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A NEW SPECIES OF TOAD IN THE GENUS *BUFO* FROM PARÁ, BRAZIL, WITH AN UNUSUAL BREEDING SITE

JANALEE P. CALDWELL

ABSTRACT

A new species of toad in the Bufo typhonius species group is described from Pará, Brazil. The new species appears to be the smallest member of this group. It occurs in sympatry at the type locality with Bufo typhonius. In this locality, B. typhonius breeds in large congregations around small ponds or temporary aquatic habitats, whereas the new species breeds singly, primarily in the fallen fruits of the Brazil nut tree, Bertholletia excelsa.

INTRODUCTION

While conducting field work in the state of Pará, Brazil, at a site near the Rio Xingu, I frequently observed toads of the *Bufo typhonius* complex. Ecological observations and morphological data subsequently revealed that two species were present. One, a relatively large species, is referable to *Bufo typhonius* Linnaeus. The other, smaller species is new and is herein described as:

***Bufo castaneoticus*, sp. n.**

(Figs. 1A, 2)

Holotype. — MZUSP 67162 (original field number JPC 6531), an adult female collected in primary lowland rain forest near Cachoeira Juruá, Rio Xingu, State of Pará, Brazil, on 24 January 1987 by Janalee P. Caldwell and Laurie J. Vitt. The type locality is approximately 03° 22' S, 51° 51' W on the international millionth map (sheet SA-22; Carta do Brasil (1:1,000,000). Instituto Brasileiro de Geografia, 1972, ed. 2).

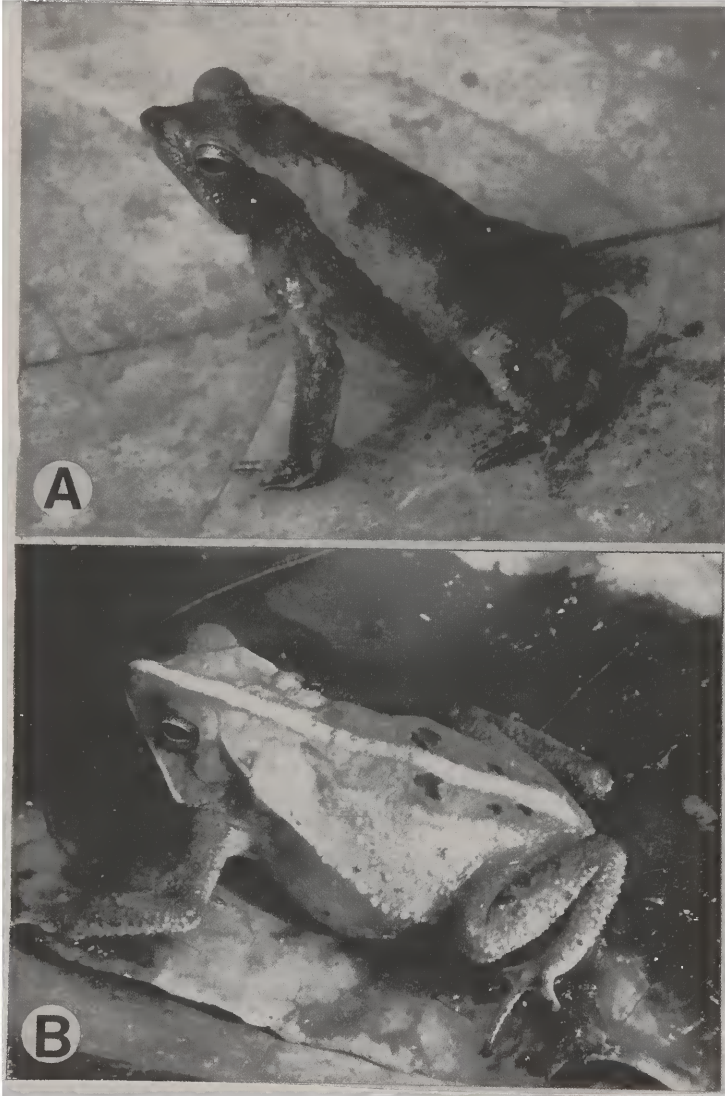
Allotype. — MZUSP 67192 (original field number, JPC 7258), an adult male, collected at the type locality on 5 March 1987 by Janalee P. Caldwell.

Paratypes. — The type series includes 19 adult females, 17 (MZUSP 67156-7; 67159; 67163-65; 67167-71; 67173; 67180-81; 67183; 67185; and 67191) from the type locality and two (MZUSP 67188 and 67196) from 11 and 13 km NW of the type locality. The type series also includes ten adult males, seven from the type locality (MZUSP 67158, 67160-61; 67172; 67174; 67179; and 67184) and three from 11 and 13 km N of the type locality (MZUSP 67189; 67193; and 67195).

