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Some new species can be foretold: An endemic collared frog (Aromobatidae: *Mannophryne* La Marca, 1992) is discovered in a still herpetologically unexplored mountain range in northern Venezuela

Algunas especies nuevas se pueden predecir: una rana endémica con collar (Aromobatidae: *Mannophryne* La Marca, 1992) es descubierta en una serranía herpetológicamente inexplorada del norte de Venezuela

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ABSTRACT

A morphological study of small body sized *Mannophryne* frog specimens from the Sierra de San Luis, Venezuela, revealed that they belong to an undescribed species. By having a narrow collar, the new species differentiates from all *Mannophryne* having a wide collar (a character present in almost half of the species included in this genus). From the rest of narrow-collared *Mannophryne* it is easily differentiated by a combination of different foot-web formula and pattern of coloration. The geographically closest species is *M. caquetio* Mijares-Urrutia & Arends, 1999, from which it differs by having a distinctive pattern of coloration, different shape of the tip of the snout, size of tympanum, degree of detachment of tongue from floor of mouth, by having lateral fringes along toes not forming flap folding on digits, and by having a more extensive foot-web. The most closely resembling frog to the new species is *M. lamarcai* Mijares-Urrutia & Arends, 1999, from which it differs by having a distinctive pattern of coloration, of which it stands out the uniformly dark dorsum without dorsolateral bands; also, by having the tip-of-snout truncated, lateral flaps along toes not folding onto digits, and less foot-webbing. The new species comes from a Premontane humid forest that is completely isolated by surrounding dry forests and raises to three the known members of the genus in Falcon State, a Venezuelan geopolitical division still lacking complete herpetological inventories. It is the northernmost Venezuelan and continental South American *Mannophryne*, rising to 21 the known species in the genus. In this paper we describe the new species, provide a diagnosis comparing it to all known members of the genus, and provide data on its biogeography, ecology, and conservation.

Key words: Aromobatidae, biogeography, conservation, Dendrobatoidea, Falcon state.

RESUMEN

Un estudio morfológico de ejemplares de pequeñas ranas *Mannophryne* de la Sierra de San Luis, Venezuela, reveló que pertenecen a un taxón previamente no descrito. Al tener un collar estrecho, la nueva especie se diferencia de todos los *Mannophryne* que tienen un collar ancho (carácter presente en casi la mitad de las especies incluidas en este género). Del resto de *Mannophryne* con collar estrecho se diferencia por la combinación de diferente extensión de membranas en las patas y por el patrón de coloración. La especie geográficamente más cercana es *M. caquetio* Mijares-Urrutia & Arends, 1999, de la cual se diferencia por tener distinto patrón de coloración, diferente forma de la punta del hocico, tamaño del tímpano, grado de desprendimiento de la lengua desde el piso de la boca, por tener rebordes laterales a lo largo de los dedos de los pies que no forman solapas plegables sobre los dedos y por tener una membrana podal más extensa. La rana que más se parece a la nueva especie es *M. lamarcai* Mijares-Urrutia & Arends, 1999, de la cual se diferencia por tener un patrón de coloración distinto, del cual destaca el dorso uniformemente oscuro y sin bandas dorsolaterales; también por tener la punta del hocico truncada, solapas laterales a lo largo de los dedos de los pies que no se doblan sobre los dedos y por poseer menor extensión de las membranas en los pies. La nueva especie proviene de un bosque húmedo premontano aislado y completamente rodeado por bosques secos, y eleva a tres los miembros conocidos del género en el estado Falcón, una división geopolítica venezolana aún carente de inventarios herpetológicos completos. En este artículo describimos la nueva especie, proporcionamos un diagnóstico donde se compara con todos los miembros conocidos del género y aportamos datos sobre su biogeografía, ecología y conservación.

Palabras clave: Aromobatidae, biogeografía, conservación, Dendrobatoidea, estado Falcón.

INTRODUCTION

Mannophryne La Marca, 1992, is a genus of Neotropical frogs found almost exclusively in Venezuela (Rojas-Runjaic *et al.* 2018). A total of 20 species (Frost 2023) are known, distributed mainly in the mountain systems to the north and west of this country, being more numerous in the Cordillera de Mérida, followed by those located in the mountains to the east of the country. This genus is also represented in the Lara-Falcón Mountain System (Yústiz 1991, Mijares-Urrutia & Arends 1999a, b, Mijares-Urrutia 2000), which is a kind of wedge between the Venezuelan Andean and coastal systems, but the species inventory there is still far from complete.

Mannophryne species are found mostly in humid forests, specifically those characterized as “Premontane moist forest” and “Premontane wet forest” in the Holdridge’s Life Zone system (Ewel *et al.* 1976). This close association of species in the genus and this Life Zone served to postulate a hypothesis (La Marca 1994, 1995) which predicts the existence of representatives of the genus in these plant formations where these frogs have not been previously reported, especially if they are naturally isolated from each other.

