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Leptodactylus syphax.

***Leptodactylus syphax* Bokermann**
Burgundy Thin-toed Frog

Leptodactylus syphax Bokermann 1969:13. Type-locality, "São Vicente (Gustavo Dutra), Cuiabá, 600 m, Brasil." Holotype, Museu de Zoologia da Universidade de São Paulo (MZUSP) 73851, formerly WCAB 16141, adult male, collected by M. Alvarenga, F.M. Oliveira, and W.C.A. Bokermann on 27 November 1963 (examined by WRH).

Leptodactylus siphax: Borges-Nojosa and Arzabe 2005:233. *Lapsus*.

• **CONTENT.** The species is monotypic.

• **DEFINITION.** Adult *Leptodactylus syphax* are moderately sized (males 58–83 mm, females 70–90 mm SVL). The head is about as long as wide, but usually is just wider than long. The hind limbs are moderately short (Table 1; Heyer and Thompson 2000 provided definitions of adult size and leg length categories for *Leptodactylus*). Male vocal sacs are laterally expanded, tan, and not darker than the adjacent throat. The male snout is not spatulate, the snout profile is rounded to obtuse in both sexes. Male arms are hypertrophied during the breeding season in sexually active males. The male thumb has two large, sharp, black spines; a pair of black chest spine patches has sharp, protruding spines. The dorsum is indistinctly patterned with dark, poorly defined spots or blotches, sometimes the spots/blotches are regularly distributed. A dark posteriorly-directed triangular interorbital mark is variably present. The supratympanic fold is either the same color as or noticeably darker than the tan or brown surrounding area. There are no dorso-lateral folds. The dorsum is smooth to weakly rugose with large white tubercles limited to the sacral and postsacral region. The toe tips are rounded and are either weakly or noticeably swollen with a diameter greater than the region immediately behind the toe tip. The toes usually lack any lateral fringe or ridge or basal webbing; rarely the toes have weak ridges or a trace of webbing between toes II-III-IV. The dorsal

TABLE 1. Summary measurement data for *Leptodactylus syphax* (means are in parentheses). HL = head length, HW = head width, TL = thigh length, SL = shank length, FL = foot length.

Measurement	Males (N = 46)	Females (N = 41)
SVL (mm)	58–83 (72.5)	70–90 (78.8)
HL/SVL (%)	31–38 (35)	33–40 (35)
HW/SVL (%)	34–41 (37)	32–40 (36)
TL/SVL (%)	38–44 (41)	36–44 (40)
SL/SVL (%)	38–45 (41)	36–43 (40)
FF/SVL (%)	36–48 (41)	34–45 (40)



FIGURE 1. *Leptodactylus syphax* from the region now submerged by the Serra da Mesa hydroelectric dam, upper Rio Tocantins, Tocantins State, Brazil. Photograph by Danté Fenolio.

surface of the shank has scattered white or black-tipped tubercles. The posterior surface of the tarsus and sole of the foot are either smooth or have a few large white or black-tipped tubercles. The upper lip has poorly defined to distinct vertical bars, one between the nostril and eye and two underneath the eye, or a complex dark and light pattern. There is no mid-dorsal stripe. The belly is lightly to moderately mottled with light gray or brown markings. The posterior surfaces of the thighs are boldly patterned with various-sized light tan and brown markings and lack a light longitudinal stripe on the lower halves.