Diagnosis. — A member of the *Bufo typhonius* complex (sensu Hoogmoed (1986, 1990; Duellman, 1991), *B. castaneoticus* differs from sympatric *B. typhonius* by its smaller size and lack of enlarged supratympanic ridges, enlarged vertebral knobs, and a lateral row of enlarged tubercles along the sides. In addition, the new species has an acutely pointed snout compared to the more truncated snout of *B. typhonius*.

Department of Zoology and Oklahoma Museum of Natural History, University of Oklahoma, Norman, Oklahoma 73019.

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Figs. 1A and 1B. (A) *Bufo castaneoticus*, sp. n., adult male, SVL 34.3 mm. MZUSP 67193 (original field no. JPC 7271). (B) *Bufo typhonius*. Adult male, SVL 54.4 mm. MZUSP 67095 (original field no. JPC 6362).

Of the three additional species retained in the group by Hoogmoed (1990), *B. castaneoticus* is the smallest. The largest female *B. castaneoticus* has a SVL of 42.6 mm, whereas sizes of other females in the group are: *B. dapsilis*, 77 mm; *B. nasicus*, 66.5 mm; and *B. ceratophrys*, 83.4 mm.

Description of Holotype. — Snout-vent length, 39.0 mm; head width, 12.7 mm at angle of jaws; head shorter than wide; head length from tip of snout to angle of jaw, 11.3 mm; snout acutely pointed, elongate, protruding above the lower jaw in lateral profile; internarial distance, 2.6 mm; canthus slightly concave; top of head flat; weak knobs at angles of jaws; supraorbital crest only slightly developed posterior to orbit, continuous with supratympanic crest; parotoids not well developed, triangular, pointed posteriorly, surface pitted; parotoids 3.3 mm in width and 5.8 mm in length; tympanum present but indistinct, 2.6 mm in diameter.

Skin of dorsum and limbs covered with low spicules, becoming more numerous and larger on outer edges of limbs, dense on upper jaw; sides lacking a lateral row of tubercles; skin of venter coarsely granular.

Upper arms relatively slender; digits long; tips of digits slightly bulbous; finger lengths, shortest to longest: IV-II-I-III; rudimentary webbing between all fingers; edge of webbing spinulose; thenar tubercle oval, approximately one-third the size of palmar tubercle; both tubercles low; subarticular and supernumerary tubercles present, filling almost all area on palm (Fig. 2A).

Hind limbs slender; inner metatarsal tubercle oval, approximately three times as large as outer; plantar surface with conical subarticular and many supernumerary tubercles; webbing formula: I1-1/II1-2/III1-3/IV3-1 1/2V; edge of webbing spinulose (Fig. 2B).

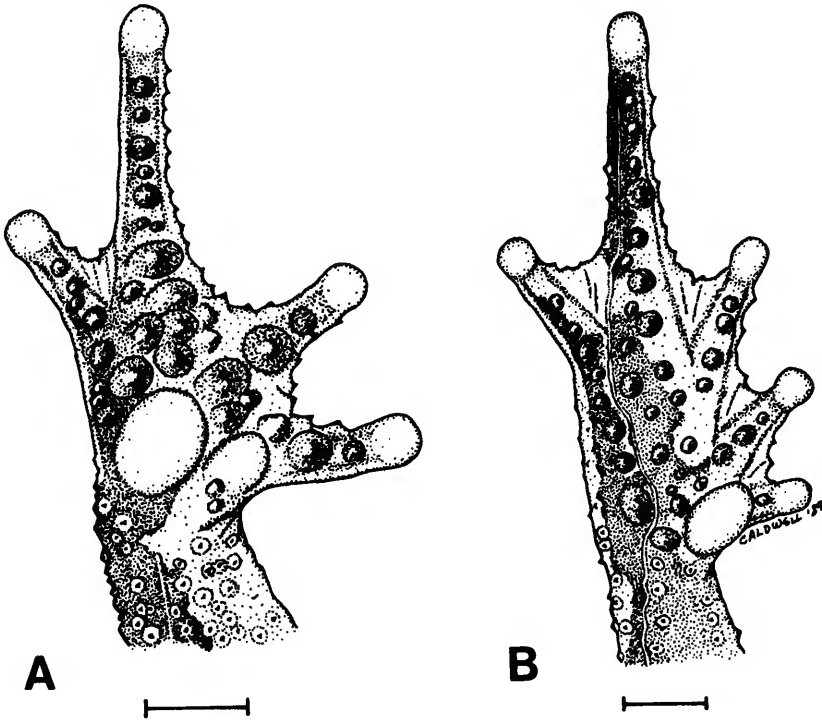
Color in preservative: dorsum with leaf-like pattern in shades of dark to light brown; dark brown triangular area on head, beginning posterior to eyes; sides of head with irregular brown vertical stripes on a light background; an irregular dark brown lateral stripe from tip of snout, along canthus, posterior to eye below parotoids, through groin to knee. Dark brown stripes across third finger, forearm, elbow, and proximal upper arm; dark brown stripes matching on upper leg and tibia when leg folded, also on shank and fourth toe; dark brown stripes on outer edge of forearm and shank; venter and throat creamy with small areas of brown flecking on throat and anterior portion of belly; very faint middorsal hairline stripe; color in life similar to that in preservative; eye in life greenish-yellow with black reticulations.