Studying frogs from the Sierra de San Luis, in the Falcón state, we found some specimens belonging to the genus *Mannophryne* and coming from a Premontane humid forest that is completely isolated by surrounding dry forests. The morphological study of these animals revealed that they belong to an undescribed taxon whose presence was expected in this type of forest, as predicted. The description of this species is the main objective of this work.

MATERIALS AND METHODS

Specimens examined are listed in the Appendix 1. Terminology and methods follow La Marca *et al.* (2004), Vargas Galarce & La Marca (2007); and La Marca (2009). Sex was determined by gonadal inspection. Measurements (in mm) were taken on the left side of animals under a Wild stereomicroscope (TYP 181300, Heerbrugg, Switzerland), using a Surtek® digital caliper (model 122202) with a precision of 0.01 mm.

Measurements taken for post-metamorphic specimens were snout-to-vent length (SVL); head length: distance from tip-of-snout to posterior corner of mouth (HL); head width: maximum straight distance between angle of jaws (HW); eye-to-naris distance: distance from anterior corner of eye to center of naris (EN); internarial distance: maximum straight length between centers of nares (IN); nares to tip-of-snout distance (NTS); eye length: distance from anterior to posterior corner of eye (EYE); horizontal length of tympanum: distance between anterior and posterior level of tympanum (T); hand length: distance from proximal edge of palmar tubercle to tip of finger III (HAND); tibia length: distance from outer edge of flexed knee to heel (TL); foot length: distance from proximal edge of outer metatarsal tubercle to tip of toe IV (FOOT); interorbital distance: distance between borders of upper eyelids (IOD); upper eyelid width: distance between border of eye and base of eyelid (UEW); distance from anterior border of eye to tip-of-snout (ETS); distance from anterior border of tympanum to posterior border of eye (TE); length of shank from knee or tibio-tarsal joint to

heel (TARSUS); length of dermal fold on tarsus (LTF); width of pad on third finger (WP3F); width of phalanx adjacent to pad on third finger (WPAP).

A definition and a diagnosis are presented separately for the new taxon before its description. These concepts are, as Simpson (1961:138) pointed out “importantly different, but in fact taxonomists seldom use the terms consistently and commonly assume that they are synonymous”. Gloyd & Conant (1990:13) stated that “A definition explains what a taxon is, whereas a diagnosis tells what it is not, especially if a comparison is made with one or more other taxa”. Both terms, definition and diagnosis, have been consistently used by the first author in all his publications regarding the genus *Mannophryne*.

Mannophryne phylidros sp. nov.

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(Figs. 1, 2)

Mannophryne sp. 2. Mijares-Urrutia & Arends 2000: 6.

Holotype. CHCG (Colección Herpetológica Carlos Gottberg) 428; adult female (Fig. 1), collected by Carlos Gottberg in Cataratas de Hueque (11° 11'N, 69° 34'W), 610 m asl, Sierra de San Luis, municipio Petit, estado Falcón, Venezuela.

Paratypes. Topotypes (Fig. 2), same data as holotype. CHCG 425-427, and 429, four adult females; and CHCG 430-431, two adult males.

Remark: the CHCG is housed as a separate collection within the Colección de Vertebrados de la Universidad de Los Andes (CVULA), Mérida, Venezuela.

Etymology. The specific name derives from the Greek word “*phylidros*”, meaning “water-loving” (Brown 1978: 845), in loose relation to the association of the type specimens with the waterfalls at the type locality.

Definition. A medium sized *Mannophryne*, mean SVL males: 23.4 mm (range 23.2-23.7 mm), females: 26.4 mm (range 25.3-27.6 mm), distinguished from other *Mannophryne* by the following combination of characters: (1) skin of dorsum smooth, (2) lower part of tympanum moderately conspicuous, (3) tip-of-snout truncated, (4) canthus rostralis ill-defined, sinuous, (5) first finger equal in length to second, (6) pad on third finger about twice wider than adjacent phalanx, (7) fingers bearing lateral fringes, (8) short cloacal fold with crenulate border, (9) tarsal fold strong, not forming a flap, (10) foot web formula: I (1.5-2.0)-0.5II 1.5-1 III 1.5-1IV (0.5-1)-1V, (11) toes with lateral flaps, not folding onto digits, (12) pale dorsolateral band absent, dorsolateral dark band absent, (13) width of pad on third toe slightly less than half the width of the adjacent phalanx, (14) heel reaching to eye when leg is adpressed forward, (15) short pale oblique inguinal band, (16) collar dark-brown, relatively-narrow and with small cream-colored blotches, (17) undefined pale ventrolateral blotches, (18) venter cream or dirty cream in females; black to gray (especially darker on anterior part) in males.

