

## A new toad of the *Bufo typhonius* complex from humid montane forests of Bolivia

(Amphibia, Anura, Bufonidae)

Stefan Lötters & Jörn Köhler

Lötters, S. & J. Köhler (2000): A new toad of the *Bufo typhonius* complex from humid montane forests of Bolivia (Amphibia, Anura, Bufonidae). – Spixiana 23/3: 293–303

A new species of toad referable to the *Bufo typhonius* species complex is described from humid montane forests in the Departamentos Cochabamba and Santa Cruz, Bolivia. The new species is mainly characterised by tuberculate dorsal skin, well developed protrusions at angle of jaws, a lateral row of conical tubercles and absence of neural vertebrae. In addition, we provide diagnostic characters for *Bufo acutirostris* Spix, 1824 and comment on other available names of the complex. Including the new species, at least four different forms related to *B. typhonius* (Linnaeus, 1758) are known from Bolivia.

Stefan Lötters, Jörn Köhler, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany; e-mail: [uzs5r6@uni-bonn.de](mailto:uzs5r6@uni-bonn.de) (SL), [koehler.joern@t-online.de](mailto:koehler.joern@t-online.de) (JK).

### Introduction

The taxonomy of Neotropical toads related to *Bufo typhonius* is very chaotic (Hoogmoed 1986, 1989, 1990). In recent years it has become evident that behind the name *B. typhonius* a complex of similar species is hidden (*Bufo margaritifera* complex of some authors), which are distributed over the entire Amazon basin and lower Central America. Nothing is known about their phylogenetic relationships (Frost 1985, Hoogmoed 1986, 1989, 1990, Caldwell 1991, Duellman & Schulte 1992, Hass et al. 1995). Because of the difficulty to assign the many available names and the lack of a comprehensive revision (e.g. Hoogmoed 1990) contributors sometimes simply refer to morphs related to *B. typhonius* without assigning names (e.g. Duellman & Mendelson 1995, Köhler & Lötters 1999).

In recent times, Bolivia has become well known for its diversity in anurans. Due to a remarkable increase in scientific efforts within the last decade, the number of species known has almost doubled (De la Riva et al. 2000). Populations referable to *B. typhonius* repeatedly were reported from this country (Schmidt 1857, 1858, De la Riva 1990, Hoogmoed 1990, Aparicio 1992, De la Riva et al. 1992, 1996, Reynolds & Foster 1992, Köhler et al. 1997, Harvey et al. 1998, Köhler & Lötters 1999, De la Riva et al. 2000). Among them, at least four different species or morphs can be distinguished (for their known distributions see Fig. 1): (1) *Bufo castaneoticus* and (2) a sympatric form occurring in the Departamento Pando in north-western Bolivia (Köhler & Lötters 1999). Following the diagnosis provided for the latter form by Köhler & Lötters (1999), this morph is somehow similar to *B. acutirostris*, an apparently valid taxon known from eastern Colombia, southern Venezuela and north-western Brazil (Hoogmoed & Gruber 1983). Also Hoogmoed (1986) concluded that populations from Amazonian Bolivia resemble *B. acutirostris*. But he suggested that Bolivian specimens are not conspecific with those from northern Amazonia because of the large intervening area from which such toads are unknown. Currently, it is

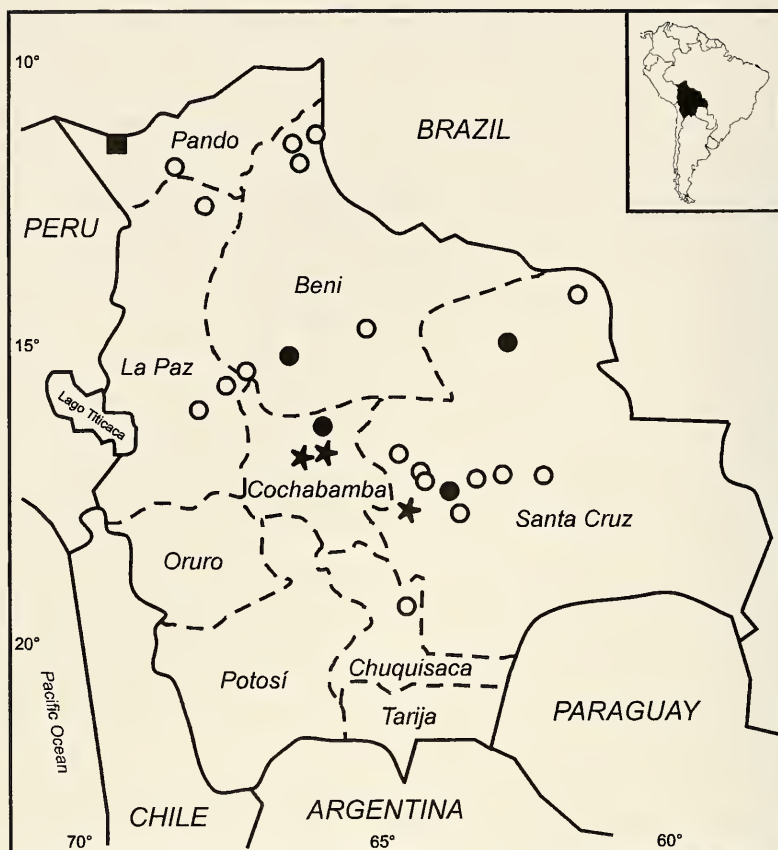


Fig. 1. Known distributions of toads of the *Bufo typhonius* complex in Bolivia. Asterisks: known localities of *B. stanlali*, spec. nov.; square: sympatric occurrence of *B. castaneoticus* and *B. cf. acutirostris*; dots: *Bufo* sp. 1; circles: lowland populations of unknown taxonomic status.

