

New *Physalaemus* (Anura: Leptodactylidae) from the Atlantic Forest of Minas Gerais, Brazil

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A new species of the frog genus *Physalaemus*, belonging to the *P. signifer* species group, is described from the Atlantic Forest of the Serra do Brigadeiro (20°42'S, 42°29'W), Municipality of Araponga, State of Minas Gerais, Brazil. The new species is readily separated from all other species included in the *P. signifer* group by its large size (43.3–48.5 mm SVL).

Uma nova espécie de anuro do gênero *Physalaemus*, pertencente ao grupo de *P. signifer*, é descrita da Floresta Atlântica da Serra do Brigadeiro (20°42'S, 42°29'W), Município de Araponga, Estado de Minas Gerais, Brasil. A nova espécie é facilmente separada de todas as outras espécies do grupo de *P. signifer* pelo seu maior tamanho (43,3–48,5 mm SVL).

THE genus *Physalaemus* contains 38 recognized species, and is known from Mexico to Southern South America (Frost, 1985; Duellman, 1993; Pombal and Madureira, 1997). Lynch (1970) diagnosed and recognized four species groups in the genus: *P. biligonigerus* group, *P. cuvieri* group, *P. pustulosus* group, and *P. signifer* group. However, *P. deimaticus* Sazima and Caramaschi and *P. rupestris* Caramaschi, Carcerelli, and Feio are not assigned to any recognized species group (Sazima and Caramaschi, 1986; Heyer and Wolf, 1989; Caramaschi et al., 1991). The *P. signifer* group is characterized by its small to moderate size (15–35 mm SVL), slender body, smooth skin, first finger shorter than second, no inner tarsal tubercle, small noncompressed metatarsal tubercles, small to large inguinal glands, and paratoid glands absent (Lynch, 1970). Ten species are presently allocated to this group: *P. bokermanni* Cardoso and Haddad, *P. caete* Pombal and Madureira, *P. crombiei* Heyer and Wolf, *P. maculiventris* (A. Lutz), *P. moreirae* (Miranda-Ribeiro), *P. nanus* (Boulenger), *P. oblectus* Bokermann, *P. olfersii* (Lichtenstein and Martens), *P. signifer* (Girard), and *P. spiniger* (Miranda-Ribeiro) (Frost, 1985; Duellman, 1993; Pombal and Madureira, 1997).

During an ecological study on the anurans of the Serra do Brigadeiro, State of Minas Gerais, southeastern Brazil, one of us (RNF) collected specimens of a large species of the *P. signifer* group. Herein, we describe this new species.

MATERIALS AND METHODS

Specimens used in the description or examined for comparisons are deposited in AL–MN (Adolpho Lutz Collection, deposited in the Museu Nacional, Rio de Janeiro, Brazil), CFBH

(Célio F. B. Haddad Collection, deposited in the Departamento de Zoologia, Universidade Estadual Paulista, Rio Claro, Brazil), EI (Eugenio Izecksohn Collection, deposited in the Departamento de Biologia Animal, Universidade Federal Rural do Rio de Janeiro, Brazil), JJ (Jorge Jim Collection, deposited in the Departamento de Zoologia, Universidade Estadual Paulista, Campus de Botucatu, Brazil), MNRJ (Museu Nacional, Rio de Janeiro, Brazil), MZUFV (Museu de Zoologia “João Moojen de Oliveira,” Universidade Federal de Viçosa, Brazil), MZUSP (Museu de Zoologia, Universidade de São Paulo, Brazil), ZUEC (Museu de História Natural, Universidade Estadual de Campinas, Brazil). Additional specimens examined are listed in the appendix.

Abbreviations used in the measurements of the adults are SVL (snout–vent length), HL (head length), HW (head width), ED (eye diameter), END (eye to nostril distance), IND (internarial distance), THL (thigh length), TBL (tibia length), and FL (foot length). All measurements (in millimeters) follow Duellman (1970) and Cei (1980) and were taken with a calliper except for the DO, DON, and DIN, which were measured with an ocular micrometer in a Zeiss stereomicroscope. Drawings of the holotype were made using a Zeiss stereomicroscope with a drawing tube.

Physalaemus maximus sp. nov.

Holotype.—MNRJ 18810 (Fig. 1), adult male, collected at the Fazenda Neblina, Serra do Brigadeiro (20°42'S, 42°29'W; 1375 m above sea level), Municipality of Araponga, State of Minas Gerais, Brazil, on 29 October 1996, by R. N. Feio and J. L. Pontes.