Diagnosis. As other members in the genus, *Mannophryne phylidros* sp. nov. has a dark band (“collar”) on chest. The new species has a relatively narrow collar, which allows to differentiate it from other members of the genus having a wide collar [*M. collaris* (Boulenger, 1912); *M. cordilleriana* La Marca, 1994; *M. herminae* (Boettger, 1893); *M. larandina* (Yústiz, 1991); *M. molinai* Rojas-



Figure 1. Dorsal and ventral view of preserved holotype of *Mannophryne phylidros* sp. nov.



Figure 2. Dorsal and ventral views of preserved paratypes of *Mannophryne phylidros* sp. nov.

Runjaic *et al.* 2018; *M. oblitterata* (Rivero, 1984), *M. riveroi* (Donoso-Barros, 1964); *M. speeri* La Marca, 2009; *M. trujillensis* Vargas Gallarce & La Marca, 2007; and *M. yustizi* (La Marca, 1989)]. Of those *Mannophryne* having a narrow collar, the new species differs as follows (characters of compared species are within parentheses): from *M. leonardo* Manzanilla *et al.* 2007, by lacking a dark canthal band surrounding snout and by having a more extensive foot web (dark canthal band surrounds snout, and feet basally webbed, I1-0.5III1-0.5III1-1IV0.5-1V); from *M. neblina* (Test, 1956) by having a spotted dorsum and a brown upper lip (uniformly brown dorsum; uniform cream lip); from *M. olmonae* (Hardy, 1983) and *M. trinitatis* (Garman, 1887), by having a crenulate free cloacal-sheath border (smooth free border); from *M. orellana* Barrio-Amorós, Santos & Molina, 2010, by having a less-well developed foot web (I1-2III1-3III2-3.5IV3-2V); from *M. urticans* Barrio-Amorós, Santos & Molina, 2010, by being smaller (females 30.8 mm, males 26.9 mm) and less-well developed foot web (I1.5⁺-2.5⁺II2-3III2.5⁺-4IV4-2.5⁺V); from *M. vulcano* Barrio-Amorós, Santos & Molina, 2010, and *M. venezuelensis* Manzanilla, Jowers, La Marca & García-París, 2007, by having more developed foot web (only a basal web between toes III and IV in *M. vulcano*, and basal webbing between toes, absent between III and IV, in *M. venezuelensis*). Only two other *Mannophryne* with narrow collars are left to compare. One of them (*M. lamarcai*) is the most closely resembling, while the other (*M. caquetio*) is the geographically closest to the new taxon. These two species are compared as follows.

The new species differs from *M. caquetio* (diagnostic characters of the later given within parentheses) by having a uniformly dark colored dorsum without dorsolateral bands and without pale bands on shoulders (very dark conspicuous dorsolateral bands reaching to inguinal region; short pale bands on shoulders); a narrow dark supratympanic fringe, extending from behind the eye to arm insertion (a not-conspicuous narrow dark fringe goes beyond and onto the flank in adults; juveniles with same pattern as the new species); dark stippling on lateral side of head from tip-of-snout to level of shoulder (reticulated pattern); dark canthal band bordering tip-of-snout but not very differentiated from coloration of top of the head (canthal band not very much different in coloration from other lateral parts of the head, but well differentiated from top of the head); loreal region dark, with narrow medial pale line (loreal region dark with little pale spots, without pale line); dark upper lip with heavy dark stippling and inconspicuous little pale spots (upper lip darker, with large pale spots coalescent or not); tympanum bi-colored, upper part dark and lower part pale brown (tympanum

uniformly dark colored, with pale portions on inferior border); flanks dark brown, as dorsum, with a pale oblique inguinal band extending to half the flank (flanks stained with brown, and bearing a disordered oblique band, spotted and inconspicuous, extending onto posterior 1/3 of flank); chin and lateral parts of throat, dark (chin not or inconspicuously dark-colored, inconspicuously darker along borders of throat); dark collar with pale stippling which is more blurred towards the sides of collar (collar broader and more pale-stippled); extremities not conspicuously banded (well-defined dark bands on extremities). Tip-of-snout truncated (tip-of-snout semicircular); disk on third finger covers 1/3 of tympanum (disk covers 1/2 of the tympanum); posterior end of tongue detached 1/2 of its extension from the floor of mouth (tongue almost completely detached, about 3/4 of its length); cloacal flap crenulate, with dark border (cloacal flap slightly crenulate, bearing small blunt papillae, with brown border, undifferentiated); lateral fringes along toes, not forming a flap folding onto the digits (lateral fringes on toes, folding on digits); foot-web I(1.5-2.0)-(0.5-1)III1.5-1III(1.0-1.5)-(1.0-1)IV(0.5-1.0)-(0.5-1)V (foot-web less-extensive, I1.5-0.5III1.5-1.0III0.5-1.5IV0.5-1.5V).