Variation. — The type series includes 19 adult females, 17 from the type locality and two paratopotypes from 11 and 13 km NW of the type locality. Of these 19 females, 6 (31.5%) have no middorsal stripe, 7 (37%) have a hairline middorsal stripe, and 6 (31.5%) have a wide middorsal stripe. Eleven (58%) have a plain dorsum, while 8 (42%) have an irregularly mottled leaf-like pattern. Thirteen (68%) have a distinct tympanum, whereas 6 (32%) have an indistinct tympanum. Two of the 19 (11%) have a distinct light line on the upper lip. Both of the latter have broad middorsal light stripes that are continuous across the tip of the snout with the lip line. The dorsal surfaces of all females have small spicules, although these are more prominent in some individuals than in others. Variation in and proportions of morphometric measurements are presented in Tables 1 and 2.

The type series also includes ten adult males, seven of which are paratypes, and three of which are paratopotypes from 11 and 13 km N of the type locality. Of these, four (40%) have no middorsal stripe, four (40%) have a hairline middorsal stripe, and 2 (20%) have wide middorsal stripes. Four (40%) have a mottled-leaf pattern on the dorsum, and six (60%) have a plain dorsum. Two (20%) have a light line bordering the upper lip. The dorsal surfaces are smooth in all males, in marked contrast to females. Proportions and morphometric variation are presented in Tables 1 and 2.

The allotype has a SVL of 36.8 mm. It differs from the holotype in having a distinct tympanum 2.5 mm in diameter, skin on the dorsum and upper surfaces of the limbs smooth, a stouter forearm, and fine nuptial excrescences on the dorsal surfaces of the first and second fingers. The vocal slits extend from a point about two-thirds posterior to the tip of the maxilla on the floor of the mouth to the angle of the jaw. There is a single subangular vocal sac, not distinct in color from the throat.

Etymology. — The species name is derived from the Latin/Portuguese *castanea/castanha* (chestnut) + the Latin adjectival suffix *-(t)icus* (belonging to); the connective *o* (rather than the usual



Figs. 2A and 2B. Holotype of *B. castaneoticus*, sp. n., MZUSP 67162. (A) Right hand. (B) Right foot. Scale - 2 mm.

Latin *i*) is inserted for euphony. The allusion is not to the European chestnut tree (*Castanea*) but rather to the tropical South American Brazil nut tree (*Bertholletia excelsa*, family Lecythidaceae), whose Brazilian common name is "Castanha do Pará" and whose fallen fruit capsules are the breeding site of this small *Bufo*.

Comparison of *Bufo castaneoticus* and *Bufo typhonius*. — A series of 13 adult female (MZUSP 67096; 67098; 67100; 67103; 67122; 67127-28; 67136; 67139; 67143-44; 67146-47) and 24 male (MZUSP 67095; 67097; 67099; 67101; 67121; 67127; 67129-34; 67138; 67140-42; 67148-55) *B. typhonius* is available from the type locality of *Bufo castaneoticus* (Fig. 1B). The largest female and male are 72.9 mm and 55.8 mm, respectively, whereas the largest female and male of *B. castaneoticus* are 42.6 mm and 36.8 mm, respectively. Excluding the three subadult females in the *B. typhonius* series, the smallest *B. typhonius* female (46.1 mm) is larger than the largest female *B. castaneoticus* (42.6 mm).