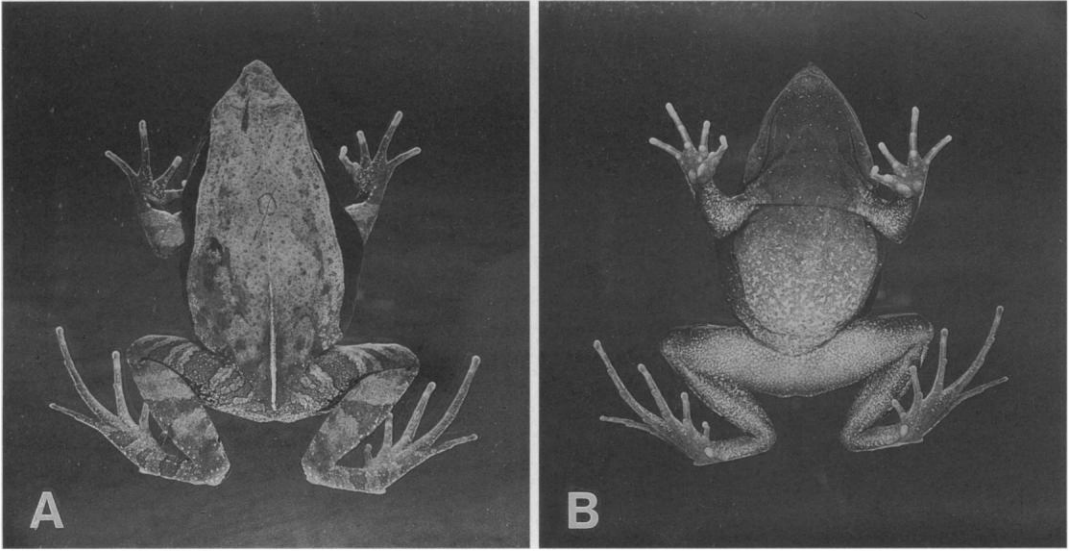


Fig. 1. *Physalaemus maximus*, holotype MNRJ 18810. (A) Dorsal view, and (B) ventral view.

Paratopotypes.—MNRJ 18811 and MZUFV 2723, adult males collected with the holotype; MNRJ 21736–38 and MZUFV 3280 collected on 11 November 1997, by R. N. Feio, J. L. Pontes, and P. S. Santos.

Diagnosis.—A species belonging to the *P. signifer* group (sensu Lynch, 1970), characterized by (1) large size (males 43.3–48.5 mm SVL); (2) snout pointed to subelliptical in dorsal view and protruding in lateral view; (3) canthus rostralis distinct; (4) dorsal skin texture smooth; (5) white stripe from back edge of eye to shoulder. *Physalaemus maximus* is readily separated from all species included in the *P. signifer* group by its large size (45.4–47.4 mm SVL in *P. maximus*, and combined SVL 15.0–34.5 mm in the other species; see Pombal and Madureira, 1997; Haddad and Pombal, 1998, and references therein). The new species is distinguished from species of *P. signifer* group, except *P. olfersii*, by the absence of spots in the inguinal region, absence of dark inverted V-shaped or arrow marks on the back, and presence of a white stripe from posterior corner of eye to shoulder. The new species, differs from syntopic *P. cf. olfersii* by absence of an inner tarsal tubercle and in having an oval rather than elongate inner metatarsal tubercle. *Physalaemus maximus* is similar to *P. aguirrei* and *P. soaresi* (however, these species belong to the *P. cuvieri* group, sensu Lynch, 1970). The new species is distinguished from *P. aguirrei* and *P. soaresi* by its large size (males 25–29 mm SVL in *P. soaresi* and *P. aguirrei*; Izecksohn, 1965; Bokermann, 1966) and absence of an inner tarsal tu-

bercle (present in *P. soaresi* and *P. aguirrei*; Izecksohn, 1965; Bokermann, 1966).

Description of holotype.—Body robust; head slightly wider than long; snout subelliptical in dorsal view, protruding in lateral view (Fig. 2A–B); nostrils slightly protuberant, directed laterally; canthus rostralis distinct, slightly concave; eye medium sized, lateral, slightly protuberant; tympanum not visible; indistinct supratympanic fold; vocal sac distinct, subgular, moderately expanded, extending to the border of chest with belly; vocal slits present; choanae medium sized, nearly rounded; tongue narrow, long; vomerine teeth absent; maxillary teeth visible, numerous; a single, very small toothlike process in front of lower jaw. Arms slender; forearms moderately slender; no forearm fold; fingers long, slender; no prepollex; sides of fingers smooth, no ridges; extensive brown nuptial pad on inner side of thumb, divided in two parts; subarticular tubercles single, protruding and round; inner metacarpal tubercle large, nearly elliptical; outer metacarpal tubercle medium sized, nearly ovoid; metacarpal tubercles present; finger tips slightly expanded; finger lengths $I < II < IV < III$ (Fig. 2C). Legs moderately robust; tibia length longer than thigh length; toes long, slightly fringed; inner metatarsal tubercle ovoid, protruding; outer metatarsal tubercle small, round, protruding; subarticular tubercle single, nearly ovoid, protruding; inner side of the first toe free; toe lengths $I < II < V < III < IV$ (Fig. 2D). Inguinal glands small, no spot on glands;

