

A NEW SPECIES OF COLLARED FROG (AMPHIBIA: ANURA: AROMOBATIDAE: *MANNOPHRYNE*) FROM THE ANDES OF TRUJILLO STATE, VENEZUELA

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Abstract: We describe a new species of *Mannophryne* frog, coming from Trujillo State, in the Venezuelan Andes, which constitutes the first species of the genus described from that political unit. This new taxon is distinguished from its congeners by the following combination of characters: small size (SVL males 20.1-23.1 mm, females 23.3-27.5 mm); tympanum about ½ the horizontal length of eye; first finger almost equal, or slightly shorter than second; fingers with thick lateral fringes; tarsal fold conspicuous; foot-web formula: I1.0-0.5II1.0-1.0III1.5-0.5IV0.5-2.0V; toes with lateral flaps; short oblique pale inguinal band; collar moderately wide, solid, with small pale blotches; ventrolateral band absent. We provide data on coloration, in life and in preservative, of specimens of the type series, as well as a description of the larvae and ecological data for the species.

Key words: *Mannophryne*, Amphibia, Anura, Venezuela, Andes, taxonomy, natural history, conservation.

Resumen: J.Y. Vargas Galarce y E. La Marca. "Una nueva especie de rana con collar (Amphibia: Anura: Aromobatidae: *Mannophryne*) de los Andes del Estado Trujillo, Venezuela". Describimos una nueva especie de rana *Mannophryne*, proveniente del Estado Trujillo, Andes de Venezuela, que constituye la primera especie descrita en el género proveniente de esta entidad política. Este nuevo taxón se distingue de sus congéneres por la siguiente combinación de atributos: tamaño pequeño (SVL machos 20.1-23.1 mm, hembras 23.3-27.5 mm); tímpano alrededor de ½ de la longitud horizontal del ojo; primer dedo casi igual o ligeramente más corto que el segundo; dedos de la mano con rebordes membranosos gruesos; pliegue tarsiano conspicuo; fórmula de membrana del pie: I1.0-0.5II1.0-1.0III1.5-0.5IV0.5-2.0V; dedos de los pies con flecos laterales; una corta banda clara inguinal oblicua; collar sólido y moderadamente ancho, con manchitas claras; banda ventrolateral ausente. Proveemos datos de coloración de ejemplares en la serie tipo en vida y en preservativo, así como una descripción del renacuajo y datos ecológicos de la especie.

Palabras claves: *Mannophryne*, Amphibia, Anura, Venezuela, Andes, taxonomía, historia natural, conservación.

INTRODUCTION

The "collared frogs" (genus *Mannophryne*) constitute a monophyletic assemblage of neotropical amphibians, of which thirteen species are currently described (La Marca 1994, 1997; Mijares-Urrutia and Arends 1999a,b; Manzanilla *et al.* 2007). They are diurnal and terrestrial inhabitants of humid mountain forests in the Venezuelan Andes and Coastal Range, as well as in Trinidad and Tobago islands (La Marca 1995). Most of the environments where these frogs occur have undergone massive habitat destruction and their current distribution appears as highly patchy or fragmented. This is more evident in Trujillo State, where a long history of human occupation and land use, backing to the pre-Hispanic occupation (Claret 1985) and continuing up to date, have destroyed much of the original forest cover. Explorations in some of these forest remnants have unveiled populations of a collared frog that we regard as an undescribed species. The object of this paper is to describe this new taxon and to provide pertinent biological and ecological information.

MATERIAL AND METHODS

Terminology and methods for adult specimens follow La Marca *et al.* (2004). Measurements (in mm) were taken with a Helios® digital caliper (precision 0.01). Measurements taken for post-metamorphic specimens were snout-vent length (SVL); head length from posterior corner of mouth to tip of snout (HL); head width at level of angle of jaws (HW); eye-to-nostril distance from anterior corner of eye to center of naris (EN); internostril distance (IN); eye length from anterior to posterior corner (EYE); horizontal length of tympanum (T); hand length from proximal edge of palmar tubercle to tip of finger III (HAND); tibia length from outer edge of flexed knee to heel (TL); foot length from proximal edge of outer metatarsal tubercle to tip of toe IV (FOOT). Developmental staging of tadpoles follows Gosner (1960). Terminology for tadpoles follows Mijares-Urrutia (1998) with modifications. Abbreviations for tadpole measurements are: BL= body length, TL= tail length, BH= body height, END= eye-to-nostril distance,

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ESD= eye-to-snout distance, ED= eye diameter, SSD= spiracle-to-snout distance, SDD= spiracle-to-dorsum distance, CMH= caudal musculature height, DFH= dorsal fin height, VFH= ventral fin height, ADW= anterior diastema width, PDW= posterior diastema width, ODW= oral disc width, BW= body width, IOD= interorbital distance, IND= internostril distance.