The new species differs from *M. lamarcai* (characters of the later given within parentheses) by having a uniformly dark dorsum without dorsolateral bands (dark dorsolateral bands present and tending to blur backwards); loreal region, dark, with a narrow medial pale line bordering tip-of-snout (loreal region dark, with a medial pale line twice as wide as that of the new species); dark canthal band bordering tip-of-snout but not very differentiated from coloration of top of the head (dark canthal band very well differentiated from top of the head); dark upper lip with heavy dark stippling and inconspicuous little pale spots (upper lip cream to pale brown); a narrow dark supratympanic fringe (dark supratympanic band, ill-defined); tympanum bi-colored, upper part dark and lower part pale brown (tympanum bicolored, inferior 2/3 pale brown, superior 1/3 dark); extremities without conspicuous bands (extremities bearing conspicuous dark bands); chin and lateral parts of throat, dark (chin somehow dark-colored, without conspicuous marks on lateral sides of throat); dark and well-defined collar with conspicuous and well-spaced little pale spots (collar diffuse, with not-conspicuous little pale spots). Tip-of-snout truncated (tip-of-snout from almost truncate to semicircular); posterior end of tongue detached 1/2 of its extension from the floor of mouth (tongue extensively, but not completely detached; although less detached than in *M. caquetio*); tarsal fold conspicuous (tarsal fold not very conspicuous); cloacal flap crenulate, with dark border (cloacal flap

almost smooth to crenulate, with brown border, undifferentiated); lateral flaps along toes, not folding onto digits (well-developed lateral fringes on toes, folding on digits); foot-web I(1.5-2.0)-(0.5-1)III1.5-1III(1.0-1.5)-(1.0-1⁺)IV(0.5-1.0)-(0.5-1⁺)V (foot-web a little more extensive, I(1.0-2.0)-(0.5-1)II(1.5-2.0)-(1.0-1.5)III(1.5-2.0)-(1.0-1.5)IV(0.5-1.0)-(1.0-2.0)V).

Description of holotype. Adult female with deeply convoluted oviducts and mature ova (largest ovum, 2.0 mm). Head slightly wider than long; interorbital region smooth; interorbital distance 1.5 times greater than upper eyelid width; canthus rostralis ill-defined, sinuous; nares slightly elevated, directed slightly posterolaterally; loreal region slightly convex; snout truncated in dorsal view; tip-of-snout truncated, protruding not much beyond lower jaw; length of eye about 1.5 times eye-to-nostril distance; internarial distance about 1.7 times eye-to-nostril distance; tympanum with elevated anterior and inferior parts, and upper 1/3 concealed by a thick supratympanic ridge; tympanum separated from eye by about half its horizontal length; a single, rounded, rather large tubercle behind angle of jaws and below tympanum; tongue elongate, entire, posterior 1/3 not adherent to floor of mouth; lingual papillae absent; choanae rounded, almost completely concealed by palatal shelf of maxillary arch; maxilla and premaxilla toothed; teeth minute.

Dorsum smooth, with low-elevated tubercles on lower back, although conspicuous on cloacal fold; flanks shagreened, with low tubercles towards groin; venter shagreened; palmar tubercle single, rounded, three times larger than thenar; thenar with lacrimal shape, about twice longer than wide; supernumerary tubercles present; subarticular tubercles rounded, elevated; fingers with small-sized pads; largest pad on third finger, covering about half the size of tympanum when placed on it; pads as long as wide; pad on third finger about twice wider than adjacent phalanx; fingers free, with lateral fringes along fingers II, III, and along internal border of I and external border of IV; first finger equal in length to second.

Cloacal opening above midlevel of thighs, directed ventrally, covered by a medium-sized cloacal flap with crenulate border; border of cloacal flap dark, differentiated; supra-cloacal flap thick, bearing few blunt tubercles; thighs and shanks without conspicuous tubercles; strong tarsal fold, not forming a flap, from base of first toe to a point about 3/5 of distance from tibiotarsal articulation to base of foot; no conspicuous tubercles on tarsal fold or behind it; outer metatarsal tubercle elevated, rounded in outline, subconical in lateral profile; inner metatarsal tubercle elongate, about 3 times longer than wide, about twice the size of outer; no supernumerary tubercles; subarticular

tubercles moderate-sized, rounded to oval, flattened; toes with very little foot webbing; foot-web formula (left foot) I2.0-0.5III1.5-1.0III1.5-1IV0.5-1V (right foot similar webbed, except that between toes IV and V the foot web is a little bit more extensive, starting at first tubercle on toe IV); toes with well-developed lateral flaps; thick flap along border of fifth toe, from base of pad to almost falling short of outer metatarsal tubercle; pads wider than long; largest pad on third toe, slightly wider than pad on fourth toe; pad on third toe slightly less than half the width of adjacent phalanx; heels do not overlap when thighs are held at right angles to body axis, reaching to eye when leg is adpressed forward.