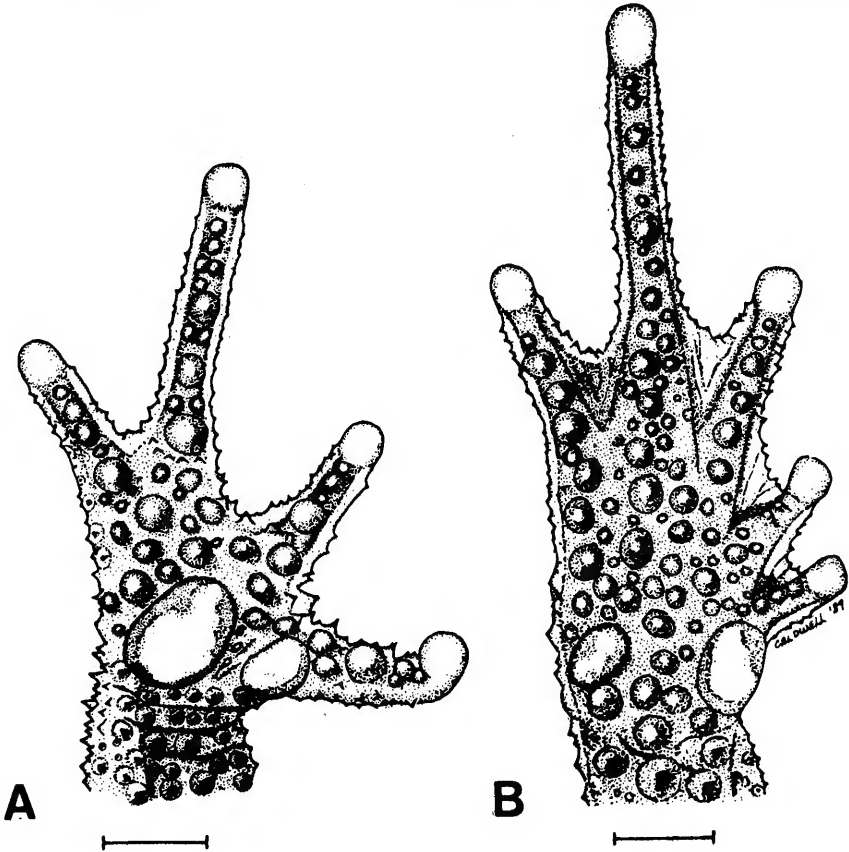
All *B. typhonius* females in the series except three small subadults (MZUSP 67094; 67137; and 67145) have greatly expanded supraorbital and supratympanic flanges. The parotoids are distinct and raised. A single row of large conical tubercles originates on the outer edge of the parotoid and extends

laterally to the groin. These tubercles are generally cream-colored and stand out against the darker ground color of the dorsum and sides. Middorsally, the skin is smooth; toward the posterior portion of the dorsum and the sides, small spicules are present. The limbs are heavily covered with spicules. Prominent vertebral knobs, lacking in *B. castaneoticus*, are present in females larger than 50 mm in SVL.

The most common color pattern of these females is a brown dorsum with one to four black sacral spots (75%, 12 of 16). The other four specimens have a plain dorsum. Three (19%) have no middorsal stripe, ten (62%) have a hairline middorsal stripe, and three (19%) have a wide middorsal stripe. Four of the specimens have a distinct light line on the upper lip.

Like *Bufo castaneoticus*, *B. typhonius* has large subarticular tubercles and many supernumerary tubercles on the hands and feet (Fig. 3).

Of the 24 *B. typhonius* males, five (21%) have no middorsal stripe, 15 (62%) have a hairline middorsal stripe, and four (17%) have a wide stripe. Of the 24, 10 (42%) have a mottled-leaf pattern and 14 (58%) are plain; of the plain specimens, seven have from one to three small black sacral spots.



Figs. 3A and 3B. *B. typhonius*, MZUSP 67147, adult female, SVL 72.9 mm. (A) Right hand. (B) Right foot. Scale = 3 mm.

Supraorbital and supratympanic flanges are present in all males, even the smallest, although they are never as enlarged as in the largest females. The lateral row of tubercles is also present in males but is not as conspicuous as in females.

Nine of the 24 males have dark gray to black throats; in the others, the throat is dirty white with some black flecking. Bellies vary from heavily mottled gray and off-white to white with only a few brown flecks. Four of the 24 specimens have a distinct white line on the upper lip; as in the other groups, this is often correlated with having a wide light middorsal stripe.

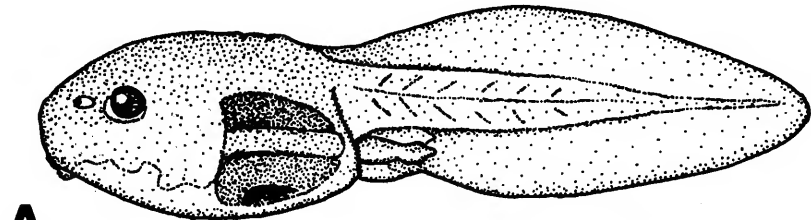
TADPOLE DESCRIPTIONS

Bufo castaneoticus. — A typical tadpole in Stage 34 (Gosner, 1960) (MZUSP 68230; original field no. JPC 6796) is 11.5 mm in total length and 4.8 mm in body length (Fig. 4A). Body depressed, wider (3.5 mm) than deep (2.9 mm); snout bluntly rounded in dorsal view and rounded in profile; nostrils located dorsally and directed dorsolaterally; longest axis of narial opening is 0.4 mm; distance from anterior edge of nostril to tip of snout 0.6 mm; internarial distance 0.5 mm; eyes located dorsally and directed dorsolaterally; diameter of the eyeball 0.5 mm; intraocular plane at anterior-most point of eyes 1.2 mm from midpoint of snout; intraocular distance 0.8 mm.