Larvae are exotrophic, lotic, benthic guild members (McDiarmid and Altig 1999, guild IIA1, but larvae have only been collected from streams [Eterovick and Sazima 2000a]). The oral disk is ventrally positioned, either entire or slightly emarginated, and has a moderate anterior gap (about 1/2 width of oral disk) lacking marginal papillae. There are two rows of marginal papillae on the lower labium, whereas laterally and dorsolaterally the marginal papillae are arranged in a single row; submarginal papillae are absent. The tooth row formula is 2(2)/3(1). All tooth rows are subequal in length. Tooth rows A-2 and P-1 are narrowly separated from each other. The spiracle is sinistral, with its inner wall completely fused to the body, and the vent tube is median. The dorsal fin originates at the posterior end of the body. Average larval total length at Gosner stage 32 is 36.0 mm, at stages 37 and 41, 42.0–43.9 mm. Tail length is 60–65% of total length. Eye diameter is 9–11% of body length. The average width of the oral disk is 27% of body length. A lateral line system is not distinct. The dorsum of the body is uniformly suffused with melanophores. The ventral surfaces of the body and anal tube are patternless (lacking melanophores) and the intestines are visible through the body wall. The dorsal and ventral tail fins are blotched with patches of melanophores. The upper half of the tail musculature is more uniformly pigmented than the lower half, which is much lighter than the upper half; myotomes are visible but not strongly marked (larval description based on MNRJ 48012–48013).

The advertisement call consists of a single note given at rates of 48–90/min. Call duration varies from

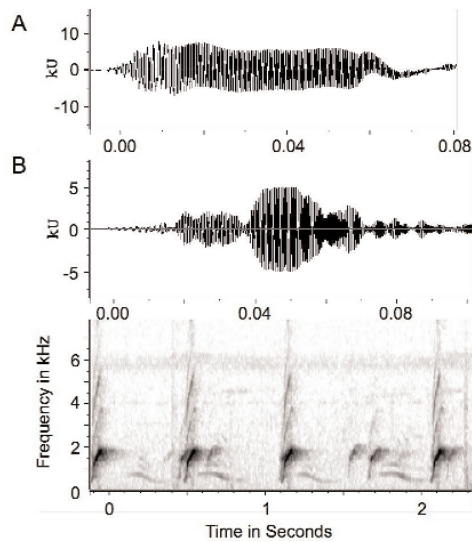


FIGURE 2. Advertisement calls of *Leptodactylus syphax*. A - wave form of recording USNM 328 cut 5, voucher WCAB 15336, recorded by W.C.A. Bokermann. B - wave form and audiospectrogram of recording USNM 319 cut 1, unvouchered, recorded by W.R. Heyer. Both recordings from Chapada dos Guimarães, Mato Grosso, Brazil.

0.05–0.06 s (Alpinópolis, Minas Gerais, Brazil; Barra do Bugres, Reserva Biológica Serra das Araras, Mato Grosso, Brazil; São Raimundo Nonato, Piauí, Brazil) to 0.08–0.10 s (Chapada dos Guimarães, Mato Grosso, Brazil). The call is amplitude modulated with 2–3 major pulses; several minor pulses may be present. The call is either most intense at the beginning (Heyer 1979, Fig. 23) or at the middle of the call. The call, a loud rising whistle, is frequency modulated, beginning at about 380–390 Hz and ending at 1900–2300 Hz. The dominant frequency is the fundamental frequency and ranges from 1310–1330 Hz (Alpinópolis), 1640–1680 Hz (Chapada dos Guimarães, São Raimundo Nonato), to 1800–1850 Hz (Barra do Bugres). The call has harmonic structure. (Most of the call information was obtained from Cardoso and Heyer 1995 and Heyer 1979).

• **DIAGNOSIS.** Adult *Leptodactylus syphax* lack lateral toe fringes and lack dorsolateral folds. These conditions are shared with (at least some individuals of) *L. bufonius*, *L. fragilis*, *L. labyrinthicus*, *L. laticeps*, *L. latinasus*, *L. lithonaetes*, *L. myersi*, *L. rugosus*, *L. turimiquensis*, and *L. troglodytes*. The dorsal pattern of *L. syphax* is muted, not visually arresting as is the aposematic, contrasting dark and light tile-like pattern of *L. laticeps* (bright yellow, red, and black in life). The posterior thighs of *L. syphax* lack distinct longitudinal light stripes on the lower thighs and adult males have two keratinized thumb spines and a pair of keratinized chest spines; the posterior thighs of *L. fragilis* and *L. latinasus* have longitudinal light stripes and the males lack both thumb and chest spines. *Leptodactylus syphax* is larger (males 58–83 mm, females 70–90 mm SVL) than *L. bufonius* and *L. troglodytes* (males 46–59 mm, females 45–62 mm SVL), and male *L. bufonius* and *L. troglodytes* lack thumb and