impossible to clarify the taxonomic status of the many populations resembling *B. acutirostris*. Therefore, we here apply the name *B. acutirostris* to the holotype only (see Appendix). For the population from north-western Bolivia (*Bufo* sp. A in Köhler & Lötters 1999) we use the name *B. cf. acutirostris*. (3) A morph from the central lowlands which at least occurs in the Departamentos Beni, Cochabamba and Santa Cruz. Conspecificity of these populations is supported by the coincidence of advertisement call characters (De la Riva et al. 1996, Köhler et al. 1997; for Departamento Cochabamba, unpubl. data)\*. This form may represent an undescribed species (this form is here called *Bufo* sp. 1). But further research involving additional specimens from various lowland sites in Bolivia (Fig. 1) and adjacent countries is needed. (4) A morph reported from humid montane forests in the Departamento Cochabamba by Reynolds & Foster (1992) and Köhler et al. (1997). Reynolds & Foster (1992) suggested it to represent an undescribed species. Although we are aware that the *B. typhonius* complex needs rigorous revision, recently collected material supports that non of the available names is applicable to the above mentioned morph from humid montane forests. The purpose of this paper is to describe it as a new species.

\* Hoogmoed (1986) proposed that at least sympatric species of the *B. typhonius* complex in Suriname can be distinguished by their vocalisations (although data were not provided). The only other advertisement calls described from species related to *B. typhonius* are those of *B. castaneoticus* (Köhler & Lötters 1999) and *B. dapsilis* (Zimmerman & Bogart 1988) which are clearly distinguished from those described by De la Riva et al. (1996) and Köhler et al. (1997).

## Material and methods

Specimens examined are deposited in the Colección Boliviana de Fauna (CBF), La Paz; National Museum of Natural History, Smithsonian Institution (USNM), Washington; Zoologisches Forschungsinstitut und Museum Alexander Koenig (ZFMK), Bonn; and Zoologische Staatssammlung München (ZSM).

Geographic positions of localities of the new species were obtained with a Magellan 3000 XL GPS receiver. Colour slides of specimens were taken in the field. Measurements of specimens are in millimetres and were taken to the nearest 0.1 mm with dial callipers. Abbreviations are as follows: SVL (snout-vent length), HW (head width at angles of jaws), HL (head length, distance from tip of snout to angle of jaws), IOD (interorbital distance), TYMD (vertical diameter of tympanic annulus), EYED (horizontal diameter of eye), TIBL (tibia length), FOOT (foot length, distance from proximal edge of outer metatarsal tubercle to tip of third toe), N-N (inter-narial distance), E-N (eye-nostril distance, measured from nostril to anterior corner of eye), PARL (length of parotoid gland), PARW (greatest width of parotoid gland), HAND (hand length, distance from proximal edge of outer metacarpal tubercle to tip of third finger). Despite some modifications, terminology and diagnostic characters generally follow Duellman & Mendelson (1995). Sexes in adults were determined by dissection. For webbing formulae we use the scheme of Savage & Heyer (1967) as modified by Myers & Duellman (1982).

### *Bufo stanlali*, spec. nov.

Figs 2-4

?*Bufo margaritifera* – Schmidt 1857: 13; Schmidt 1858: 251 (non Laurenti, 1768).

*Bufo* sp. – Reynolds & Foster 1992: 89.

*Bufo margaritifera* complex (partim) – Köhler et al. 1997: 7 (non Laurenti, 1768).

**Types.** Holotype: CBF 3346, an adult female, from a point 3.3 km on the road to San Onofre from the road from Cochabamba to Villa Tunari (17°11'S, 65°45'W), Provincia Chapare, Departamento Cochabamba, Bolivia, 1900 m above sea level; collected on 9 February 1998 by Jörn Köhler and Stefan Lötters (field number JKSL 506). – Paratypes: USNM 257797, an adult male, and USNM 257798, a subadult female, from the same locality as the holotype, collected on 1 and 3 November 1979 by Mercedes S. Foster; ZFMK 67097, juvenile, same locality as holotype; USNM 257796, an adult male, from km 96.7 on the road from Cochabamba to Villa Tunari, Provincia Chapare, Departamento Cochabamba, Bolivia, 1967 m above sea level, collected on 22 September 1979 by Mercedes S. Foster; ZFMK 60464, an adult female, from km 115 on the road from Cochabamba to Villa Tunari, Provincia Chapare, Departamento Cochabamba, Bolivia, 1850 m above sea level, collected on 9 December 1994 by Lutz Dirksen and Jörn Köhler; ZFMK 67096, an adult male, from a point ca. 36 km on the “old” road from Paracitito to Cochabamba (17°07'S, 65°35'W), Provincia Chapare, Departamento Cochabamba, Bolivia, 1600 m above sea level, collected on 3 January 1999 by Jörn Köhler and Stefan Lötters; ZSM 144/1999, an adult male, from La Hoyada (17°54'S, 64°08'W), Provincia Florida, Departamento Santa Cruz, Bolivia, 1700 m above sea level, collected on 16 November 1998 by Jörn Köhler and Stefan Lötters.