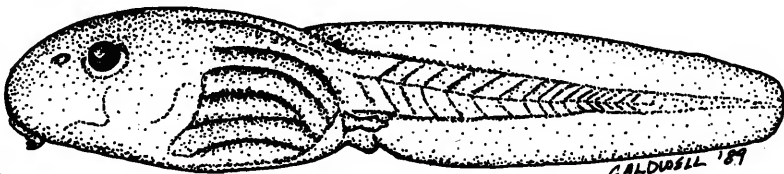
Spiracle sinistral and positioned slightly below lateral midline, 3.4 mm posterior to snout; vent tube, 1.0 mm in length, located on midline.

Length of tail 6.6 mm; depth of tail 3.0 mm; dorsal and ventral fins of equal length, 1.0 mm, and equal to the depth of tail musculature; dorsal fin originates just anterior to junction of tail and body.

Oral disc anteroventral, 1.4 mm in width (40% of the maximum width of body), laterally indented with a single row of papillae only on lateral margins of disc; 5 papillae on upper labium and 4 on lower labium on right side; margins of upper lower labia corresponding to length of labial tooth



A



B

Figs. 4A and 4B. (A) *B. castaneoticus*, sp. n., MZUSP 68230, total length 11.5 mm, Stage 34. (B) *B. typhonioides*, MZUSP 68217, total length 14.4 mm, Stage 34.

rows bare; upper and lower jaw sheaths finely serrated; tooth row formula 2(2)/3; labial teeth on lower labium decrease in size from P-1 to P-3, labial teeth on P-3 very tiny; length of A-1 1.0 mm; each half of A-2 0.4 mm; lower tooth rows slightly smaller than A-1 and approximately equal in length (Fig. 5A).

In life, light brown dorsally; skin both dorsally and ventrally transparent; caudal musculature light brown; fin opaque; color in preservative slightly lighter brown.

Variation in tooth rows. — The two lower tooth rows in the tadpole just described are broken in the center. Of ten other tadpoles in the same lot (MZUSP 68231) in stages 34–35, all have complete upper tooth rows with a gap in A-2. Three have the three lower rows complete, but seven have some portions or all of the lower rows missing.

Bufo typhonius. — A typical tadpole in Stage 34 (Gosner, 1960) (MZUSP 68217; original field no. JPC 6713) is 14.4 mm in total length and has a body length of 6.3 mm (Fig. 4B). Body 4.3 mm in width and 3.0 mm in depth; snout rounded in dorsal view and bluntly rounded in lateral view; nostrils located dorsally and directed dorsolaterally; longest axis of opening of nostril 0.4 mm; distance from anterior edge of nostril to tip of snout 0.9 mm; internarial distance 0.6 mm; eyes located dorsally and directed dorsolaterally; diameter of eye 0.6 mm; interocular plane 1.6 mm from tip of snout; intraocular distance 1.0 mm. Spiracle sinister and located 4.1 mm from tip of snout; opening directed posterodorsally; vent tube, 0.7 mm in length, located on midline.

Length of tail 8.1 mm; depth of tail at greatest point 2.7 mm; musculature at this point 1.0 mm, dorsal fin, 1.0 mm, slightly deeper than ventral fin (0.7 mm); dorsal fin originates at junction of tail and body.

Oral disc anteroventral, 2.0 mm in width (48% of maximum width of body); oral disc laterally indented; a single row of 10 outer conical papillae and 1 inner papilla on upper labium on right side; lower labium has 9 outer papillae in a single row and 2 inner papillae; margins of upper and lower labia corresponding to length of tooth rows bare; upper and lower jaw sheaths finely serrated; tooth row formula 2(2)/3; length of A-1 1.7 mm; each half of A-2 0.7 mm, A-2 gap 0.2 mm; three lower rows complete, all measure 1.6 mm (Fig. 5B).

In life, color of body and tail light brown; skin and tail fins transparent; color is nearly same in preservative.

Variation in tooth rows. — In 10 tadpoles in stages 33–35 collected at the same time (MZUSP 68218), the upper and lower tooth rows are well developed.

Comparison of tadpoles of *Bufo castaneoticus* and *B. typhonius*. — At the same stage of development, tadpoles of *B. castaneoticus* are smaller than those of *B. typhonius*. Metamorphosing specimens of *B. castaneoticus* in stage 43 (SVL, $x = 6.0$ mm, $n = 2$) are also smaller than those of *B. typhonius* in the same stage (SVL, $x = 6.9$ mm, $n = 2$). The oral disc is smaller in *B. castaneoticus* and the individual denticles in the tooth rows are much finer. Whereas the tooth rows are well developed in older *B. typhonius* tadpoles, the lower rows are poorly developed or missing in *B. castaneoticus*. The marginal papillae are smaller and fewer in number in *B. castaneoticus*.