Measurements (in mm) of the holotype. For abbreviations, see the section on Materials and Methods. SVL 26.7; TL 12.1; HW 9.3; HL 8.7; IOD 2.8; UEW 1.9; NTS 1.1; EN 2.1; EYE 3.2; IN 3.5; T 1.7; ETS 4.2; TE 1.0; HAND 6.9; FOOT 10.8; TARSUS 67.5; LTF 4.7; WP3F 0.9; WPAP 0.5.

Coloration in preservative (ethanol 70%, after 10% formaldehyde fixation) of the holotype. Dorsum chocolate brown, uniform; under magnification there appear small pale blotches, especially evident towards anterior part of dorsum, with larger pale blotches between upper eyelids; a diffuse wide dark-brown band between upper eyelids; a short whitish line between anterior part of upper eyelids; dorsum of head, in anterior part, as dark as dorsum; upper eyelids darker than dorsum; loreal region brown, as dark as dorsum of head; a pale line between anterior part of eye to naris or slightly beyond, but not bordering tip of snout; upper lip brown, heavily stippled with dark brown; border of eye membrane with a narrow band heavily stippled with dark brown; tympanum bicolored, upper half dark brown, lower half cream but with heavily dark stippling; a narrow dark band below tympanum to posterior border of eye, connecting to dark band on middle anterior part of arm; short bracelets on upper part of forearms; ulnar tubercles showing pale tips with dark brown base; upper part of anterior extremities same as dorsum; no bands evident on hands nor on fingers, except for inconspicuous band on fourth finger; flanks slightly darker than dorsum with a short oblique inguinal band extending from groin to about 2/5 of distance from groin to arm insertion; undefined pale ventrolateral blotches on inferior part of flanks.

Lower extremities, in general, with same background coloration as dorsum, except on posterior part of thighs which are darker, with pale blotches forming an irregular band at mid-level of thighs; a cream irregular blot on ventrolateral part of thighs; the mid-level cream band tends to connect to inguinal band through an irregular band passing alongside

cloaca and insertion of thighs; two dark brown transversal bands on dorsal and anterior part of thighs, connecting to longitudinal dark band from groin to knee, becoming diffuse as irregular blotches on shanks; under parts of lower and upper extremities cream-colored, with dense minute stippling; transversal dark bands on dorsal surfaces of shanks, tarsi and toes; palms and soles dark brown.

Lower part of throat cream, almost immaculate; anterior part of throat and chin dark brown (densely stippled); collar dark brown with small blotches, cream-colored; a few small cream blotches on collar, towards right part of body; venter dark, darker towards anterior part; posterior part of chest cream, constituting a kind of band that connects ventral cream parts of upper extremities. There are small pale blotches, that seem the product of loosening skin, on dorsum, posterior extremities, and flanks. Venter dark, darker towards anterior part.

Variation in paratypes. Color variation of paratypes, as compared to holotype, as follows: CHCG 425: Inconspicuous pale spots on anterior part of head and between upper eyelids; inconspicuous narrow dark bands on fingers; inguinal band $\frac{2}{3}$ longer on left side than on right side, extending to just $\frac{1}{2}$ the flank on the later; palms and soles slightly darkened. CHCG 426: Fingers bearing dark bands; dark spots on dorsum; cream inguinal band from groin to anterior upper part of thigh, not connecting with pale inguinal band; external half of ventral portion of forearms dark brown with pale dots, as in most paratypes; pale venter. CHCG 427: Upper lip with less dark stippling than holotype; inconspicuous dark band below tympanum, fingers banded; cream band besides cloaca, not connecting to inguinal band. CHCG 429: Inconspicuous pale spots on anterior part of head or between upper eyelids; dark bands on fingers; pale inguinal band extending along $\frac{2}{3}$ of distance from groin to insertion of arm; pale venter. CHCG 430: Anterior part of venter, chest and throat black, no indication of collar; inguinal stripe very

short, ill-defined; upper parts of legs blackened; $\frac{1}{3}$ lower part of tympanum pale-colored. CHCG 431: Anterior part of venter, and throat, gray; a faint indication of collar; inguinal stripe short, ill-defined; upper part of legs faintly banded; lower half of tympanum pale-colored. Variation in measurements of paratypes are indicated in Table 1.

Foot-web variation in paratypes, as compared to holotype, as follows: there is no appreciable variation in the type series. Three specimens (CHGC 425, 429, 430) are slightly less webbed between first and second toe (I1.5-0.5II); and specimen CHGC 427 has a slight difference between third and fourth toe (III.0-0.5IV).

