



A NEW LARGE TREEFROG SPECIES, GENUS *HYLA* LAURENTI, 1768, FROM SOUTHERN BAHIA, BRAZIL (AMPHIBIA, ANURA, HYLIDAE) ¹

(With 5 figures)

ULISSES CARAMASCHI ^{2,4}
MIGUEL TREFAUT RODRIGUES ^{3,4}

ABSTRACT: A new large treefrog species of the genus *Hyla* is described from São José da Vitória and Wenceslau Guimarães, in southern State of Bahia, Brazil. *Hyla exastis* sp.nov., morphologically belonging to the *H. boans* (Linnaeus, 1758) species group and related to *H. pardalis* Spix, 1827 and *H. lundii* Burmeister, 1856, is characterized by: large size (snout-vent length, 81.1-99.0mm in males, 86.5mm in female); dorsum granulose; a developed crenulate fringe along external border of forearm, finger IV, foot, and toe V; calcar appendix conspicuous; anal plate distinct, inferiorly delimited by a transversal row of white tubercles; dorsum grayish yellow (in life) or brown (in preservative), with dark brown to black marks without forming a definite pattern, resembling tree bark with lichens; in life, palm of hand bluish yellow, fingers and disks deep blue, and webbing yellowish gray; sole of foot gray, toes and disks deep blue, and webbing black; palmar formula, I 2 - 2⁺ II 1 - 2⁻ III 1½ - 1 IV; plantar formula, I 1 - 1 II 1 - 1½ III 1 - 1½ IV 1½ - 1 V.

Key words: Amphibia; Anura; Hylidae; *Hyla exastis* sp.nov., Southern Bahia; Taxonomy.

RESUMO: Nova espécie de *Hyla* Laurenti, 1768 de grande porte do sul da Bahia, Brasil (Amphibia, Anura, Hylidae).

Uma nova espécie de *Hyla* de grande porte é descrita de São José da Vitória e Wenceslau Guimarães, no sul do Estado da Bahia, Brasil. *Hyla exastis* sp.nov., morfológicamente pertencente ao grupo de *H. boans* (Linnaeus, 1758) e relacionada a *H. pardalis* Spix, 1827 e *H. lundii* Burmeister, 1856, é caracterizada por: tamanho grande (comprimento rostro-cloacal, 81,1-99,0mm em machos, 86,5mm na fêmea); dorso granuloso; uma fimbria crenulada desenvolvida ao longo da borda externa do antebraço, dedo IV, pé e artelho V; apêndice calcâneo desenvolvido; placa anal desenvolvida, delimitada inferiormente por uma fileira transversal de tubérculos brancos; dorso amarelo acinzentado (em vida) ou castanho (em preservativo), com manchas castanho escuro a preto sem formar desenho definido e lembrando a casca de árvore com líquens; em vida, palma da mão amarelo azulado, dedos e discos azul escuro e membranas interdigitais cinza amarelado; sola do pé cinza, artelhos e discos azul escuro e membranas interdigitais pretas; fórmula palmar, I 2 - 2⁺ II 1 - 2⁻ III 1½ - 1 IV; fórmula plantar, I 1 - 1 II 1 - 1½ III 1 - 1½ IV 1½ - 1 V.

Palavras-chave: Amphibia; Anura; Hylidae; *Hyla exastis* sp.nov., sul da Bahia; Taxonomia.

INTRODUCTION

Large Central and South American treefrog species of the genus *Hyla* Laurenti, 1768 assigned to the *H. boans* group, as defined by DUELLMAN (2001) and CARAMASCHI & NAPOLI (in press), are *H. boans* (Linnaeus, 1758), *H. faber* Wied, 1821, *H. crepitans* Wied, 1824, *H. pardalis* Spix, 1824, *H. lundii* Burmeister, 1856, *H. pugnax* Schmidt, 1857, *H. rosenbergi* Boulenger, 1899, and *H. wavrini* Parker, 1936. Among them, *H. pardalis* and *H. lundii* are supposed to be closely related by having a rugose dorsal skin texture and by presenting a lichenous color pattern (the other species in the group have a smooth dorsal skin and a dorsum

uniformly brown with a dark brown longitudinal line or dark brown blotches).