Geographical coordinates were obtained with a receptor Garmin® GPS map 60 CSx. Type specimens are deposited in the Collection of Amphibians and Reptiles of the Laboratorio de Biogeografía, Universidad de Los Andes, Mérida, Venezuela (ULABG).

DESCRIPTION OF SPECIES

Mannophryne trujillensis sp. nov.
(Figs. 1-7)

Holotype

ULABG 1160, an adult female with deeply convoluted oviducts and eggs 1.2 mm in diameter, from Paseo Los Ilustres, Quebrada Los Cedros, 840 m. elevation, 9°21'46.0"N, 70°26'41.8"W., Trujillo, Estado Trujillo, Venezuela. Collected by Enrique La Marca on 30 November 1984.

Paratypes

ULABG 1150-1159 and 1392-1401, topotypes bearing the same data as holotype; ULABG 1198-1216, from Paragüita, 700 m. elevation, 2 Km East of Flor de Patria, Estado Trujillo, Venezuela; captured by Enrique La Marca and Dexy Borjas on 20 January 1985. ULABG 6845-6846, topotypes, collected by Enrique La Marca, Diego Cadenas and Luis Felipe Esqueda on 26 July 2006.

Etymology

The specific name is a toponym that refers to the political unit of provenance of the type series, the Estado Trujillo, in northwestern Venezuela.

Definition and diagnosis

A small species of *Mannophryne* (SVL males 20.1-23.1 mm, females 23.3-27.5 mm); characterized by (1) skin of dorsum smooth with small inconspicuous flat tubercles in lower back; (2) tympanum with a thick supratympanic fold, about ½ horizontal length of eye; (3) point of snout slightly rounded in both dorsal and lateral views; (4) canthus rostralis not well-defined, between straight and slightly curved; (5) first finger almost equal or slightly shorter than second; (6) disk on third finger about 1.8 times wider than adjacent phalanx; (7) fingers with thick lateral fringes; keel along outer edge of fourth finger, from base of pad to half of the hand, almost reaching thenar; (8) cloacal fold short with entire border; (9) tarsal fold conspicuous, not ending in enlargement or tubercle; (10) foot-web formula: I1.0-0.5II1.0-1.0III1.5-0.5IV0.5-2.0V; (11) toes with lateral flaps; (12) no pale nor dark dorsolateral bands present; (13) disc on fourth toe wider than preceding phalanx; (14) short oblique pale inguinal band; (15) collar moderately wide, solid or with small pale blotches; (16) ventrolateral band absent; (17) marks on venter absent; (18) third finger in males not enlarged; (19) short teeth, not fang-like; (20) lingual papillae absent; (21) pad absent on distal portion of forearm in males; (22) testes cream.

M. trujillensis more closely resembles another wide-collar aromobatid frog: *M. lamarcai* Mijares-Urrutia and Arends, 1999. The new species can be distinguished from the former (characters of *M. lamarcai* within parentheses) by having a wider collar (narrower), less webbing between toes (more webbing, 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(0.5-2.0)-(1.0-2.0)V). Furthermore, *M. trujillensis* lacks a cream canthal stripe surrounding the snout that is so distinctive in specimens of *M. lamarcai*, albeit some specimens of *M. trujillensis* may have heavily dark-stippled cream spots. Additionally, *M. trujillensis* lacks the cream stripe that is present below the tympani in specimens of *M. lamarcai*.

From all other species in the genus having a wide collar, *Mannophryne trujillensis* is distinguished by the combination of characters in its definition. In some specific details, the new taxon is easily distinguished from the remaining wide-collar *Mannophryne* by having a unique foot-web formula between toes IV and V (i.e. IV0.5-2.0V), and by having a larger tympanum in relation to the horizontal length of eye (1/2 versus 1/3 to 2/3) except from *M. yustizi* (La Marca, 1989) that is also 1/2. The later has less amount of webbing between the outermost toes (IV0.5-1.0V versus the unique formula given above for *M. trujillensis*).