**Etymology.** The specific name is a patronym for Mr. Stanley Lai (New York) in recognition of supporting taxonomic research and forthcoming conservation projects in Bolivia.

**Diagnosis.** A species of the *Bufo typhonius* complex with the following combination of characters: (1) SVL of three adult males 39.1-54.1 mm (mean 45.8 mm), of two adult females 57.2 and 59.4 mm; (2) snout pointed in dorsal view, acute in lateral view, protruding beyond margin of lip; mouth slightly curved in profile; (3) nostrils protuberant at point anterior to anterior margin of lower jaw; (4) canthal crest not raised, supraorbital and prominent supratympanic crests continuous and prominent (more elevated in females); (5) tympanum rounded in males, ovoid in females, distinct, smaller than eye; (6) well developed bony protrusion at angle of jaws; (7) neural crests of vertebrae absent; (8) well developed parotoid glands ovoid to triangular, protruding laterally and incorporated into lateral row of tubercles; (9) lateral row of tubercles present, rounded in males, conical in females; (10) skin on dorsal and dorsolateral surfaces including all cranial crests tubercular, dorsally most intense on posterior head; (11) skin of limbs tubercular or spinous; (12) first and second finger equal in length, or first finger slightly longer; (13) palmar tubercle large, ovoid, three or four times the size of rounded thenar tubercle; (14) basal webbing between fingers; (15) inner metatarsal tubercle ovoid, twice the size





Fig. 2. Female holotype of *Bufo stanlaili*, spec. nov. (CBF 3346) in life.

of outer rounded metatarsal tubercle; (16) foot webbing formula I 1 – 1<sup>+</sup> II 1<sup>-</sup> – 2<sup>-</sup> III 1 – 4 IV 4 – 0<sup>+</sup> V; (17) supernumerary tubercles present, numerous; (18) dorsum brown, with irregular dark markings and spots, pale middorsal line or stripe; ventral colours brown and cream; (19) vocal slits absent and nuptial excrescences present in males.

The new species is most similar to *B. acutirostris* (see Appendix; Fig. 5), *B. cf. acutirostris* from north-western Bolivia and *Bufo* sp. 1 from the Bolivian lowlands. In *B. acutirostris* and *Bufo* sp. 1, the bony protrusion at the angle of jaws is weakly developed (well developed in *B. stanlaili*); in their males, the supratympanic crest is only hardly elevated, its maximum elevation smaller than half the vertical tympanum diameter (although variable in size, the supratympanic crest in *B. stanlaili* males is always larger than half the vertical tympanum diameter). In *B. acutirostris* the nostril (although also at point anterior to anterior margin of lower jaw) is situated immediate to the anterior margin of the lower jaw (well anterior to anterior margin of lower jaw in *B. stanlaili*). In *Bufo* sp. 1 the snout is straight posteroventrally in profile, or concave respective to eye (snout always convex respective to eye in *B. stanlaili*). In *B. cf. acutirostris* from north-western Bolivia neural crests of vertebrae may be present (always absent in *B. stanlaili*); males possess vocal slits (absent in *B. stanlaili*).

The other proposed species in the *B. typhonius* complex (see also discussion) can be distinguished from the new species as follows: *Bufo pleuropterus* has more pointed toe tips, outer and inner metatarsal tubercle of nearly same size, a more homogeneously tuberculated dorsum and a less pointed snout. *Bufo castaneoticus* and *B. proboscideus* lack a prominent supratympanic crest and a lateral row of tubercles; in addition, *B. castaneoticus* is smaller and *B. proboscideus* has a very distinctly pointed snout;



Fig. 3. Male paratype of *Bufo stanlali*, spec. nov. (ZFMK 67096) in life.

*B. ceratophrys*, *B. roqueanus* and *B. typhoni* (including *B. margaritifer* and *B. nasutus*) are considerably larger (female SVL > 80.0 mm); *B. ceratophrys* can be distinguished further by the presence of a triangular dermal projection on the eyelid, and *B. roqueanus* and *B. typhoni* by the presence extremely enlarged supratympanic flanges; *B. dapsilis* almost lacks cranial crests and tubercles; *B. nasicus* lacks prominent supratympanic crests and has longer legs (Spix 1824, Schmidt 1858, Hoogmoed 1977, 1986, Caldwell 1991, Rodríguez & Duellman 1994).