Biogeography. *Mannophryne* frogs are mostly endemic species with very restricted distributions and are known to inhabit the Holdridge's Life Zone systems (Ewel *et al.* 1976) of moist and wet Premontane forests (La Marca 1992a). The type locality of *Mannophryne phylidros* sp. nov. lies within a Premontane moist forest (bosque húmedo Premontano, according to Ewel *et al.* 1976). The disjunct distribution of the humid forests in the northwestern part of the country, being separated by semiarid regions, makes this locality a "biogeographical island". As such, it is separated from similar other regions to the south, especially those occupied by *Mannophryne caquetio* and *M. lammarcai* (Fig. 3). Rivas *et al.* (2021) indicated that the area surrounding the Sierra de San Luis is extremely dry.

Mannophryne phylidros sp. nov. is the northernmost Venezuelan and continental South American species in the genus (Fig. 3). This addition raises to 21 the known *Mannophryne* frogs (see Frost 2023). Other 16 amphibians, 15 of them anurans (see La Marca 1992b, Mijares-Urrutia & Arends 2000, 2001, Barrio-Amorós *et al.* 2019, Rivas *et al.* 2021, Frost 2023), were previously known from the Sierra de San Luis: *Allobates pittieri* (La Marca *et al.* 2004), *Boana platanera* (La Marca *et al.* 2021), *Boana* sp., *Bolitoglossa* cf. *borburata*, *Dendropsophus luteocellatus* (Roux, 1927), *D. microcephalus* (Cope, 1886), *D. minu-*

Table 1. Measurements (in mm) of specimens in the type series of *Mannophryne phylidros* sp. nov. Holotype indicated by an asterisk. Abbreviations as explained in methods; additionally, F: Female, M: Male.

Museum number	SVL	HW	HL	T	Eye	EN	IN	Hand	Foot	Sex
CHCG 0425	26.4	9.4	8.3	1.8	3.8	2.2	3.7	6.6	12.5	F
CHCG0426	26.2	9.1	8.0	2.3	3.4	2.6	4.1	6.4	11.4	F
CHCG0427	25.3	9.4	8.2	1.8	3.4	2.1	3.4	6.7	12.3	F
CHCG0428*	26.7	9.3	8.7	1.7	2.8	2.1	3.5	6.6	12.4	F
CHCG0429	27.6	9.3	8.3	1.9	3.9	2.4	3.6	6.3	12.7	F
CHCG0430	23.7	8.1	7.1	1.7	3.3	2.3	3.3	6.1	10.5	M
CHCG0431	23.2	8.4	7.1	2.0	3.3	2.0	3.4	6.2	11.3	M



Figure 3. Map of northwestern Venezuela depicting the type locality of *Mannophryne phylidros* sp. nov. (red star), and localities of the geographical closest *M. lamarcai* (red circles), *M. caquetio* (red square) and *M. molinai* (red triangle). Records are based on La Marca (1996), Mijares & Arends (1999a, b), Morán *et al.* (2016) and Rojas-Runjaic *et al.* (2018).

tus (Peters, 1872), *Flectonotus pygmaeus* (Boettger, 1893), *Hyalinobatrachium* sp., *Phyllomedusa trinitatis* (Mertens, 1926), *Pristimantis* sp., *Rhinella horribilis* (Wiegmann, 1833), *R. sternosignata* (Günther, 1858), *R. sclerocephala* (Mijares-Urrutia & Arends-R, 2001) and *Scinax rostratus* (Peters, 1863). Only two (*Bolitoglossa* cf. *borburata* and *Mannophryne phylidros* sp. nov.) out of the total 16 amphibians, are endemics of the Sierra de San Luis. This 11% of amphibian endemics is higher than the degree of endemism of the flora of this mountain range (estimated in 6%, Steyermark 1975), although amphibian inventories are far from complete.

There are few mentions of *Mannophryne* frogs reported previously from the Sierra de San Luis. Mijares-Urrutia & Arends (2000) mentioned a "*Mannophryne* sp. 2" from middle to highest elevations of Sierra de San

Luis, coming from the localities of Cerro Galicia, Curimagua, Cataratas de Hueque (Municipio Petit), and near La Chapa (Municipio Miranda). They are considered here as *Mannophryne phylidros* new species. There is a single collared frog specimen reported as *Mannophryne* aff. *caquetio* by Barrio-Amorós *et al.* (2010) from Sierra de San Luis (at Cabure, San José). The latter is probably the same individual depicted in Barrio-Amorós *et al.* (2019), but the lack of museum numbers or more precise information impedes to better ascertain this. This (or these) animal(s) may be conspecific with *M. phylidros* sp. nov., but proper comparisons should await until more specimens or precise data become available. There is a listing of a "*Mannophryne* sp. 1" coming from Sierra de San Luis in Rivas *et al.* (2021, Supporting Information S4 Table). No specific locality nor museum number(s) were given for this mentioning,

making it difficult to ascertain the taxonomic identity of this collared frog.