Additional characters to distinguish the new species from the other wide-collared *Mannophryne* frogs are as follows. *Mannophryne trinitatis* (Garman, 1887) has low lateral flaps on toes (well developed in *M. trujillensis*), and less amount of web between toes IV and V ((0.0-0.5)-(0.0-0.5) vs. 0.5-2.0 in *M. trujillensis*). *Mannophryne riveroi* (Donoso-Barros, 1965) is a much larger frog (SVL females 43.3 mm, males 35 mm; versus 25.4 mm in females and 21.6 mm in males of the new species) and lacks the oblique inguinal band present in *M. trujillensis*. *Mannophryne oblitterata* (Rivero, 1984) is a much more foot-webbed frog (every pair of toes having webs reaching from two to three phalanges versus less than two in *M. trujillensis*). *Mannophryne caquetio* Mijares-Urrutia and Arends, 1999, *M. collaris* (Boulenger, 1912) and *M. cordilleriana* La Marca, 1994, among other characters, have smaller tympani (2/5 of the horizontal length of eye vs. ½ in *M. trujillensis*). *Mannophryne herminae* (Boettger, 1893) has an internostril distance 1.7 times eye-to-nostril distance (1.5 times in *M. trujillensis*) and a more developed tarsal fold.

Of the *Mannophryne* with narrow collar, the new species is differentiated from *M. olmonae* (Hardy, 1983) and *M. neblina* (Test, 1956) by having a uniformly dark collar (with pale flecks in *M. trujillensis*); additionally, *M. neblina* is a larger frog, with entire pale immaculate lips (a unique character within the genus).

The new taxon is distinguished from the recently described *M. leonardo* Manzanilla *et al.*, 2007, by having more webbed feet (rudimentary foot web in the later) and from an undescribed species, coming from Peninsula de Paria (Manzanilla *et al.*, in press), among other characters, by having a wide collar, as opposed to narrow collar.

Description of Holotype

Head slightly wider than long. Interorbital area smooth, very slightly curved (almost flat); interorbital distance about 1/3 greater than upper eyelid width. Canthus rostralis not well-defined, between straight and

slightly curved. Nares slightly elevated, directed laterally and slightly backwards; nares closer to tip-of-snout than to eye. Loreal region almost vertical, slightly concave, descending abruptly to lips. Snout sub-ovoid in dorsal view (cf. Fig. 1); tip of snout slightly rounded in both dorsal and lateral view. Horizontal length of eye about 1.7 times eye-to-nostril distance. Internostril distance about 1.5 times eye-to-nostril distance. Tympanum separated from eye about $\frac{1}{2}$ its horizontal length; thick supratympanic fold, covering both lower and posterior upper parts of tympanum; tympanic ring well defined, with both anterior and ventral ridges slightly elevated. Mouth rictus with one to three tubercles. Tongue spatulate, wider and with an entire border in its posterior end; about twice longer than wide and its width about $\frac{1}{3}$ mouth width; posterior $\frac{1}{2}$ not adherent to floor of mouth. Lingual papillae absent. Choanae rounded with its anterior part concealed by palatal shelf of maxillary arch. Maxilla and premaxilla toothed; teeth short, not fang-like.

Dorsum smooth on anterior part, bearing small inconspicuous tubercles on lower back. Flanks with low, inconspicuous tubercles, look almost smooth. Throat, chest and venter smooth. Upper arm and forearm bearing inconspicuous tubercles; a small, inconspicuous tubercle on distal end of ventral surfaces of forearm; metacarpal tubercle not well-defined; palmar tubercle oval, almost rounded in outline, about 1.5 times the size of thenar; thenar tubercle oval, about twice longer than wide; no supernumerary tubercles; subarticular tubercles moderate-sized, flattened, rounded to oval in shape, largest on first finger; small pads on fingers, pads wider than long, largest pad on third finger, about $\frac{1}{3}$ size of tympanum and about 1.8 times wider than adjacent phalanx. Fingers free, with thick lateral fringes; keel along outer edge of fourth finger, from base of pad to half of the hand, almost reaching to thenar. First finger almost equal, or slightly shorter than second (cf. Fig. 2); third finger in males, not enlarged; disks on fingers rounded, with two oval, well-defined dorsal scutes.