### Description of holotype

Adult female; body robust; head wider than long, head length less than one third of SVL; snout pointed from above, acute in lateral profile, protruding beyond margin of lip, slightly curved posteroventrally in profile (curve convex respective to eye); well developed bony protrusion at angle of jaws; dorsal surface of snout weakly depressed; nostrils lateral at point anterior to anterior margin of lower jaw, protuberant, directed dorsolaterally; canthus rostralis barely concave; loreal region concave, horizontal eye diameter about the same as distance from nostril to anterior corner of eye; temporal area straight; tympanum distinct, ovoid, smaller than eye; canthal crest not raised; supraorbital crest suspicious posterior to eye, continuous with prominent supratympanic crest; parotoid gland well developed, ovoid, slightly triangular, protruding laterally; lateral row of conical tubercles from mid of parotoid gland to area between sacrum and groin; skin on dorsal and dorsolateral surfaces tubercular, partly with conical tubercles; mid-dorsum and area between eyes relatively smooth; all cranial crests, paro-



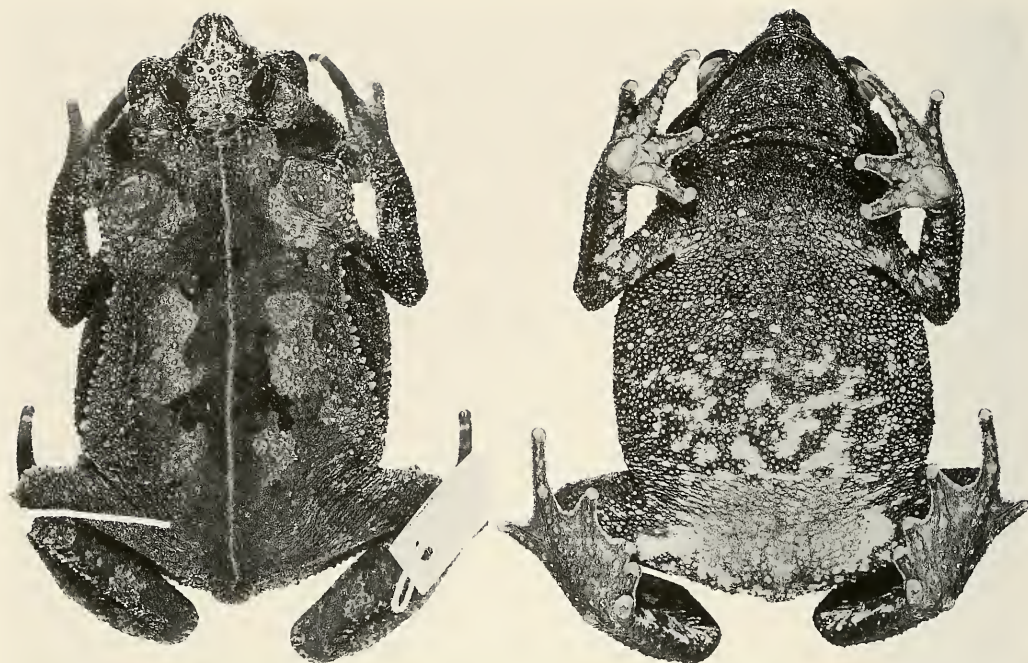


Fig. 4. Dorsal and ventral view of holotype of *Bufo stanlani*, spec. nov. (CBF 3346) in preservative.

toad glands and in-between conspicuously tubercular; skin of lateral body and head, upper lip, throat, chest and limbs spinous; skin of belly spinous and tubercular, partly with conical tubercles.

Forelimb relatively slender; relative length of fingers I = II < IV < III; palmar tubercle prominent, ovoid; thenar tubercle rounded, in size about one third of former; subarticular and supernumerary tubercles filling almost all area of palm; basal webbing between fingers, edge of webbing slightly serrate.

Hind limb slender; sole from proximal edge of outer metatarsal tubercle to tip of third toe about the same length as tibia; relative length of toes I < II < III < V < IV; inner metatarsal tubercle distinct, ovoid; outer metatarsal tubercle small, rounded, about half the size of inner; plantar surface with supernumerary tubercles; toes with prominent subarticular tubercles; toes with moderate webbing, edge slightly serrate, webbing formula I 1 - 1\* II 1 - 2\* III 1 - 4 IV 4 - 0\* V.

Measurements and proportions are provided in Table 1.

In preservative, ground colour brown; dorsally with dark brown "dead leaf pattern" from between eyes anterior to cloacal region, with pale middorsal line from snout to cloaca; upper loreal region, lateral side of supratympanic crest and lateral body below row of tubercles dark brown; laterally below eye and on tympanic membrane pale markings, continued on ventrolaterally; limbs with irregular dark brown markings; dorsolateral and lateral tubercles light orange, others brown; spines on limbs brown, light orange, or cream; throat, chest and anterior belly brown with scattered cream spots, posteriorly with irregular cream marbling; posterior belly uniformly brownish cream; cloacal region bordered by cream spots; ventral surfaces of limbs brown with irregular cream markings; palm light brown with cream tubercles; sole brown with cream tubercles; foot webbing light brown with cream borders. Coloration in life differed only in respect to the more intensive reddish colour of lateral and dorsal tubercles. Iris was silvery greenish (taken from colour slides).