Ecology. The type series of *Mannophryne phylidros* sp. nov. was collected by day, during the morning hours, along the banks of a mountain stream around the waterfalls known as “Cataratas de Hueque”. Some males were singing among leaf litter in very humid places (C. Gottberg, field notes). The leaf litter on the floor is, according to Ewel *et al.* (1976) the product of some deciduous trees which lose the leaves during the short dry season but is even perceptible during the rainy season.

The type locality (Fig. 4) has a sub-humid climate type, characterized by having a mean annual precipitation between 800 and 1,500 mm, with two dry seasons (usually lasting from 4 to 6 months, mainly between December and April) and one humid season (usually lasting from 6 to 8 months, mainly between July and September). The maximum mean annual temperature is around 25 °C (Pla *et al.* 1978, Diaz Zavala 2009). These climate parameters corroborate that the type locality lies within the Premontane moist forest (bosque húmedo premontano) of Ewel *et al.* (1976), who also indicated that the median annual temperature of this life zone in Venezuela is 18 to 24 °C.

Conservation. *Mannophryne* frogs are currently threatened by a combination of factors, among which the anthropogenic activities seem to play the most important role. In northwestern Venezuela, where the new species was discovered, there are only two other collared frogs known so far: *M. caquetio* and *M. lamarcai*. Both are endangered species that are suffering from habitat destruction (Mijares-Urrutia *et al.* 2008a, b; Barrio-Amorós *et al.* 2010) and both having populations with abnormalities in their feet, attributed to pollution or some other cause (Mijares-Urrutia *et al.* 2008a,b).

Populations of the *Mannophryne phylidros* sp. nov. are currently favored by their occurrence in a protected area (Juan Crisóstomo Falcón National Park), an area of roughly 20,000 hectares that was decreed in 1972. This protected area houses 2,000 ha of evergreen forests at elevations between 200 and 1,500 m asl (Ataroff 2001). In spite of this protection, the evergreen forests in the Petit municipality, where the type locality is situated, were considered under the risk category of “Vulnerable” in the Red Book of Terrestrial Ecosystems of Venezuela (Zager & Carrasquel 2010: 285). The degree of intervention of these forests is medium-to-high, and by its degree of threat they are considered as endangered (Oliveira-Miranda *et al.* 2010: 132, Fig. 1C).