This description of the tadpole of *B. typhonius* agrees well with that presented for *B. typhonius* in Ecuador by Duellman (1978), with the exception of size. Ecuadorian tadpoles in Stage 41 have total lengths of 23.5 mm, whereas those in the present series are 16.1 mm at Stage 41.

DISTRIBUTION

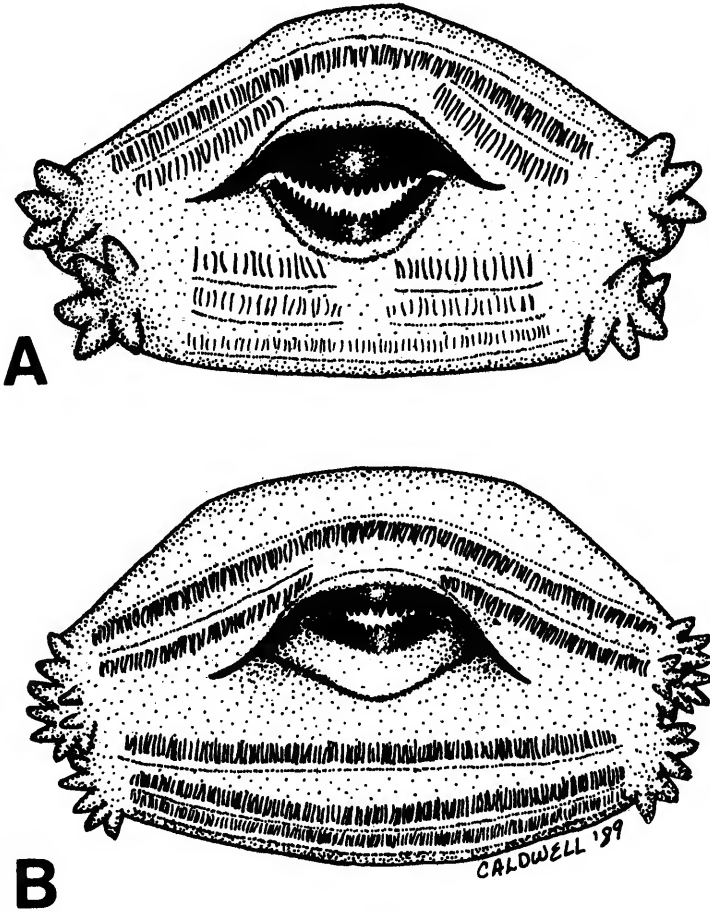
Bufo castaneoticus is presently known only from the type locality. Individuals of small species in the *B. typhonius* group have been observed or collected from Rondonia, Brazil (pers. obs.), Surinam (Hoogmoed, 1986), and the Rio Tapajós in Pará (R. Crombie, pers. obs.). Whether any of these are conspecific with *B. castaneoticus* is unknown at the present time.

LIFE HISTORY

Both species were breeding during the course of field work from January to March 1987. Occasional rains began in January, and the onset of the rainy season occurred in February (Caldwell

and Lopez, 1989). Individuals of *Bufo typhonius* congregated in large choruses around small temporary ponds after heavy rains as reported for this species in Ecuador and Panama (Duellman, 1978; Wells, 1979). Many individuals called in a large congregation, and many egg clutches were found in the ponds the following day.

In contrast to the breeding behavior of *B. typhonius*, *B. castaneoticus* did not breed in ponds but instead utilized the fallen empty fruit capsules of the Brasil nut tree (*Bertholletia excelsa*, family Lecythidaceae) for breeding. The coconut-sized fruits have a woody pericarp and are functionally indehiscent. They are opened by agoutis, which either cache or eat the seeds (Mori and Prance, 1990). Once empty, the fruits fill with rain water and are used as breeding sites by *B. castaneoticus* and a



Figs. 5A and 5B. Oral discs of tadpoles. (A) *B. castaneoticus*, sp. n., MZUSP 68230, Stage 34, width of disc, 1.4 mm. (B) *B. typhonius*, MZUSP 68217, Stage 34, width of disc, 2.0 mm.

Table 1. Variation in morphometric measurements (mm) of *Bufo Castaneoticus*, sp. n., and *Bufo typhonius* from Pará, Brazil. Values are means \pm SE; ranges are in parentheses.