**Variation.** For variation in measurements and proportions see Tab. 1. In the female USNM 257798, the head measures slightly more than one third of the SVL. The snout is less pointed in ZFMK 60464. The parotoid gland may be more ovoid or more triangular than in the holotype (even variable within one individual). ZSM 144/1999 (male) in general is less tubercular dorsally and less spinous laterally than

all other specimens. Ventral spines are absent or almost absent in USNM 257796 and ZSM 144/1999. In USNM 257796, ZFMK 67096, and ZSM 144/1999, the limbs are tubercular (versus spinous in the holotype). The male USNM 257796 has remarkably large feet when comparing FOOT and FOOT/SVL with the other type specimens. In ZFMK 60464 (female), the palmar tubercle is four times the size of the thenar tubercle. In the subadult female USNM 257798, the palmar tubercle is two times the size of the thenar tubercle which may reflect ontogenetic variation. ZSM 144/1999 exhibits a somewhat more rounded palmar tubercle.

Sexual dimorphism is indicated by males having smaller size (Tab. 1), a more rounded (versus ovoid) tympanum, somewhat less prominent supratympanic crests and the presence of a lateral row of rounded (versus conical) tubercles. Vocal slits are absent and nuptial excrescences on Fingers I and II present in all males. In the juvenile (ZFMK 67097), cranial crest are less developed while other characters fit those of the adults.

Colour variation includes light or reddish brown ground colour; the “dead leaf pattern” may be absent while the light brown middorsal line (occasionally bordered with dark brown) is always present; few dark brown markings may be present on the posterior dorsum; lateral areas (dark in the holotype) may have the ground colour; tubercles (light orange in the holotype) may be brown or cream; the throat may be cream with irregular brown markings; the cream area on the posterior belly (with irregular brown markings) may reach anteriorly to the chest.

**Distribution and ecology.** *Bufo stanlali* is known from the localities given in the type series, comprising an elevation range from 1600 to almost 2000 m above sea level. The localities are situated within humid montane rainforest at the Amazonian versant of the Bolivian Andes. The annual precipitation in this area reaches more than 3500 mm, most of which appears from January to March; mean annual temperature can be expected to range between 12 and 15 °C (see Lauer & Erlenbach 1987). Specimens were observed active during the day and at night in leaf litter. The holotype, collected in February 1998, and ZFMK 60464, collected in December 1994, each contain masses of tan eggs in their ovaries.

**Tab. 1.** Measurements (in mm) and proportions of adults of type series of *Bufo stanlali*, spec. nov. For abbreviations see text.

	Holotype		Paratypes				
	CBF 3346 (♀)	ZFMK 60464 (♀)	USNM 257798 (subadult ♀)	USNM 257796 (♂)	USNM 257797 (♂)	ZFMK 67096 (♂)	ZSM 144/1999 (♂)
SVL	57.2	59.4	38.6	44.3	39.1	46.5	54.1
HW	21.9	20.2	14.9	17.1	14.5	16.1	20.6
HL	17.6	22.2	12.3	13.3	12.2	13.8	16.6
IOD	8.9	9.9	6.2	6.8	6.2	6.6	9.6
TYMD	4.0	3.4	3.1	3.0	2.6	3.4	4.0
EYED	5.3	5.1	4.2	4.4	4.1	5.0	6.2
TIBL	21.6	22.3	15.3	19.7	14.7	18.6	20.9
FOOT	21.1	21.2	14.6	20.1	14.6	17.0	19.2
N-N	3.2	3.5	2.7	2.9	2.5	3.0	3.1
E-N	5.5	6.0	4.2	4.3	4.3	4.9	5.1
PARL	10.3	10.0	6.2	7.8	7.9	7.7	9.5
PARW	6.6	6.2	4.4	4.9	4.5	4.9	5.2
HAND	15.2	14.2	11.1	14.0	10.3	12.6	14.2
HW/SVL	0.38	0.34	0.39	0.39	0.37	0.35	0.38
HL/SVL	0.31	0.37	0.32	0.30	0.31	0.30	0.31
IOD/HW	0.41	0.49	0.42	0.40	0.42	0.41	0.47
TYMD/HW	0.18	0.17	0.21	0.18	0.18	0.21	0.19
EYED/HW	0.24	0.25	0.28	0.26	0.28	0.31	0.30
E-N/HW	0.25	0.30	0.28	0.25	0.30	0.30	0.25
PARL/SVL	0.18	0.17	0.16	0.18	0.20	0.17	0.17
TIBL/SVL	0.38	0.38	0.40	0.44	0.38	0.40	0.39
FOOT/SVL	0.37	0.36	0.38	0.45	0.37	0.37	0.35