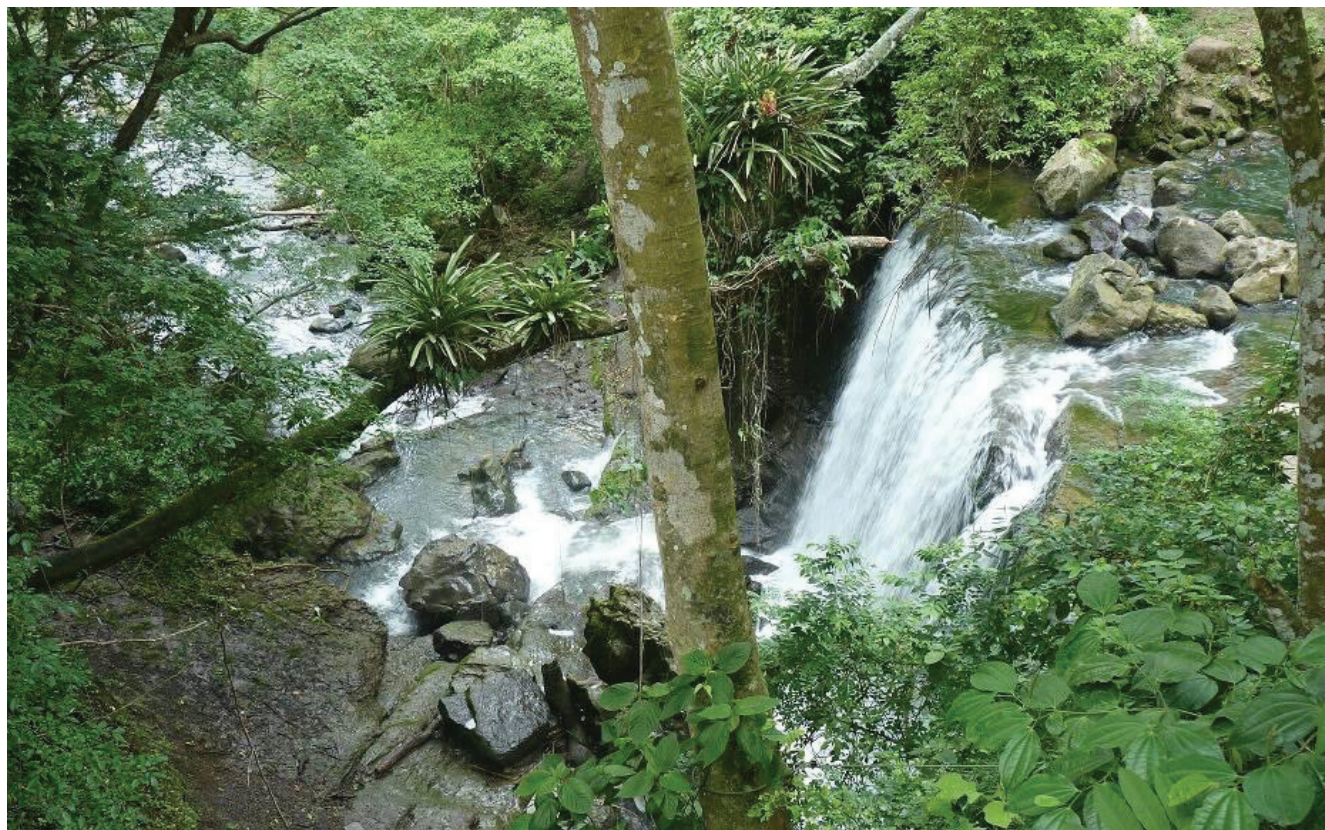


Figure 4. Cataratas de Hueque, type locality of *Mannophryne phylidros* sp. nov. Photo by José R. Ochoa.

Rodríguez Olarte *et al.* (2018) evaluated the state of conservation of the Hueque River basin, based on satellite images, shape files of Venezuelan protected areas (sigot.geoportalsb.gob.ve), data from the Venezuelan Red Book of Ecosystems (Rodríguez *et al.* 2010), and the map of degree of intervention of Venezuelan plant formations (Madi *et al.* 2011). They concluded that the Hueque River basin was in the class 3 (out of 4 classes ranging from good to very-poor conservation), meaning that its state of conservation is poor.

Cataratas de Hueque is a bathing resort, which may pose some level of threat to the local population through pollution, accidental killings or extraction of specimens. We have second-hand information indicating that the general area of the type locality is currently affected by negative practices such as illegal logging to make bonfires, use of soap by the bathers, use of detergents to wash vehicles, garbage accumulation, disposal of organic and inorganic waste, and decomposing plant and animal matter product of Santería rituals that have been in practice since a couple of decades ago.

Although there is paucity of information regarding the population status of the new species, given its reduced distribution, the degree of pollution at the type locality, and the high amount of habitat fragmentation in the region, we recommend applying the IUCN category of Vulnerable (VU). We encourage to do more studies to better understand the biogeography and ecology of the new taxon, to apply a more precise conservation category.

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APPENDIX 1
SPECIMENS EXAMINED

The following specimens all come from Venezuela, South America. Museum acronyms as follows: CVULA: Colección de Vertebrados de la Universidad de Los Andes, Mérida, Venezuela; ULABG: Colección de anfibios y reptiles del Laboratorio de Biogeografía, Escuela de Geografía, Universidad de Los Andes, Mérida, Venezuela.

Mannophryne caquetio. CVULA 8546-8548, CVULA 8549-8550, ESTADO FALCÓN: El Macano, Mapararí, 10 km from Churuguara, 900 m asl.

Mannophryne cf. *caquetio*. ULABG 5579-5583, ESTADO LARA: Aguada Grande, Serranía de Parupano, 1,000 m asl.

Mannophryne cf. *herminae*. ULABG 4506-4508, ESTADO CARABOBO: La Entrada, near Valencia, 10°17'53"N y 68°2'45"W, 530 m asl.

Mannophryne lamarcai. ULABG 4078-4087, Paratypes, ESTADO FALCÓN: Municipio Mauroa, Cerro Socopo, 1,250 m asl.

Mannophryne larandina. ULABG 4800, Holotype, ESTADO LARA: Municipio Morán, Parque Nacional Dinira, Hato Arriba, 1,800 m asl.

Mannophryne molinai. ULABG 7821, Paratype, ESTADO YARACUY: Municipio Sucre, Sierra de Aroa, Quebrada La Rondona, 10°18.7'N y 68°50.9"W, 950 m asl.

Mannophryne phylidros new species. Holotype and paratypes. Specimens' numbers and data given herein.

Mannophryne trujillensis. ULABG 1160, Holotype, ESTADO TRUJILLO: Quebrada Los Cedros, Paseo Los Ilustres, 9°21'46.0"N, 70°26'41.8"W, 840 m asl.