No tubercles on any surfaces of posterior extremities. Length of

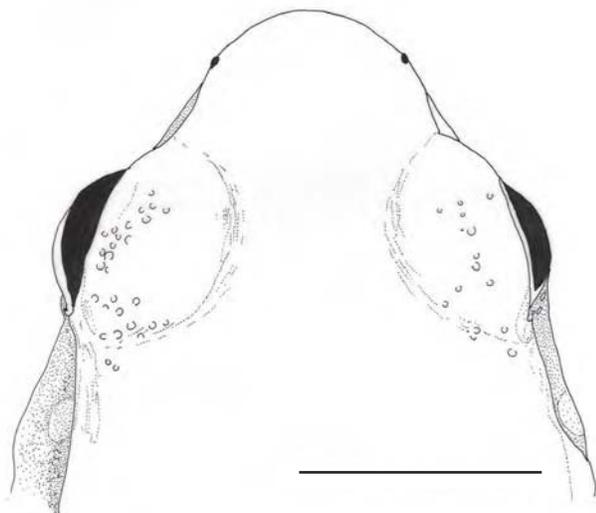


FIG. 1. Dorsal view of head of *Mannophryne trujillensis* (paratype ULABG 1198), Paragüita, Trujillo State, Venezuela. Scale= 5 mm.

Vista dorsal de cabeza de *Mannophryne trujillensis* (paratipo ULABG 1198), de Paragüita, Estado Trujillo, Venezuela. Escala= 5 mm.



FIG. 2. Left hand (ventral view) of *Mannophryne trujillensis* (paratype ULABG 1198). Scale= 5 mm.

Mano izquierda (vista ventral) de *Mannophryne trujillensis* (paratipo ULABG 1198). Escala= 5 mm.

tibia about 47% snout-to-vent distance. Tarsal fold conspicuous, not ending in tubercle nor having a distal enlargement; inner metatarsal tubercle elongated; outer metatarsal tubercle oval, shorter than inner metatarsal tubercle; subarticular tubercles oval, flattened. Toes moderately webbed; foot web formula: I1.0–0.5II1.0–1.0III1.5–0.5IV0.5–2V; toes with lateral flaps; largest toe disk on second toe (cf. Fig. 3). Heels do not overlap when thighs are held at right angles to body axis.

Coloration of holotype in preservative

Dorsum pale brown with little dark dots and a relatively large irregular spot spread for all around dorsum; head paler than dorsum; numerous cream spots with smaller dark brown dots, from the medium part of tympanum to venter; lower lip paler than upper lip. Lower part of tympanic fold and lower eyelid are pale-cream; palpebral membrane transparent with a dark brown edge. Loreal region dark brown, alike the rim of nostril. There are cream spots distributed all around the arm. Phalanges begin with a transversal cream stripe followed by a dark brown stripe with small cream dots; both colour stripes being alternate. Discs on fingers II and IV dark brown and the discs III and I are cream. Flanks mostly as dark as dorsum. A discontinuous cream stripe extends from angle to half of flank and continues in form of little pale brown spots, until insertion of arm.

There is a cream spot in the inguinal region that follows perpendicular to half of thigh. Ventral area between shank and thigh is brown, coloration that fades towards its posterior region. Thigh with cream spots of different sizes, mostly concentrated on its posterior surface. Tarsi, metatarsi and phalanges light brown with little cream spots that become more prominent toward the phalanges, where they form stripes that cover the subarticular tubercles. Discs on toes are dark brown.

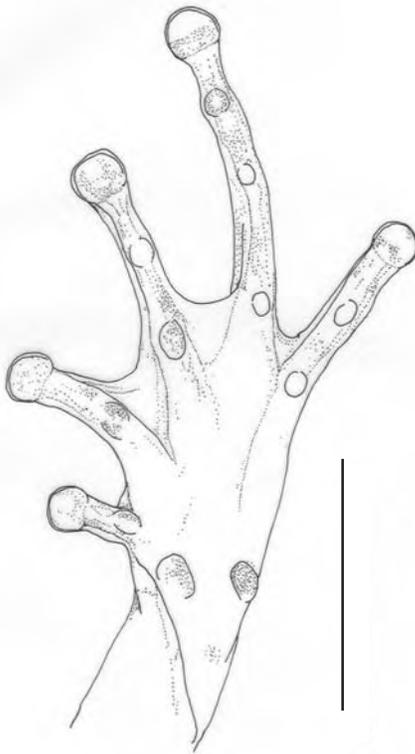


FIG. 3. Left foot (ventral view) of *Mannophryne trujillensis* (paratype ULABG 1198). Scale= 5 mm.