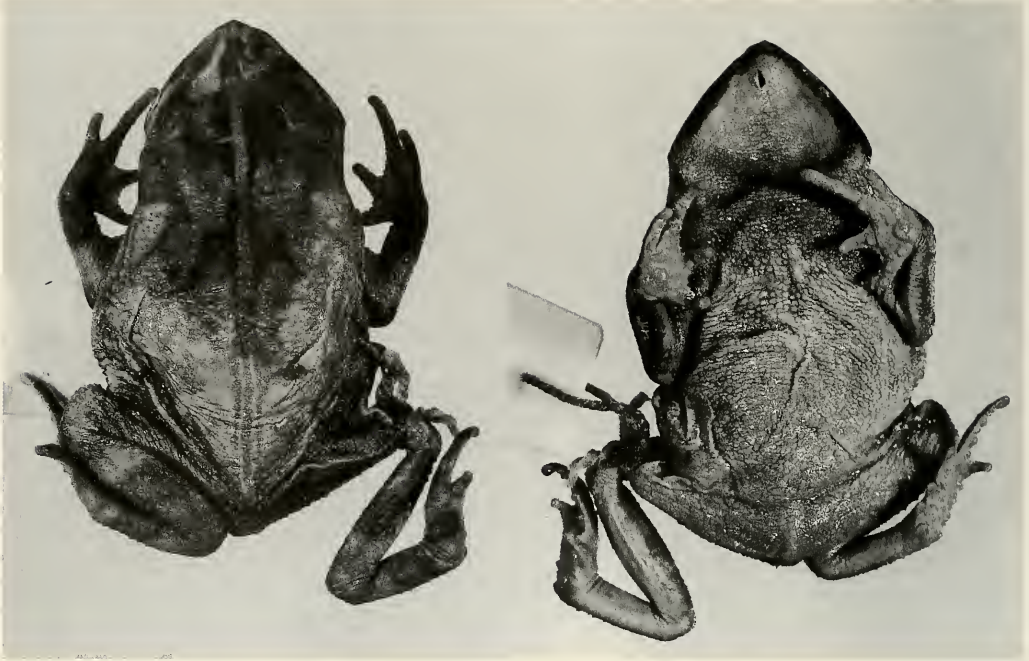


Fig. 5. Preserved holotype of *Bufo acutirostris* Spix, 1824; male (ZSM 1147/0).

### Discussion

Describing a new toad of the *Bufo typhonius* complex is accompanied by certain difficulties with respect to other available names. Most descriptions are imprecise and often type specimens are in poor condition or even lost. In the following we summarise and discuss the taxonomic status of names associated with the *B. typhonius* complex by different authors.

Hoogmoed (1990) stated that 17 forms previously related to the *Bufo typhonius* complex (e.g. Cei 1968, 1972; Frost 1985) “do not have anything to do with it”. As a result, he preliminarily considered the following members – besides *B. typhonius* (Linnaeus, 1758) itself – as part of this complex: *B. ceratophrys* Boulenger, 1882, *B. dapsilis* Myers & Carvalho, 1945 and *B. nasicus* Werner, 1903. Moreover, Hoogmoed (1990) proposed that *B. typhonius roqueanus* Melin, 1941 will have to be elevated to the species rank (in a way adopted by Duellman & Schulte 1992 and Morales 1995) and that the names *B. acutirostris* Spix, 1824, *B. margaritifer* (Laurenti, 1768) and *B. proboscideus* Spix, 1824 will have to be re-established. *Bufo margaritifer* was suggested as a possible replacement name for *B. typhonius* because of nomenclatural problems (Hoogmoed 1989, 1990). We do not address to this problem here and treat both names synonymous. *Bufo alatus* Thominot, 1884 from Panama was tentatively suggested to represent a synonym of *B. acutirostris* (Hoogmoed 1986) but may actually represent a valid trans-Andean species (C. M. Vélez, pers. comm.). The type material of *B. nasutus* Schneider, 1799 is apparently lost. Reading its original description (Schneider 1799), we tentatively consider it a synonym of *B. typhonius*. The name *B. naricus* Spix, 1824 is either referable to the *B. typhonius* complex. However, because the type material is lost (Hoogmoed & Gruber 1983) and the original description and the figure therein do not provide significant details (Spix 1824), we consider *B. naricus* a nomen dubium. The taxonomic status of *B. pleuropterus* Schmidt, 1857 (currently considered a synonym of *B. typhonius*) remains unclear. According to the descriptions by Schmidt (1857, 1858) and photographs provided to us of the juvenile holotype (Musaei Zoologici Univ. Jag. Kraków No. 1030), it may possibly represent a valid species. However, the drawing by Schmidt (1858: plate 17) is somewhat misleading with respect to the snout shape. Actually, the snout is considerably less pointed in dorsal view (Fig. 6). The type locality of *B. pleuropterus* was given as “Grenzgebiet von Bolivia gegen Peru, in etwa 3000' Höhe” by Schmidt





Fig. 6. Preserved holotype of *Bufo pleuropterus* Schmidt, 1857; juvenile (Musaei Zoologici Univ. Jag. Kraków No. 1030; photograph by Krzysztof Smagowicz).

(1858). According to the loss of Bolivian territory in 1909 and the travel route of the collector, J. v. Warszewicz (see Savage 1970), the type locality is probably in present-day Peru. The taxonomic status of *B. sternosignatus* Günther, 1859 was uncertain (Hoogmoed 1990) until recently La Marca & Mijares-Urrutia (1996) redescribed this species as a taxon probably not related to *B. typhonius*.