In this paper we describe a new large species of *Hyla* morphologically belonging to the *H. boans* group and related to *H. pardalis* and *H. lundii*, obtained in southern State of Bahia, Brazil.

MATERIAL AND METHODS

Type specimens are deposited in the collections of the Museu de Zoologia, Universidade de São Paulo, SP, Brazil (MZUSP) and Museu Nacional, Rio de Janeiro, RJ, Brazil (MNRJ). Specimens used for comparisons are referred to in CARAMASCHI &

¹ Received on 13 May, 2003. Accepted on 7 July, 2003.

² Museu Nacional/UF RJ, Departamento de Vertebrados. Quinta da Boa Vista, São Cristóvão, 20940-040, Rio de Janeiro, RJ, Brasil. E-mail: ulisses@acd.ufrj.br.

³ Universidade de São Paulo, Instituto de Biociências, Departamento de Zoologia. Caixa Postal 11461, São Paulo, 05422-970, RJ, Brasil. E-mail: mturodri@usp.br.

⁴ Fellow of Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

NAPOLI (in press). Measurements, in millimeters, were made according to NAPOLI & CARAMASCHI (1998) as follows: SVL (snout-vent length), HL (head length), HW (head width), IND (internarial distance), END (eye to nostril distance), ED (eye diameter), UEW (upper eyelid width), IOD (interorbital distance), TD (tympanum diameter), THL (thigh length), TL (tibia length), FL (foot length), 3FD (third finger disk diameter), and 4TD (four toe disk diameter). Webbing formula notation follows SAVAGE & HEYER (1967) as modified by MYERS & DUELLMAN (1982). Line art drawings were made with the aid of a stereomicroscope Zeiss SV-4 equipped with a camera lucida.

Hyla exastis sp.nov.
(Figs.1-5)

Holotype – BRAZIL: BAHIA: Municipality of São José da Vitória, Fazenda Unacau (15°09'S, 39°18'W), adult ♂ (Fig.1), MZUSP 63540, M. Rodrigues col., 10-21/X/1986 (field number 86.7180).

Paratypes – BRAZIL: BAHIA: collected with the holotype, MZUSP 63538, MZUSP 63542, MNRJ

29976, adult ♂, MZUSP 63541, adult ♀. Municipality of Wenceslau Guimarães, Estação Ecológica Estadual de Nova Esperança (13°36'S, 39°43'W), adult ♂, MNRJ 29784, B.V.S.Pimenta e R.V.Lopes cols., 29/VIII/2000.

Diagnosis – A treefrog morphologically belonging to the *H. boans* species group and related to *H. pardalis* and *H. lundii*, characterized by: (1) large size (SVL 81.1-99.0mm in males, 86.5mm in female); (2) dorsum granulose; (3) a developed crenulate fringe along external border of forearm, finger IV, foot, and toe V; (4) calcar appendix conspicuous; (5) anal plate distinct, inferiorly delimited by a transverse row of white tubercles; (6) dorsum grayish yellow (in life) or brown (in preservative), with dark brown to black marks without forming a definite pattern and resembling tree bark with lichens; (7) in life, palm of hand bluish yellow, fingers and disks deep blue, and webbing yellowish gray; sole of foot gray, toes and disks deep blue, and webbing black; (8) palmar formula, I 2 - 2⁺ II 1 - 2⁻ III 1½ - 1 IV; (9) plantar formula, I 1 - 1 II 1 - 1½ III 1 - 1½ IV 1½ - 1 V.



Fig.1- Dorsal and ventral views of *Hyla exastis* sp.nov. (MZUSP 63540, holotype; SVL 99.0mm).