chest spines. *Leptodactylus syphax* is smaller (maximum 90 mm SVL) than *L. labyrinthicus* (minimum 117 mm SVL) and *L. turimiquensis* (minimum 122 mm SVL) and most *L. labyrinthicus* and *L. turimiquensis* have a distinct, short pair of dorsolateral folds extending from behind the eye varying distances to the sacrum. *Leptodactylus syphax* is smaller than *L. myersi* (males 74–123 mm, females 79–113 mm SVL), male *L. myersi* have only one thumb spine and lack chest spines, and juvenile *L. myersi* have distinct light spots (bright red in life) on the upper portions of the posterior thigh surfaces (no *L. syphax* have distinct light thigh spots). *Leptodactylus syphax* is most likely to be confused with *L. lithonaetes* or *L. rugosus*. The most distinctive characteristics separating the 3 species are male secondary sexual characteristics. Male *Leptodactylus syphax* have 2 black spines on each thumb, a pair of black chest spines, and lack a patch of brown/black tubercles on the chin and throat. Male *L. lithonaetes* have a single black thumb spine and have a patch of brown/black tubercles on the chin and throat; male *L. rugosus* have 1 or 2 black thumb spines and lack a patch of brown/black tubercles on the chin and throat. Some *L. syphax* males have a dorsal pattern of low-contrast, regularly distributed quadrangular ocellations; no male *L. lithonaetes* or *L. rugosus* have such a pattern.

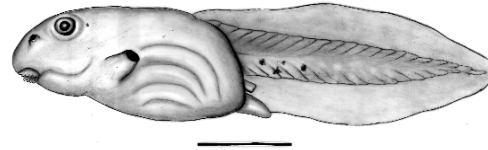


FIGURE 3. Tadpole of *Leptodactylus syphax* (MNRJ 48012), Gosner stage 31. Bar = 1 cm.

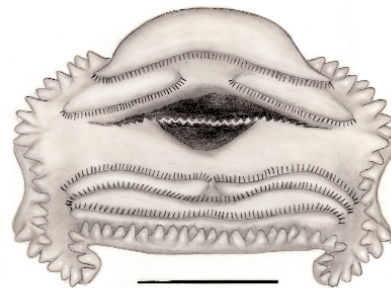


FIGURE 4. Oral disk of *Leptodactylus syphax* (MNRJ 48012), Gosner stage 31. Bar = 1 mm.

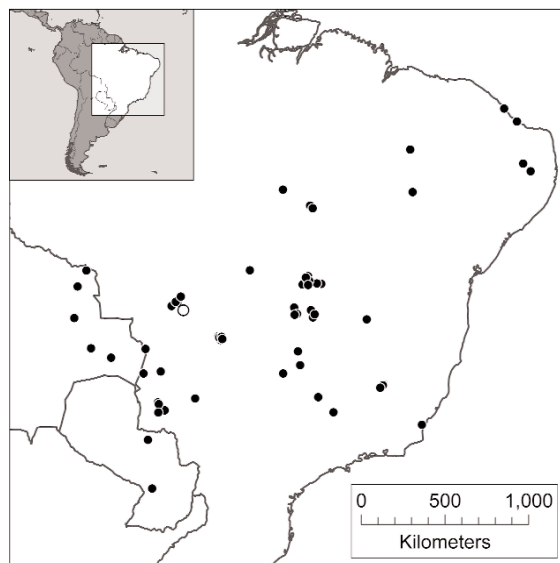
• **DESCRIPTIONS.** Bokermann's (1969) original description of the holotype of *Leptodactylus syphax* included color information and Heyer (1979) provided information on adult characteristics and color. Descriptions of larval morphology and color can be found in Eterovick and Sazima (2000a). Bokermann (1969), Cardoso and Heyer (1995), and Heyer (1979) des-

cribed the advertisement call, while Cardoso and Heyer (1995) delineated aggressive calls and foot stamping behavior. Female reciprocation vocalizations are described in Silva and Giaretta (2005).