Pata izquierda (vista ventral) de Mannophryne trujillensis (paratipo ULABG 1198). Escala= 5 mm.

Ventral region cream-colored, except under the legs which are yellowish. Edge of lower lip with small pale brown dots. The collar is solid and moderately wide, with small pale blotches. Upper part of forearm with disperse pale brown dots, while ventrally it has a dark brown blotch that continues onto hand, covering all of it except the discs on fingers I, II and III, which are cream. Finger-pads gray. Lateral edges of venter with pale brown spots with cream dots inside. Lateral edges of thighs covered by a dark-brown blotch with little cream spots. Lateral edges of shanks with elongate dark-brown blotches. Under portions of tarsi covered by pale-brown dots. Soles pale brown with cream spots. Upper part of discs on toes, and toe-pads, pale gray; interdigital membranes cream.

Coloration of type series in life

The holotype possessed a marbled dorsum; black collar; yellow throat, with anterior part gray, posterior part yellow; white venter; yellow stripe in front of arms, reaching almost to corner of mouth; yellow inguinal stripe; yellow spots on flanks (E. La Marca, field notes 30 November 1984).

The coloration for the paratopotype series ULABG 1151 to 1157, from Trujillo city, is on records as follows: collar dark brown, blackish to almost black; or dusted with yellow on posterior part. Posterior part of throat intense-yellow with white lateral borders, anterior part whitish or gray (sometimes, a white coloration borders the yellow on the sides). Chest and venter are white or grayish-white. Yellow tinge or yellowish spots present on the border between flanks and venter.

Oblique inguinal band between pale yellow to intense yellow, reaching to mid-flank, where it turns to brown up to arm insertion. Undersides of thighs pale gray, lead-gray or with a pale-violet tinge. Posterior surfaces of thighs with yellowish-white minute dots. Dorsum almost uniformly brown, dark brown, dark-brown with pale spots, or ashy-brown. Cross-bars on thighs pale brown, inconspicuous (sometimes absent). Dermal scutes present on digit-tips, pale-blue. Base of tympanum pale-gray, while the iris is pale-brown (E. La Marca, field notes 29-30 November 1984).

The coloration for the paratype series ULABG 1198 to 1216, from Paragüita, near Flor de Patria, was recorded as follows: collar wide, blackish, without reticulations, reaching laterally to mandibles in males; with white stippling in females. The throat is gray to dark gray, sometimes with yellow in posterior part or with two yellow spots on chest at the level of the scapular girdle in males; intense yellow in females. Chest is uniformly intense yellow, or with anterior part gray, or uniformly gray, in females. Venter, in males, white or grayish, except on posterior part that is dirty white. Venter, in females, yellow or whitish, or gray with posterior part white. Inguinal yellow-greenish or pale green spots sometimes present in females. Inguinal oblique band is coppery or yellowish (sometimes with an infra-posterior yellow spot) in males; yellow or pale yellow in females. Undersides of thighs are uniformly gray in males; pale green in proximal or distal parts in females. Proximal ventral parts of shanks gray to greenish-yellow in males and females. Tubercle at rictus has a copperish tinge (E. La Marca, field notes 20 January 1985).

Adult female paratopotype ULABG 6846 (Fig. 4) had an intense yellow throat, with lateral and anterior parts gray (Fig. 5). The collar was solid black, with some gray markings on its posterior border. Chest and venter intense yellow, with some irregular white spots. Under parts of thighs grayish. Shanks, below, yellowish-gray. Palms and soles dark gray. Iris pale caramel. Yellow inguinal band ending as diffuse spots near insertion of arm. Upper parts of legs with dark wide bands that alternate with narrower grayish-cream bands. Top of head dark brown. Dorsum with large dark brown spots on a dark brown-greenish background. Some elongate pale brown markings on shoulders. Arm and forearms with dark brown bands. Base of arm yellowish-cream. Dark loreal band. Grayish band, bearing dark spots, on upper lip, crossing the lower half of tympanum and almost reaching the arm pit. Dermal scutes on digits pale-gray. Narrow pale-gray bands on fingers and toes. Tongue yellowish-cream. Two short cream bands on each side of cloacal opening. Upper part of thighs, marbled (E. La Marca, field notes 1 August 2006).