Species	SVL	HW	HL	IOD	TYM
<i>B. castaneoticus</i> , Holotype, female	39.9	12.7	11.3	8.6	2.6
<i>B. castaneoticus</i> , Allotype, male	36.8	12.5	11.0	8.3	2.5
<i>B. castaneoticus</i> , Females, n = 20	39.5 + 0.5 (33.8-42.6)	13.0 + 0.12 (11.8-13.9)	11.8 + 0.15 (10.5-12.8)	8.6 + 0.11 (7.7-9.4)	2.5 + 0.97 (2.0-3.2)
<i>B. castaneoticus</i> , Males, n = 11	34.1 + 0.6 (30.9-36.8)	11.5 + 0.23 (10.5-12.5)	10.5 + 0.14 (9.8-11.2)	7.7 + 0.13 (7.0-8.3)	2.2 + 0.09 (1.7-2.7)
<i>B. typhonius</i> , Females, n = 13	59.9 + 1.9 (46.1-72.9)	21.1 + 0.63 (16.5-25.6)	18.6 + 0.56 (14.9-22.4)	12.9 + 0.30 (11.2-14.7)	3.9 + 0.14 (3.0-5.1)
<i>B. typhonius</i> , Males, n = 24	48.3 + 0.7 (39.2-55.8)	17.5 + 0.30 (13.7-20.4)	15.2 + 0.25 (12.2-17.0)	11.0 + 0.19 (8.9-12.8)	3.6 + 0.12 (2.1-4.5)

Table 1. Continued.

Species	EYE	TIB	FT	IND	EN
<i>B. castaneoticus</i> , Holotype, female	4.0	15.1	12.6	2.6	4.2
<i>B. castaneoticus</i> , Allotype, male	3.8	13.9	11.8	2.4	4.0
<i>B. castaneoticus</i> , Females, n = 20	3.9 + 0.05 (3.4-4.2)	14.0 + 0.19 (12.4-15.6)	11.9 + 0.17 (10.6-13.6)	2.5 + 0.04 (2.2-2.9)	4.3 + 0.04 (4.0-4.7)
<i>B. castaneoticus</i> , Males, n = 11	3.7 + 0.06 (3.4-4.0)	13.0 + 0.21 (11.4-13.9)	10.9 + 0.16 (10.2-11.8)	2.2 + 0.05 (1.9-2.5)	3.8 + 0.06 (3.5-4.1)
<i>B. typhonius</i> , Females, n = 13	5.4 + 0.16 (4.3-6.6)	23.3 + 0.69 (18.5-27.4)	20.9 + 0.68 (15.4-24.5)	3.9 + 0.11 (3.2-4.6)	5.7 + 0.13 (4.8-6.6)
<i>B. typhonius</i> , Males, n = 24	5.0 + 0.11 (3.9-5.8)	19.5 + 0.28 (16.0-22.4)	17.1 + 0.28 (13.7-19.4)	3.1 + 0.06 (2.5-3.8)	4.9 + 0.09 (4.1-5.7)

Table 2. Proportions (given in percentages) of morphological measurements of *Bufo castaneoticus*, sp. n., and *B. typhonioides*. Values are means \pm SE; ranges are given in parentheses.

Species	HW/SVL	HL/SVL	IOD/HW	TYM/HW	EYE/HW
<i>B. castaneoticus</i> , Holotype, female	31.9	28.4	67.9	20.4	31.5
<i>B. castaneoticus</i> , Allotype, male	33.9	29.8	66.8	20.0	30.5
<i>B. castaneoticus</i> , Females, n = 20	32.9 (30.8-36.0)	29.8 (28.1-32.5)	66.6 (62.1-71.2)	18.9 (16.1-23.0)	29.8 (26.1-31.5)
<i>B. castaneoticus</i> , Males, n = 11	33.6 (30.5-36.5)	30.8 (29.0-32.5)	67.5 (62.6-73.0)	19.0 (15.6-23.0)	32.0 (28.6-34.2)
<i>B. typhonioides</i> , Females, n = 13	35.3 (32.8-36.8)	31.0 (28.7-32.3)	61.2 (54.2-67.9)	18.5 (15.8-22.3)	25.7 (22.6-27.6)
<i>B. typhonioides</i> , Males, n = 24	36.3 (33.0-38.7)	31.4 (29.0-33.9)	62.8 (57.2-68.8)	20.4 (15.3-26.4)	28.5 (24.1-31.7)

Table 2. Continued.