• **ILLUSTRATIONS.** Photos of the holotype of *Leptodactylus syphax* were presented by Bokermann (1969) and color photos of the species are provided by Brandão et al. (2006b), De la Riva et al. (2000), Eterovick and Sazima (2004), Freitas and Silva (2004, 2005, 2007), Gordo and Campos (2005), Köhler (1995), and Köhler and Böhme (1996). Haddad et al. (2008) provided a color photograph of male chest and thumb spines. Illustrations of lateral and dorsal views of the larva and the larval oral disc appear in Eterovick and Sazima (2000a). Audiospectrograms of the advertisement call are in Bokermann (1969), Cardoso and Heyer (1995), and Heyer (1979), and wave forms of the advertisement call are illustrated in Cardoso and Heyer (1995) and Heyer (1979). An audiospectrogram of male aggressive calls and foot-pounding appear in Cardoso and Heyer (1995). Silva and Giaretta (2009) provided a photograph of an amplexant pair building a foam nest, and a photograph of the reproductive habitat and a schematic drawing of an individual in its characteristic calling site appear in Eterovick and Sazima (2004).

• **DISTRIBUTION.** The relatively broad geographic range of *Leptodactylus syphax* extends from Bolivia and Paraguay to northeastern Brazil. The species occupies open habitat and its distribution is characterized by very local populations primarily associated with rocky outcrops separated from each other by large distances. J. Caldwell and L. Vitt collected specimens not associated with rocky outcrops in the Cerrado biome, including finding specimens in termite mounds (J. Caldwell e-mail 9 October 2007). Whereas specimens from the Serra da Bodoquena were found among rocks or in small caves, specimens from the city of Campo Grande were observed in underground ducts used for rain drainage about 500 m from the nearest stream (F.L. Souza, e-mail 18 February 2007). The population from Presidente Kennedy, Espírito Santo is also exceptional in that it occurs in restinga (sand dune scrub); there are no rocky outcrops in the area where the frogs occur (R. Brandão, e-mail 4 July 2007). *Leptodactylus syphax* is known to occur between elevations of 175 m (unpublished data on <http://learning.richmond.edu/Leptodactylus/index.cfm>) to 1485 m (Eterovick and Fernandes 2001). Duellman (1999) tabulated its distribution by natural region as Caatinga-Cerrado-Chaco, while Harding (1983) listed its distribution by countries in the New World.

References to distribution, localities, and elevation (when provided) are listed by country: **Bolivia** (De la Riva et al. 2000; González A. and Reichle 2000; Harvey et al. 1998; Köhler 1995, 2000; Köhler and Böhme 1996; Reichle 2004, 2006), **Brazil** (Alho et al. 2000; Ávila and Ferreira 2004; Barbosa et al. 2007; Bokermann 1969; Borges-Nojosa 2006; Borges-Nojosa and Arzabe 2005 [as *L. siphax* {sic}]; Brandão



MAP. Distribution of *Leptodactylus syphax*. The type-locality is indicated by an open circle, other localities by a black dot. A single dot may represent more than one site. A range outline is not provided because the species primarily occurs in disjunct rocky outcrops that are patchily distributed throughout the species' range (see **Distribution**). Published locality data used to generate the map should be considered as secondary sources of information, as we did not confirm identifications for all specimen localities. The locality coordinate data and sources are available on a spread-sheet at <http://learning.richmond.edu/Leptodactylus>.