Variation

The yellow throat coloration in females becomes more intense as females grow larger. Old mature females have intense yellow venters, while subadult and young adult females have white venters (Fig. 5). The collar, in females, ranges from solid to reticulate, the later resembling some *Mannophryne herminae* from Rancho Grande (Aragua State). The yellow inguinal band can be short or extending to reach almost the base of arm. Base of forearm can be yellowish cream to pale brown. Dark bands on legs can be conspicuous or inconspicuous.



FIG. 4. Adult female of *Mannophryne trujillensis* (paratype ULABG 6846) from Quebrada Los Cedros at Park “Los ilustres”, in Trujillo City, Venezuela. From a digital picture by E. La Marca.

Hembra adulta de Mannophryne trujillensis (paratipo ULABG 6846) de Quebrada Los Cedros en el Parque Los ilustres, Trujillo, Venezuela. De una fotografía digital por E. La Marca.

Variation in measurements of the type specimens is given in Table 1; data are arranged according to the places of origin of the populations.

In comparison to the holotype, toe-webbing could be more extensive between toes I and II (e.g. I1½-III in ULABG 1157, 1206 and 1210; I2-III in ULABG 1205), less or more between toes II and III (e.g. III1½-III in ULABG 1157 and 1205-1206; II½-III in ULABG 1202, 1210 and 1212), more between toes III and IV (e.g. III2-IV in ULABG 1202 and 1212, III1½-IV in ULABG 1205-1206, III2-1½IV in ULABG 1210, III1½-1½IV in ULABG 1157), and variable between toes IV and V (e.g. IV1½-2V in ULABG 1157, IV½-1½V in ULABG 1198, IV1-1½V in ULABG 1202, 1205-1206, 1210 and 1212).

ULABG 1198 has the right hand with atrophied phalanges; ULABG 1204 has the right foot larger (about 1.8 mm larger) than the left foot; ULABG 1211 lacks the second finger on left hand, apparently a malformation; ULABG 1154 presents syndactyly in three toes except the first one, and a toe is missing through malformation; ULABG 1151 and 1216 have small skin lesions (unpigmented blotches, muscles sometimes can be seen through translucent skin).

Tadpoles

The following account describe specimens in developmental stages 30 and 31 (Gosner 1960), lot ULABG 1161, all coming from the type locality. They are assigned tentatively to the new species on the basis of resemblance to other *Mannophryne* tadpoles. No other amphibians are known from this locality.

Body elongate and oval in dorsal view, depressed (wider than deep); widest in the first 1/3 of body length; deepest at about half-length of body. Snout broadly rounded in dorsal view. Eyes directed



FIG. 5. Ventral views of female paratype specimens (left, ULABG 6846; right, ULABG 6845) of *Mannophryne trujillensis*. Photo by E. La Marca.

Vistas ventrales de ejemplares paratipos hembras (izquierda, ULABG 6846; derecha, ULABG 6845) de Mannophryne trujillensis. Foto por E. La Marca.

TABLE 1. Measurements of metamorphosed *Mannophryne trujillensis*. Mean and standard deviation (above), with the range of variation (within parentheses). Abbreviations explained in materials and methods. F= females, M= males.

TABLA 1. Medidas de *Mannophryne trujillensis* post-metamórficos. Media y desviación estándar (arriba), con rango de variación (entre paréntesis). Abreviaciones, explicadas en la sección de materiales y métodos. F= hembras, M= machos.