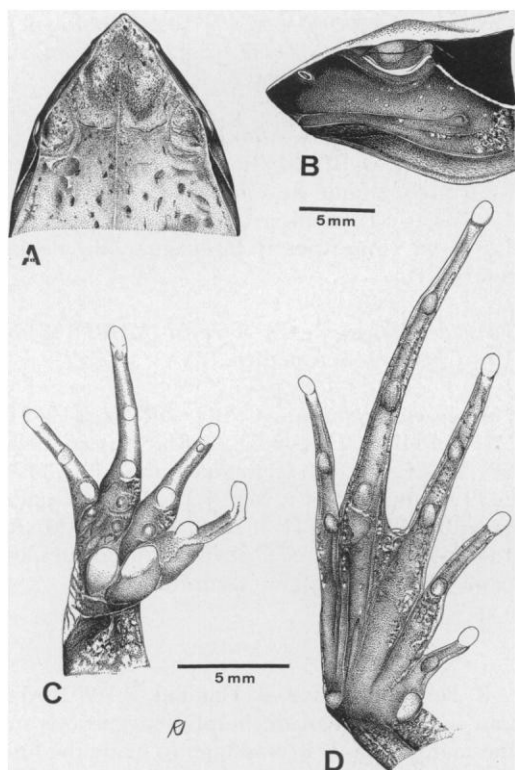


Fig. 2. *Physalaemus maximus*, holotype MNRJ 18810. (A) Dorsal and (B) lateral views of head; ventral views of (C) hand and (D) foot.

dorsal and ventral skin smooth, undersurfaces of thighs granular.

Color of the holotype.—In preservative, dorsum brown with dots or blotches dark brown; a small circle formed by a fine line gray on the scapular region (Fig. 1A); a light brown middorsal stripe most evident in the sacral region; forearms brown with a dark brown transverse bar; elbow and hand dark brown; light finger tips; thigh, tibia, and foot brown, similar to the color of dorsum; thigh and tibia with a dark brown transverse bar, hidden portion of thigh dark gray with numerous dots light gray; knee black; flanks from posterior corner of eye to inguinal region black; a white oblique stripe from posterior corner of eye to arm; dark gray anterior to this oblique stripe; light small dots above eye; chest and throat black with small light dots; belly gray with small cream blotches; underparts of thigh gray; underparts of tibia and foot gray with numerous irregular white lines; sole of hand dark gray with tips of fingers and subarticular tubercles cream; sole of foot dark gray. The coloration in life is similar to that in preservative but more contrasted.

Measurements of holotype.—SVL 47.4; HL 13.6; HW 14.5; ED 4.3; END 3.5; IND 4.1; THL 21.2; TBL 22.1; FL 23.7.

Variation.—In preservative, dorsum brown to dark gray. Measurements (range, mean $\pm$ standard deviation) of seven males (females unknown) are as follows: SVL 43.3–48.5, 46.3 ± 1.63 ; HL 12.5–15.0, 13.6 ± 0.86 ; HW 13.1–15.1, 14.1 ± 0.75 ; ED 3.8–4.3, 4.1 ± 0.20 ; END 3.1–3.8, 3.6 ± 0.25 ; IND 3.6–4.4, 4.0 ± 0.29 ; THL 18.3–21.1, 20.4 ± 1.09 ; TBL 19.9–23.1, 21.9 ± 0.97 ; FL 21.5–24.1, 23.4 ± 0.88 .

Natural history.—All specimens of *P. maximus* were collected at the margins of a permanent pond at the edge of Mesophillic Forest. The advertisement call of *P. maximus* was heard by one of us (RNF); this call is similar to that of *P. cf. olfersii* but longer and of lower frequency. The following species of anurans were collected in the same temporary pond of *P. maximus*: *Hyla albopunctata* Spix, *H. minuta* Peters, *H. polytaenia* Cope, *Phyllomedusa burmeisteri* Boulenger, *Scinax cf. duartei* (B. Lutz), *S. fuscovarius* (A. Lutz) (Hylidae), *Ceratophrys aurita* (Raddi), *Physalaemus cuvieri* Fitzinger, and *P. olfersii*.

Etymology.—The name of the species, a Latin adjective, refers to its large size.