Species	TIB/SVL	FT/SVL	IND/HW	EN/HW
<i>B. castaneoticus</i> , Holotype, female	37.9	31.7	20.4	33.0
<i>B. castaneoticus</i> , Allotype, male	37.7	32.1	19.3	10.9
<i>B. castaneoticus</i> , Females, n = 20	35.4 (32.3-39.6)	30.1 (26.9-32.6)	19.3 (17.6-21.0)	33.3 (30.8-35.8)
<i>B. castaneoticus</i> , Males, n = 11	38.0 (36.6-40.4)	31.9 (30.0-33.9)	19.5 (17.8-22.2)	33.1 (28.9-35.2)
<i>B. typhonioides</i> , Females, n = 13	39.0 (37.6-41.6)	34.8 (33.1-37.7)	18.3 (16.2-20.0)	26.9 (23.9-29.4)
<i>B. typhonioides</i> , Males, n = 24	40.4 (38.2-43.6)	35.4 (31.3-40.0)	17.9 (15.7-21.1)	27.8 (24.7-30.8)

poison frog, *Dendrobates castaneoticus* (Caldwell and Myers, 1990). Males called singly during the day from the opening of a fruit capsule. Clutch size is among the smallest reported for a member of this genus (mean \pm SD, 178.6 ± 130.3 eggs; range, 61-387; $n = 5$ clutches).

A cohort of tadpoles of *B. typhonius* followed from hatching to metamorphosis from a small pond required approximately 47 days to complete the process. In contrast, tadpoles of *B. castaneoticus* metamorphosed rapidly, within 16 days. This rapid metamorphosis may be an adaptation to predation pressure from insect larvae that also develop in the Brazil nut fruit capsules (pers. obs.).

DISCUSSION

Hoogmoed (1990) considered species in the *B. typhonius* group to be an artificial collection of unrelated species. Nevertheless, he retained four species in the group: *B. typhonius* Linnaeus, *B. ceratophrys* Boulenger, *B. dapsilis* Myers and Carvalho, and *B. nasicus* Werner. Hoogmoed (1990) further stated that two species, *B. proboscideus* and *B. acutirostris*, should be considered distinct from *B. typhonius* and that *B. t. roqueanus* should be elevated to specific rank.

The *Bufo typhonius* group was characterized by Hoogmoed (1990) as possessing: (1) a more or less pointed snout; (2) (well) developed cranial ridges; (3) a distinct tympanum; (4) distinct parotoids; (5) a lateral row of tubercles; (6) more or less protruding dorsal spines of vertebrae 3-8; (7) skin of flanks mostly attaching to the thighs closer to the knees than to the body; (8) males with smooth, females with granular, skin; and (9) presence of a dead-leaf pattern.

Bufo castaneoticus agrees with this set of characteristics with the following exceptions: (1) the cranial crests are slightly enlarged only in the largest females; (2) some specimens possess distinct tympana and parotoids, whereas others do not; (3) a lateral row of tubercles and protruding vertebrae are lacking. It is noteworthy that *B. castaneoticus* is the smallest of the species remaining in the *B. typhonius* group. Perhaps the lack of development of the cranial crests and the protruding vertebrae are related to the small size of *B. castaneoticus*, since Hoogmoed (1990) noted that these characters are only well developed in large females.

Of the two species formerly considered to be synonyms of *B. typhonius* but suggested to be distinct species by Hoogmoed (1990), *B. castaneoticus* is most similar to *B. proboscideus*. Both these species lack a lateral row of tubercles and protruding vertebrae. However, *B. proboscideus* is larger (female SVL, 54 mm) than *B. castaneoticus*. In addition, both males and females of *B. proboscideus* have smooth skin (Hoogmoed, 1990), whereas females of *B. castaneoticus* have granular skin. *B. acutirostris* (female SVL, 57 mm) is larger than *B. castaneoticus* and has a lateral row of tubercles. Another species elevated to specific rank by Hoogmoed (1990), *B. roqueanus*, is much larger (female SVL, 81 mm) than *B. castaneoticus*.

Duellman (1991) included *B. iserni* (female SVL, 74 mm), and *B. sternosignatus* (female SVL, 49 mm [Rivero, 1961]) in the *B. typhonius* group, both of which are larger than *B. castaneoticus*.

Hoogmoed (1986) noted that from two to seven sympatric species referable to the *B. typhonius* group can be found at various localities in northern South America. Duellman (1978) pointed out the possible occurrence of two species in Santa Cecilia, Ecuador, based on mating calls and call sites. In the present study, the two species under consideration were sympatric but were clearly distinguishable based on morphology and reproductive and ecological characteristics. Much additional work is needed before an understanding of the affinities of the *B. typhonius* group can be ascertained.

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SPECIMENS EXAMINED

Adults and Juveniles

Bufo castaneoticus. Brazil: Pará: vicinity of Cachoeira Juruá. (MZUSP 67156-67196).

Bufo typhonius. Brazil: Pará: vicinity of Cachoeira Juruá. (MZUSP 67094-67148).

Tadpoles

Bufo castaneoticus. Brazil: Pará: vicinity of Cachoeira Juruá. (MZUSP 68225-68246).

Bufo typhonius. Brazil: Pará: vicinity of Cachoeira Juruá. (MZUSP 68211-68224).

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