Comparisons with other species – *Hyla exastis* sp.nov. is promptly distinguished from all other members of the *H. boans* species group by the color of palm of hand and sole of foot (light brown or whitish in the other species) and, except for *H. lundii* and *H. pardalis*, by the lichenous dorsal pattern (other species are uniformly brown, frequently with a mid-dorsal longitudinal dark brown stripe) and presence of developed, crenulate fringes (absent in the other species). Additionally, *H. exastis* sp.nov. differs from *H. boans* and *H. wavrini* by the absence of golden arabesques on the transparent part of lower eyelid (present in those species) and from *H. crepitans*, *H. faber*, *H. pugnax*, and *H. rosenbergi* by the presence of a calcar appendix and an anal plate inferiorly delimited by a transverse row of white tubercles (absent in those species). From *H. lundii* and *H. pardalis*, the new species is distinguished by the slender build, larger size (combined SVL of males of *H. lundii* and *H. pardalis*, 48.0-71.0mm; of females, 54.0-70.0mm; CAIS, 1992, LUTZ, 1973), dorsum granulose (smooth in those species), absence of supranumerary tubercles on hands and feet (present in those species), and more conspicuous anal plate and its inferior row of tubercles.

Description – Body slender; head longer than wide; snout short, nearly rounded in dorsal view (Fig.2), truncate, vertical in lateral view (Fig.3); nostrils not protuberant, oblique, directed laterally; internarial distance smaller than eye to nostril distance, eye diameter, upper eyelid width, and interorbital distance, and approximately equal to tympanum diameter; canthus rostralis distinct; loreal region concave; lips not flared; eyes large, slightly protruding; eye diameter smaller than eye to nostril distance and interorbital distance, and larger than upper eyelid width and tympanum diameter; interorbital space and snout flat; tympanum large, nearly circular, with the superior border covered by a supratympanic fold; in males, vocal sac single, subgular, poorly developed; vocal slits present, large; tongue large, rounded, covering entire floor of mouth, slightly free and not notched behind; choanae large, elliptical, widely separated; vomerine teeth in two contiguous, arched patches between choanae.

Arms robust; forearm more robust than upper arm, slightly hypertrophied; a crenulate fringe along ventrolateral side of forearm and external side of finger IV. Hand large (Fig.4), no palmar or thenar tubercle; prepollex developed, with a single, curved spine; fingers long, slender; subarticular tubercles single, rounded; no supranumerary tubercles;

finger disks large, nearly circular; first finger disk slightly smaller than those of the other fingers; diameter of third finger disk about 60% of eye diameter and approximately 82% of tympanum diameter; fingers extensively webbed; webbing formula, I 2 - 2⁺ II 1 - 2 III 1½ - 1 IV.

Legs long, slender; thigh length slightly smaller than tibia length, and both clearly shorter than foot length; SVL approximately 92% of summed thigh and tibia lengths; a developed, crenulate outer tarsal fringe, extending all along the tarsus and outer edge of toe V to the base of disk; calcar developed. Foot large (Fig.5) with large, elliptical inner and vestigial outer metatarsal tubercles; subarticular tubercles small, single, rounded; supranumerary tubercles absent; toe disks large, their diameter smaller than those of finger disks; toes extensively webbed; webbing formula, I 1 - 1 II 1 - 1½ III 1 - 1½ IV 1½ - 1 V.

Skin on dorsal surfaces granulose; throat and chest smooth; belly and under surfaces of thighs areolate; anal plate developed, inferiorly delimited by a transverse row of tubercles.

Color in life – Dorsum grayish yellow with dark gray to black marks, without forming a definite pattern and resembling tree bark with lichens. A black line just below the canthus rostralis, between the eye and naris. Black bars on upper jaw continuing onto mandible. Upper surfaces of arms, hands, legs, and feet, grayish yellow with dark gray to black transverse bars. Sides of body and anterior and posterior surfaces of thighs with irregular, sometimes anostomosed, white bars. Gular region and chest, white; belly and ventral surfaces of thighs, yellow; ventral surfaces of arms, grayish yellow; palm of hand bluish yellow, fingers and disks deep blue, and webbing yellowish gray; sole of feet gray, toes and disks deep blue, and webbing black. Dorsal surfaces of the fringes of forearms and feet follow the dorsal pattern and ventral surfaces follow ventral ones. Anal region black, with stains and lines white; tubercles below anal plate, white. Iris yellow with a black horizontal bar.

Color in preservative – Dorsum brown with dark brown to black marks, without forming a definite pattern and resembling tree bark with lichens. A black line just below the canthus rostralis, between the eye and naris. Black bars on upper jaw continuing onto mandible. Upper surfaces of arms and legs brown with dark brown to black transverse bars. Sides of body and anterior and posterior surfaces of thighs cream with transverse dark gray

to black bars. Ventral surfaces of arms, hands, thighs, and tibiae, whitish cream; soles of feet gray. Dorsal surfaces of the fringes of forearms and feet follow the dorsal pattern and ventral surfaces follow ventral ones. Anal region black, with stains and lines white; tubercles below anal plate, white.