LOCALITY	SEX	N	SVL	TL	HW	HL	T	EYE	EN	IN	HAND	FOOT
Paseo Los Ilustres	F	14	24.2±2.7 (20.1-27.5)	12.1±1.0 (10.1-13.3)	8.6±1.1 (7.1-10.3)	7.5±0.9 (6.1-9.0)	1.4±0.2 (1.2-1.7)	3.3±0.3 (2.6-3.9)	2.2±0.2 (1.9-2.7)	3.1±0.3 (2.5-3.6)	6.5±0.6 (5.6-7.5)	11.2±1.1 (8.7-12.6)
	M	6	20.5±3.0 (17.4-20.0)	10.5±1.4 (8.9-12.7)	7.6±1.5 (6.0-10.1)	6.3±0.7 (5.5-7.3)	1.3±0.2 (1.1-1.6)	2.8±0.3 (2.5-3.4)	2.0±0.3 (1.6-2.5)	2.7±0.4 (2.1-3.3)	5.6±0.9 (4.8-7.3)	9.9±1.9 (7.8-13.2)
Paragüita	F	9	22.7±2.4 (19.8-26.6)	11.7±1.1 (10.1-13.2)	8.8±1.1 (6.9-9.9)	7.2±0.8 (6.2-8.7)	1.5±0.3 (1.0-1.9)	3.1±0.2 (2.8-3.4)	2.0±0.2 (1.8-2.4)	3.0±0.2 (2.8-3.2)	5.9±0.5 (5.1-6.4)	10.6±1.1 (9.2-12.2)
	M	9	21.1±1.6 (18.6-23.1)	11.0±0.6 (10.3-12.2)	7.8±0.8 (6.8-8.9)	6.8±0.7 (6.0-8.3)	1.3±0.2 (1.0-1.6)	2.9±0.3 (2.4-3.2)	1.9±0.2 (1.7-2.3)	3.0±0.2 (2.7-3.2)	5.6±0.5 (4.8-6.2)	9.7±1.1 (8.2-11.2)

dorso-laterally. Nostrils dorsolateral and directed antero-laterally, closer to eye than to tip-of-snout, about 33.3% distance from tip-of-snout to anterior border of eye. Nostril-opening with semicircular shape. Edges of nostrils without ring. Internostril distance wider than interorbital distance. Chondocranial elements visible or not through skin of head. Spiracle localized at upper left side of the anterior part of body, conspicuous, forming a short tube completely attached to skin of body. Spiracle opening directed postero-dorsally at about 59% distance from tip-of-snout to posterior end of body. Cloaca in caudal position. Cloacal tube short, with dextral opening. Dorsal fin arising on body, slightly anterior to body-tail juncture. Ventral fin begins upon the tail. Length of caudal musculature shorter than total tail-length. Dorsal fin deeper than or about equal to ventral fin at about half the length of tail. Caudal musculature strong, with well-developed miomeretes. Longitudinal tail-axis straight. Caudal musculature tapering gradually to end of tail. Tip-of-tail acutely rounded. Posterior legs intra-parallel with respect to cloacal tube. Posterior legs without dermal folds (Fig. 6).

Oral apparatus normal (i.e. with keratinized parts, without noticeable variation in their configuration along the pre-metamorphic stages), relatively small, directed ventrally at tip-of-snout. Oral apparatus medium-sized in relation to body width, located antero-ventrally and possessing lateral folds. Oral disc intra-angular (with lateral inflexions). A single row of small and blunt alternating papillae, separated by a wide rostral diastema on anterior border of the oral apparatus. Intra-marginal papillae absent. Beaks ("querastostoma" of Mijares-Urrutia 1998) completely keratinized. Upper beak broadly arched, bearing narrow lateral extensions; lower beak broadly V-shaped. Acute serrations on both beaks; serrations on lower beak stronger than serrations on upper beak. Two upper and three lower rows of keratodonts ("denticles"); upper rows slightly larger than lower rows; first upper row complete; second upper row medially separated by a short gap, first lower row medially divided by a very short gap; second and third lower rows entire. Larger keratodonts tend to be on first lower row. Keratodonts on all rows well keratinized (Fig. 7).

Coloration in preservative: dorsum pale brown with dark brown fleckings; ventral fin translucent; dorsal fin translucent with numerous brown fleckings.

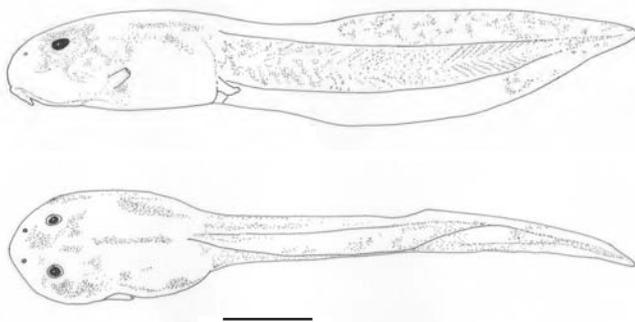


FIG. 6. Dorsal and lateral view of a tadpole of *Mannophryne trujillensis* (stage 31, lot ULABG 1161). Scale=5 mm.

Vistas dorsal y lateral de un renacuajo de *Mannophryne trujillensis* (estadio 31, lote ULABG 1161). Escala=5mm.