2002; Brandão and Péres Júnior 2001; Brandão et al. 2006b,c; Caramaschi 2008; Cardoso and Heyer 1995; Cascon 1987; Costa et al. 2006; Diniz-Filho et al. 2004; Domenico 2008; Eterovick 2003; Eterovick and Barros 2003; Eterovick et al. 2005; Eterovick and Fernandes 2001, 2002; Eterovick and Sazima 2000a,b, 2004; Freitas and Silva 2004, 2005, 2007; Giaretta et al. 2008; Gordo and Campos 2004, 2005; Heyer 1979; Martins and Silva 2009; Motta and Peña 1999; Pavan and Dixo 2002–2004; Pires et al. 2003; A. Rodrigues et al. 2007; Rodrigues 2003; Santos and Carnaval 2002; Silva Jr. 2007; Silva Jr. et al. 2005; Silva and Giaretta 2005, 2009; Silva et al. 2003; Strüssmann 2000; Strüssman et al. 2000b, 2004; Uetanabaro et al. 2007, 2008; Vieira et al. 2007a; Vogt and Bernhard 2003), **Paraguay** (Brusquetti and Lavilla 2006; Heyer 1995).

• **FOSSIL RECORD.** None.

• **PERTINENT LITERATURE.** The most comprehensive accounts of the species are Bokermann (1969) and Heyer (1979). The following literature is listed by topic; the symbol **(M)** indicates the species is only mentioned and **(S)** indicates that all the species information contained therein represents a secondary source: **behavior** (Silva and Giaretta 2009), **biogeography** (Heyer 1988; Heyer and Maxson 1982 **(M)**), **call and call parameters** (Angulo 2004 **(S)**); Bokermann 1969; Cardoso and Heyer 1995;

Ryan 1985; Silva and Giaretta 2005, 2009; Straughan and Heyer 1976), **checklist** (Colli et al. 2002; Uetanabaro et al. 2007; Vogt and Bernhard 2003), **communication** (Cardoso and Heyer 1995; Hill 2001; Köhler and Reichle 1998 (S); Souza and Haddad 2003; Silva and Giaretta 2005), **conservation** (Brandão et al. 2006a; Diniz-Filho et al. 2008; Eterovick et al. 2005; Eterovick and Sazima 2004; Reichle 2006; Stuart et al. 2008; Young et al. 2004), **distribution** (Fernández et al. 2009), **ecology, natural history, and reproduction** (Ávila and Ferreira 2004; Cascon 1987; Coutinho et al. 1977; Diniz-Filho et al. 2004; Eterovick 2003; Eterovick and Barros 2003; Eterovick and Fernandes 2001, 2002; Eterovick and Sazima 2000b; Pires et al. 2003; Ponssa and Barrionuevo 2008; Rodrigues 2003; Silva and Giaretta 2009; Strüssmann 2000; Uetanabaro et al. 2008; Vieira et al. 2007a, 2009 (S); Wells 2007), **evolution** (Heyer 1979; Silva and Giaretta 2009; Straughan and Heyer 1976), **field guide** (Eterovick and Sazima 2004; Freitas and Silva 2004, 2005, 2007), **habitat** (Alho et al. 2000; Ávila and Ferreira 2004; Brandão 2002; Brandão and Péres Júnior 2001b,c; Colli et al. 2002; Eterovick and Fernandes 2001, 2002; Eterovick and Sazima 2000a,b, 2004; Fernández et al. 2009; França et al. 2004 (M)(S); Giaretta et al. 2008; González A. and Reichle 2002; Harvey et al. 1998 (S); Heyer 1995; Jim 1980; Köhler and Böhme 1996; Motta and Peña 1999; Pires et al. 2003; Reichle 2006; A. Rodrigues et al. 2007; Rodrigues 2003; Strüssmann 2000; Uetanabaro et al. 2007), **inventory** (Brandão and Péres Júnior 2001; Gordo and Campos 2005; Pavan and Dixo 2002–2004; Silva 2007; Silva et al. 2003, 2005; Strüssmann 2000; Strüssmann et al. 2000a,b, 2004), **key** (Eterovick and Sazima 2004; Heyer 1979), **morphology** (Diniz-Filho et al. 2004; Heyer 1995; Lynch 1971; Oliveira 1996; Ponssa 2008; Prado and d'Heursel 2006 (S); Sebben et al. 2007; Silva and Giaretta 2009), **nomenclature and taxonomy** (Heyer 1974, 1979), **non technical accounts** (Eterovick and Sazima 2004; Oliveira 1996; Sebben and Silva 2004), **parasites** (Silva and Giaretta 2009; Trombeta 2008), **relationships and systematics** (Heyer 1979, 1995; Ponssa 2008; Ponssa and Barrionuevo 2008; Savage 2002 (M); Straughan and Heyer 1976), **skin secretions** (Conlon et al. 2009 (M)(S); Dourado et al. 2005, 2007; King et al. 2008; Nascimento 2007; Pires Júnior 2007; Schwartz et al. 2007; Sousa et al. 2009), **species account** (Bokermann 1969; Eterovick and Sazima 2004; Heyer 1979; Uetanabaro et al. 2008), **species comparison** (Bokermann 1969; Borteiro and Kolenc 2007 (S); Heyer 1979, 1995; Heyer and Heyer 2001; Heyer and Thompson 2000; Heyer et al. 2002), **species or taxonomic list** (Ananjeva et al. 1988; Bastos 2007; Brusquetti and Lavilla 2006; De la Riva et al. 2000; Domenico 2008; Duellman 2003; Eterovick and Sazima 2004; Freitas and Silva 2004; Frost 1985; Giaretta et al. 2008; Glaw et al. 2000; González A. and Reichle 2002; Gordo and Campos 2004; Gorham 1974; Harding 1983; Pires et al. 2003; Reichle 2004, 2006; Rodrigues 2003, 2004; Santos 1995; Uetanabaro et al. 2008), **tadpole** (Eterovick and Sazima 2000a; Rodrigues et al. 2007 (M); Silva