Measurements of holotype – SVL 99.0; HL 30.5; HW 30.9; IND 6.5; END 11.5; ED 7.3; UEW 8.0; IOD 9.8; TD 6.6; THL 49.6; TL 50.5; FL 66.4; 3FD 5.1; 4TD 4.4.

Variation – The type specimens perfectly agree in morphological and color traits. Variation in measurements is presented in table 1.

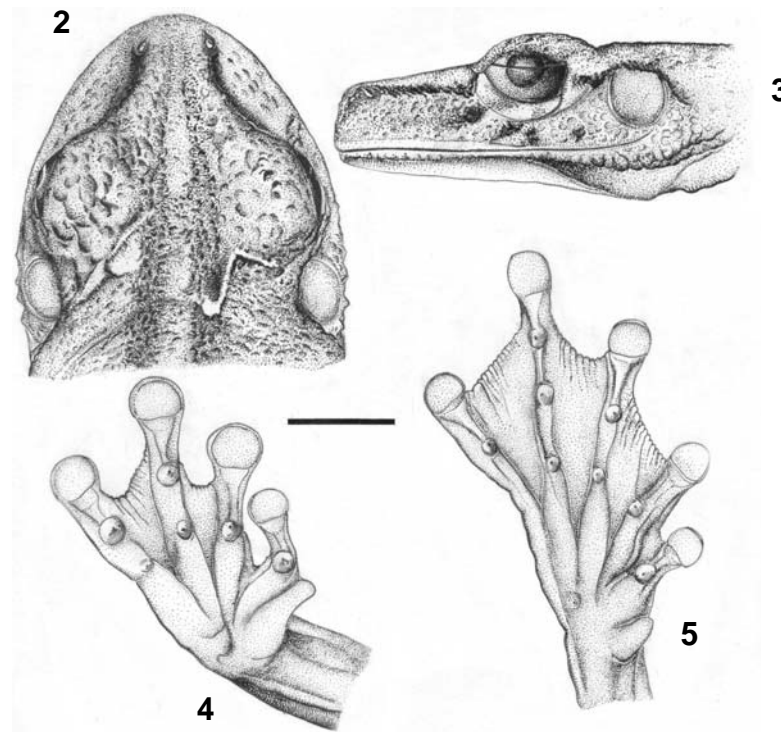
Geographical distribution – Known from two localities, in the municipalities of São José da Vitória and Wenceslau Guimarães, in southern State of Bahia, Brazil.

Habitat and habits – *Hyla exastis* sp.nov. occurs in eastern Brazil and is a primary inhabitant of rain forests associated to the Tropical Atlantic Domain in southern State of Bahia. The two localities from where the species is known, although separated by approximately 150km are located in mountainous areas of Atlantic forests situated

between 100 and 130m altitude, receiving nearly 1500mm of annual rain (CEPLAC, 1976a, 1976b). Pristine habitats in this region consisted of primary rainforest with large trees (up to 30m height) and characterized by the abundance and high diversity of epiphytes. Presently, almost all the area is disturbed for cacao plantation. At São José da Vitória, specimens of *H. exastis* sp.nov. were collected in primary forest and adjacent cacao plantations when calling in the vegetation, above 8m from the ground. Advertisement call was not recorded and tadpole is unknown.

The holotype presents marks on the region above tympanum that look as it participated in male-male combats. Although no other examined male presented these marks, it is possible that aggressive behavior exists in *H. exastis* sp.nov., as reported for other “gladiator frogs” included in the *H. boans* species group (see MARTINS, POMBAL JR. & HADDAD, 1998, and references herein).

Etymology - The specific name is derived from the Greek *exastis*, meaning rough edge, fringe, and alludes to the extensively fringed forearms, hands, feet, and anal region of the new species.



Hyla exastis sp.nov. (MZUSP 63540, holotype): fig.2- dorsal view of head; fig.3- lateral view of head; fig.4- hand; fig.5- foot. Scale = 10mm.