Remarks.—All *P. signifer* species group members (except *P. olfersii* and *P. maximus*) are very similar externally. The species this group are typically small to medium-sized (large in *P. maximus*), have small inguinal glands present, inner tarsal tubercle absent, and dorsal pattern generally with an arrow or an inverted V-shaped mark (except in *P. olfersii* and *P. maximus*); all known species of the *P. signifer* group are associated to the Atlantic Forest Domain (Ab'Saber, 1977). As pointed out by Heyer and Wolf (1989), except for *P. olfersii* and now *P. maximus*, it is possible that the species of the *P. signifer* group comprise a monophyletic assemblage.

Physalaemus cf. olfersii specimens from Viçosa and Araponga, State of Minas Gerais, are very similar morphologically to *P. olfersii*, but they have an inner tarsal tubercle (diagnostic characteristic of the *P. cuvieri* group; sensu Lynch, 1970). Izecksohn (1965) and Bokermann (1966) commented, on the original descriptions, on the general similarity of *P. soaresi* and *P. aguirrei*, with *P. olfersii*. *Physalaemus aguirrei* and *P. soaresi* have an inner tarsal tubercles (Izecksohn, 1965; Bokermann, 1966) and were allocated to the *P. cuvieri* group by Lynch (1970). The species *P. aguirrei*, *P. maximus*, *P. ol-*

fersii, and *P. soaresi* are more similar externally to each other than they are with other *Physalaemus* of the *P. cuvieri* or *P. signifer* species group (sensu Lynch, 1970). These four species are of small to large size, reproduce in forests, may or may not have an inner tarsal tubercle, have a dorsal pattern generally without an arrow or an inverted V-shaped mark, show a fine light fold from the posterior corner of the eye to the groin, and have black or dark gray surfaces below this fold. However, without additional evidence, we are reluctant to suggest a new species group for *P. aguirrei*, *P. maximus*, *P. olfersii*, and *P. soaresi*.

ADDITIONAL SPECIMENS EXAMINED

Physalaemus aguirrei.—MNRJ 4024 (paratype, Linhares, ES); MNRJ 18917–020, 18916, 19039–045 (Nova Viçosa, BA).

Physalaemus bokermanni.—UEC 4520–21 (paratypes, Santo André, SP).

Physalaemus caete.—MNRJ 9803 (holotype, Passo de Camaragibe, AL), MNRJ 9801–02, 9804–05, 9848–50 (paratopotypes, Passo de Camaragibe, AL), MNRJ 9712–17 (Murici, AL).

Physalaemus crombiei.—MNRJ 17694–745 (Araucruz, ES); MNRJ 19035–038 (Nova Viçosa, BA).

Physalaemus deimaticus.—JJ 6057–58 (holotype and paratype, Serra do Cipó, MG).

Physalaemus maculiventris.—AL–MN 684 (syntype, “Alto da Serra de Cubatão”), MNRJ 4228–30 (Paranapiacaba, SP), MNRJ 1797, 9975–10020 (Serra de Araraquara, PR).

Physalaemus moreirae.—MNRJ 464 (holotype, Paranapiacaba, Santos, SP).

Physalaemus nanus.—CFBH 081 (São José, SC), MNRJ 12827–32 (Florianópolis, SC).

Physalaemus obtectus.—MNRJ 4025, 14206–07 (paratypes, Linhares, ES).

Physalaemus olfersii.—MNRJ 2428 (Parati, RJ); MNRJ 0482, 5525–26, 12826 (Teresópolis, RJ); MNRJ 18812–13 (Botucatu, SP).

Physalaemus cf. olfersii.—MNRJ 19523–24, MZUFV 808, 2514 (Mata do Paraíso, Viçosa, MG); MNRJ 19521–22, MZUFV 2210, 2731 (Serra do Brigadeiro, Araponga, MG).

Physalaemus rupestris.—MNRJ 10551 (holotype), MNRJ 10552–53, MZUSP 67092 (paratypes, Ibitipoca, Lima Duarte, MG).

Physalaemus signifer.—MNRJ 1123, 6616–35 (Duque de Caxias, RJ), MNRJ 2753, 12461–62 (Barro Branco, Duque de Caxias, RJ); MNRJ 2766, 12477–80 (Pendotiba, Niterói, RJ), MNRJ 12837–42 (topotypes, Jacarepaguá, Rio de Janeiro, RJ).

Physalaemus soaresi.—EI 7864–87, MNRJ 18814–15 (topotypes, Seropédica, RJ).

Physalaemus spiniger.—CFBH 312–17, 319–21, MNRJ 18474, ZUEC 6878, 6881–82 (Cananéia, SP), ZUEC 9333–43 (Caraguatatuba, SP), CFBH 2479 (Eldorado, SP); MNRJ 18475–76 (Guaraqueçaba, PR); CFBH 307–10, 410, 835, MNRJ 18470–72, 18473, ZUEC 6876–77 (topotypes, Iguaçu, SP), ZUEC 3250 (Jacupiranga, SP).

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