#### Acknowledgements

We are grateful to Colección Boliviana de Fauna (CBF), La Paz, for fruitful collaboration. Fundación Amigos de la Naturaleza (FAN), Santa Cruz de la Sierra, kindly provided working facilities and logistic support during our stays in Bolivia. Janusz Wojtusiak and Krzysztof Smagowicz (Kraków Museum) kindly provided the data and photographs of the holotype of *Bufo pleuropterus*. We are indebted to Frank Glaw (ZSM) and W. Ronald Heyer (USNM) for the loan of specimens and to Gandy Suárez and Jens Wünnenberg for accompanying us in the field. Ignacio De la Riva and Michael Franzen commented on earlier versions of the manuscript. Field work of both authors was funded by grants from the Deutscher Akademischer Austauschdienst (DAAD) and the Graduiertenförderung des Landes Nordrhein-Westfalen.

#### References

- Aparicio, J. 1992. Herpetofauna. In: Salm, H. & M. Marconi (eds.), Reserva Nacional Amazónica Manuripi-Heath. Programa de reestructuración (Fase II). – Lidema, La Paz: 113-119
- Caldwell, J. P. 1991. A new species of toad in the genus *Bufo* from Pará, Brazil, with an unusual breeding site. – *Papéis Avulsos Zool.* 37: 389-400
- Cei, J. M. 1968. Remarks on the geographic distribution and phyletic trends of South American toads. – *Pearce-Sellards Ser. Texas Mem. Mus.* 13: 1-21
- 1972. *Bufo* of South America. In: Blair, W. F. (ed.), *Evolution in the genus Bufo*. – Austin, Univ. Texas Press: 89-92
- De la Riva, I. 1990. Lista preliminar comentada de los anfibios de Bolivia con datos sobre su distribución. – *Boll. Mus. reg. Sci. nat. Torino* 8: 261-319

- , J. Castroviejo & J. Cabot 1992. *Pseustes sulphureus* (Wagler, 1824) (Serpentes: Colubridae) nueva especie para Bolivia y datos sobre la herpetofauna boliviana. – Acta zool. lilloana **41**: 215-218
- , J. Bosch & R. Márquez 1996. Advertisement calls of two Bolivian toads (Anura: Bufonidae: *Bufo*). – Herpetol. J. **6**: 59-61
- , J. Köhler, S. Lötters & S. Reichle (2000). Ten years of research on Bolivian amphibians: updated checklist, distribution, taxonomic problems, literature, and iconography. – Rev. Esp. Herp. **14**: 19-164
- Duellman, W. E. & J. R. Mendelson III 1995. Amphibians and reptiles from northern Departamento Loreto, Peru: taxonomy and biogeography. – Univ. Kansas Sci. Bull. **55**: 329-376
- & R. Schulte 1992. Description of a new species of *Bufo* from northern Peru with comments on phenetic groups of South American toads (Anura: Bufonidae). – Copeia **1992**: 162-172
- Frost, D. R. (ed.) 1985. Amphibian species of the world. A taxonomic and geographical reference. – Allen Press & Assoc. Syst. Coll., Lawrence
- Harvey, M. B., J. Aparicio, C. Cortez, L. Gonzáles, J. F. Guerra, M. S. Montaña & M. E. Pérez 1998. Reptile and amphibian species of Parque Nacional Noel Kempff Mercado. In: Killeen, T. J. & T. S. Schulenberg (eds.), A biological assessment of Parque Nacional Noel Kempff Mercado, Bolivia. – RAP Working Papers **10**: 348-355
- Hass, C. A., J. F. Dunski, L. R. Maxson & M. S. Hoogmoed 1995. Divergent lineages within the *Bufo margaritifera* complex (Amphibia: Anura; Bufonidae) revealed by albumin immunology. – Biotropica **27**: 238-249
- Hoogmoed, M. S. 1977. On the presence of *Bufo uasicus* Werner in Guiana, with a redescription of the species on the basis of recently collected material. – Zool. Meded. **51**: 266-275
- 1986. Biosystematic studies of the *Bufo "typhonius"* group. A preliminary progress report. In: Rocek, Z. (ed.), Studies in herpetology. – SEH, Prague, Charles Univ.: 147-150
- 1989. South American bufonids (Amphibia: Anura: Bufonidae), an enigma for taxonomists. In: Fontanet, X. & N. Horta (eds.), Treballs d'ictiologia i herpetologia. – Tre. Soc. Cat. Ictiol. Herp., **2**: 167-180
- 1990. Biosystematics of South American Bufonidae with special reference to the *Bufo "typhonius"* group. In: Peters, G. & R. Hutterer (eds.), Vertebrates in the tropics. – Bonn, Museum Alexander Koenig: 113-123
- & U. Gruber 1983. Spix and Wagler type specimens of reptiles and amphibians in the Natural History Museum in Munich (Germany) and Leiden (The Netherlands). – Spixiana Suppl. **9**: 319-415
- Köhler, J. & S. Lötters 1999. Annotated list of amphibian records from the Departamento Pando, Bolivia, with description of some advertisement calls. – Bonn. zool. Beitr. **48**: 259-273
- , S. Reichle & G. Peters 1997. Advertisement calls of three species of *Bufo* (Amphibia: Anura: Bufonidae) from lowland Bolivia. – Stuttg. Beitr. Naturk. Ser. A **562**: 1-8
- La Marca, E. & A. Mijares-Urrutia 1996. Taxonomy and geographic distribution of a northwestern Venezuelan toad (Anura, Bufonidae, *Bufo sternosignatus*). – Alytes **14**: 101-114
- Lauer, W. & W. Erlenbach 1987. Die tropischen Anden. Geoökologische Raumgliederung und ihre Bedeutung für den Menschen. – Geogr. Rundsch. **39**: 85-95
- Morales, V. R. 1995. Checklist and taxonomic bibliography of the amphibians from Perú. – Smithson. Herp. Inform. Serv. **107**: 1-20
- Myers, C. W. & W. E. Duellman 1982. A new species of *Hyla* from Cerro Colorado, and other tree frog records and geographical notes from western Panama. – Amer. Mus. Novitates **2752**: 1-32
- Reynolds, R. P. & M. S. Foster 1992. Four new species of frogs and one new species of snake from the Chapare region of Bolivia, with notes on other species. – Herpetol. Monogr. **6**: 83-104
- Rodríguez, L. O. & W. E. Duellman 1994. Guide to the frogs of the Iquitos region, Amazonian Peru. – Univ. Kansas Spec. Publ. **22**: 1-80, pls. 1-12
- Savage, J. 1970. On the trail of the golden frog: with Warszewicz and Gabb in Central America. – Proceed. California Acad. Sci. **38**: 273-338
- & W. R. Heyer 1967. Variation and distribution of the tree-frog genus *Phyllomedusa* in Costa Rica, Central America. – Beitr. Neotrop. Fauna **5**: 111-131
- Schmidt, O. 1857. Diagnosen neuer Frösche des Zoologischen Cabinets zu Krakau. – Sitzber. math.-natwiss. Cl. Kaiserl. Akad. Wiss. Wien **24**: 10-15
- 1858. Deliciae herpetologicae musei zoologici cracoviensis. – Denkschr. math.-natwiss. Cl. Kaiserl. Akad. Wiss. Wien **14**: 237-258
- Schneider, J. G. 1799. Historiae amphibiorum naturalis et literariae fasciculus primus. – Friedrich Frommann, Jena
- Spix, J. B. 1824. Animalia Nova sive species novae Testudinum Ranarum, quas in itinere per Brasiliam annis MDCCCXVII-MDCCCXX jussu et auspiciis Maximiliani Josephi I. Bavariae regis. – Monachii: 4pp, 1-53, pls. 1-17 + 1-22
- Zimmerman, B. L. & J. P. Bogart 1988. Ecology and calls of four species of Amazonian forest frogs. – J. Herpetol. **22**: 97-108



