF Guanenta, alto Rio Fonce, 2650 m (MUJ 910); municipio de Virolin, Cañaverales km 72 carretera a Charalá, rio Cañaverales, 1830 m (ICN 9783). Not located: Tanques de Vitelma (IAvH [formerly IND-R] 0649). ***Riama unicolor***: ECUADOR: Carchi: Montufar Atal–Vinculo, 2700 m (UMMZ 105895–97). Imbabura: Lago de Cuicocha (MCZ 154515–16, 154628). Pichincha: Quito (MCZ 22154, 164616, 164662, 164665–68, 164670); Pasochoa Volcano Forest, 40 km SE Quito, 2800–2880 m (175052–53); Machachi (QCAZ 758). Not located: Chillo (MCZ 21070). Not located (QCAZ 6122). ***Riama vespertina***: ECUADOR: Loja: [Pampa] Chitoque, between San Bartolo and Pinas (AMNH 22130 holotype). ***Riama vieta***: ECUADOR: Guayas: km 85 on Duran–Tambo road (USNM 142601).

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