and Giaretta 2009; Skuk et al. 2007 (M); Vieira et al. 2007b).

• **REMARKS.** Bokermann (1965:258) clarified the two localities at which he collected at and around São Vicente. The type of *L. syphax* was collected from the grounds of the agricultural school “Gustavo Dutra” in São Vicente, not from the granitic outcrops about 10 km west of São Vicente.

Common names for *Leptodactylus syphax* include “Burgandy Thin-toed Frog” (www.learning.richmond.edu/Leptodactylus), “Caçote” (Freitas and Silva 2004, 2005, 2007), “Mato Grosso White-lipped Frog” (Frank and Ramus 1995), “Rã” (Borges-Nojosa 2006; Brandão and Péres Júnior 2001; Pavan and Dixo 2002–2004; Pires et al. 2003; Silva et al. 2005), “Rã-das-pedras” (Brandão et al. 2006c), “Rana Burgandy de Dedos Delgados” (www.learning.richmond.edu/Leptodactylus), and “Whistling Foam Frog” (Eterovick and Sazima 2004).

Leptodactylus syphax is a species noted for its varied communication modes. Males exhibit both advertisement and aggression calls and foot stamping behavior (Cardoso and Heyer 1995), while females emit reciprocation vocalizations in response to male advertisement calls (Silva and Giaretta 2005).

• **ETYMOLOGY.** Bokermann (1969) did not comment on the derivation of the scientific name. The Greek *ΣΥΦΑΧ*, “sweet new wine”, refers to the bright red color in life of the groin, belly, and ventral surfaces of the thighs and shanks of some of the type-specimens. However, not all specimens of *L. syphax* have bright red colors on the bellies, groin, shanks, or thighs.

• **ACKNOWLEDGMENTS.** Reuber Albuquerque Brandão and Paula Cabral Eterovick reviewed the manuscript. José P. Pombal, Jr. loaned us tadpoles collected by Paula Cabral Eterovick from the Museu Nacional, Rio de Janeiro. Reuber Albuquerque Brandão, Janalee Caldwell, Laurie Vitt, and Franco L. Souza allowed us to include unpublished habitat information. Staff of the Natural History Branch Library of the Smithsonian Institution, Claire Catron, Maggie Dittmore, Carmen Eyzaguirre, Richard Greene, Polly Lasker, Leslie Overstreet, Michael Richardson, Martha Rosen, Ruth Shallert, Courtney Shaw, David Steere, Wanda West, and Daria Wingreen-Mason, obtained literature needed to complete this account. Research for this account was supported by NSF award DEB-0342918 to Rafael O. de Sá and W. Ronald Heyer.

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