**Appendix: Diagnostic characters of *Bufo acutirostris***

The following diagnosis is based on the holotype of *Bufo acutirostris* Spix, 1824 (ZSM 1147/0, jar label: "habitat ad flumen, Amazonien/Brasilien"): Adult male (Fig. 5) with (1) SVL 35.3 mm, HW 14.0 mm, HL 11.8 mm, TIBL 13.9 mm; (2) snout pointed in dorsal view, acute in lateral view, protruding beyond margin of lip, slightly curved posteroventrally in profile (curve is convex respective to eye); (3) nostrils protuberant at point immediately anterior to anterior margin of lower jaw; (4) canthal crest not raised, supraorbital and supratympanic crests continuous but weak (maximum elevation of supratympanic crest smaller than half the vertical tympanum diameter); (5) tympanum rounded, distinct, smaller than eye; (6) weak bony protrusion at angle of jaws; (7) neural crests of vertebrae absent; (8) well developed parotoid glands triangular, protruding laterally and incorporated into lateral row of tubercles; (9) lateral row of tubercles present, rounded; (10) skin on dorsal and dorsolateral surfaces (except cranial crests) tubercular, dorsally most intense on anterior dorsum; (11) skin of limbs tubercular and partly spinous; (12) first finger slightly longer than second; (13) palmar tubercle large, ovoid, three times the size of rounded thenar tubercle; (14) basal webbing between fingers; (15) inner metatarsal tubercle ovoid, twice the size of outer rounded metatarsal tubercle; (16) foot webbing formula I 1 – 1<sup>+</sup> II 1<sup>-</sup> – 2<sup>-</sup> III 1 – 4 IV 4 – 0<sup>+</sup> V; (17) supernumerary tubercles present, numerous; (18) dorsum dark and posteriorly light brown with irregular dark brown markings; ventral colour cream; (19) nuptial excrescences absent.

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Spixiana, Zeitschrift für Zoologie](#)

Jahr/Year: 2000

Band/Volume: [023](#)

Autor(en)/Author(s): Lötters Stefan, Köhler Jörn

Artikel/Article: [A new toad of the Bufo typhonius complex from humid montane forests of Bolivia \(Amphibia, Anura, Bufonidae\) 293-303](#)