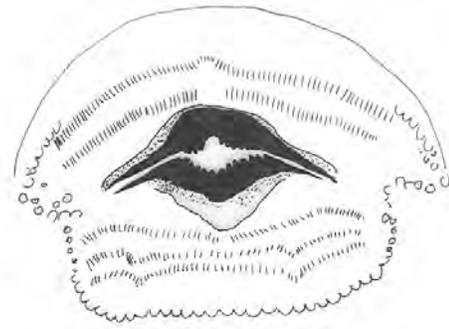


FIG. 7. Oral apparatus of a tadpole of *Mannophryne trujillensis* (stage 31, lot ULABG 1161). Scale= 1 mm.

Aparato oral de un renacuajo de *Mannophryne trujillensis* (estadio 31, lote ULABG 1161). Escala= 1 mm.

Measurements of tadpoles

Abbreviations as explained in the Material and Methods section. Measurements expressed as a mean, followed by standard deviation, and range within parentheses. BL= 10.3 ± 0.7 (9.3-11.5), TL= 21.5 ± 1.9 (19.1-24.0), BH= 4.4 ± 0.4 (3.9-4.9), END= 2.2 ± 0.2 (2.0-2.3), ESD= 2.5 ± 0.1 (2.4-2.6), ED= 0.9 ± 0.1 (0.8-1.1), SSD= 6.1 ± 0.4 (5.4-6.6), SDD= 2.8 ± 0.3 (2.3-3.1), CMH= 2.0 ± 0.1 (1.8-2.2), DFH= 1.7 ± 0.2 (1.5-1.9), VFH= 1.2 ± 0.1 (1.0-1.4), ADW= 1.2 ± 0.4 (0.8-2.0), PDW= 1.4 ± 0.2 (1.2-1.6), ODW= 2.5 ± 0.2 (2.2-2.7), BW= 5.6 ± 0.3 (5.1-5.9), IOD= 1.8 ± 0.2 (1.6-2.1), IND= 1.3 ± 0.2 (1.1-1.6).

Ecological notes

Mannophryne trujillensis inhabits semi-deciduous forests in Trujillo State. It is possible that the species occurs in many of these herpetologically unexplored places in the Andes of northwestern Venezuela. Most of the original semideciduous forests have been destroyed or highly modified for agricultural purposes (mainly coffee plantations); they can be considered among the most threatened ecosystems in the Venezuelan Andes. *Mannophryne* populations still survive in some of these places, but we lack long-term monitoring studies to assess properly their conservation status.

The ecology of the species is largely unknown. However, there are scanty worth-noting ecological data. Most specimens in Parque Los Ilustres were found on rocks and vegetation (submersed roots) in a stream Quebrada Los Cedros that runs across this urban park in Trujillo city. Some frogs were collected under rocks. Some of the collecting places had solid waste (Fig. 8) and a water pH value of 5.75. The water in the stream reached a temperature of 24 °C at 14:45 hours.

One natural predator of the new species could be the colubrid snake *Liophis melanotus* Shaw, 1802; a specimen of the later (ULABG 1162) was collected at the type locality and feed on adult specimens of the new species while kept in captivity. Pseudotelpusidae fresh water crabs, also present at the type locality, could be potential predators of the larvae as inferred from observations on its feeding on tadpoles under captivity conditions. Specimens from Paraguita come from a stream in a hilly sector behind the small town of Flor de Patria, in



FIG. 8. Detail in type locality of *Mannophryne trujillensis*. Note solid waste in stream. Photo by E. La Marca, 26 July 2006.

Detalle en la localidad tipo de Mannophryne trujillensis. Note la presencia de desperdicios sólidos en la quebrada. Foto por E. La Marca, 26 julio 2006.

Trujillo State, close to the city of Trujillo. By the time of collection, the place was forested, with a more or less undisturbed cover of semi-deciduous trees. Since the last decade of the last century, the place has undergone a strong human transformation, due to urbanization (Fig. 9). The populations at the two only known places of occurrence for the species still survive in low numbers, but no conservation assessment can be forwarded at this moment due to the lack of monitoring studies.

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FIG. 9. Forest destruction and urbanization in Paragüita, close to Flor de Patria town, Trujillo State. Photo by E. La Marca, 26 December 2006.

Destrucción de selva y urbanización en la localidad de Paragüita, cerca del pueblo de Flor de Patria, Estado Trujillo. Foto por E. La Marca, 26 diciembre 2006.

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