TABLE 1
Range, mean, and standard deviation (SD) of the measurements (mm)
of males and female of *Hyla exastis* sp.nov.

Character	♂ (n=5)			♀ (n=1)
	Range	Mean	SD	Measurements
SVL	81.1-99.0	89.6	7.28	86.5
HL	26.5-31.6	28.7	2.22	31.0
HW	26.2-30.9	28.5	2.04	30.2
IND	5.6-6.5	6.0	0.36	6.2
END	9.0-11.7	10.5	1.14	10.4
ED	7.3-8.9	8.1	0.62	8.4
UEW	6.6-8.0	7.5	0.73	7.2
IOD	8.5-9.8	9.0	0.47	8.9
TD	5.4-6.6	5.8	0.49	5.7
THL	45.2-50.9	47.6	2.50	47.1
TL	44.9-53.0	49.2	3.10	50.1
FL	60.1-68.6	63.8	3.65	63.6
3FD	4.5-5.2	4.9	0.26	4.7
4TD	3.8-4.6	4.2	0.33	3.9

(n) number of specimens.

DISCUSSION

Hyla exastis sp.nov. is included in the *H. boans* species group based on morphological traits, as defined by DUELLMAN (2001) and CARAMASCHI & NAPOLI (in press). However, the construction or utilization of special sites (nests) for egg deposition (see references in CARAMASCHI & NAPOLI, in press) is unknown, although expected. Among the species included in the *H. boans* group, there is no evidence of constructed nests for *H. pugnax* (DUELLMAN, 2001).

The skin texture and the color pattern giving a lichenous aspect similar to tree bark are characters shared by *H. exastis* sp.nov., *H. lundii*, and *H. pardalis*. This general appearance distinguishes these species from all other members of the *H. boans* species group and suggests their phylogenetic proximity (CARAMASCHI & NAPOLI, in press).

According to CARAMASCHI & NAPOLI (in press), *H. lundii* is primarily associated with the Cerrado Domain and *H. pardalis* to the Tropical Atlantic Domain (see AB'SABER, 1977, for definitions and limits of the Brazilian morphoclimatic domains). *Hyla lundii* occurs in central and southeastern Brazil, in the Federal District, and in the states of Goiás, Minas Gerais, and São Paulo. *Hyla pardalis* is distributed in eastern Brazil, in the states of Minas

Gerais, Rio de Janeiro, and São Paulo. Both species inhabit clearings, forest borders, and gallery forests along small rivers, but do not enter the forest properly; sympatry has never been observed among them. *Hyla exastis* sp.nov. occurs in eastern Brazil and is a primary inhabitant of rain forests associated to the Tropical Atlantic Domain in southern State of Bahia. This habitat preference seems to be different from those of its widely disjunct and putative relatives *H. lundii* and *H. pardalis*.

ACKNOWLEDGEMENTS

To Drs. Alfredo Ricardo Langguth (Universidade Federal da Paraíba) and Eliza Maria X. Freire (Universidade Federal do Rio Grande do Norte) for field assistance; Bruno V.S. Pimenta (MNRJ) for the paratype from Wenceslau Guimarães (BA); Paulo Roberto Nascimento (MNRJ) for the line drawings; and Financiadora de Estudos e Projetos (FINEP) for financial support.

LITERATURE CITED

AB'SABER, A.N., 1977 - Os domínios morfoclimáticos na América do Sul. Primeira aproximação. **Geomorfologia**, São Paulo, **52**:1-22, 1 mapa.

- CAIS, A., 1992 - **Aspectos biológicos e status taxonômico de *Hyla biobeba* Bokermann & Sazima, 1973 (Amphibia, Anura)**. 176p. Rio Claro. Tese (Doutorado em Ciências Biológicas - Zoologia). Universidade Estadual Paulista.
- CARAMASCHI, U. & NAPOLI, M.F., in press - The nomenclatural status of the synonyms of *Hyla pardalis* Spix, 1824, and the taxonomic position of *Hyla biobeba* Bokermann and Sazima, 1974 (Anura: Hylidae). **Journal of Herpetology**, Lawrence.
- CEPLAC, 1976a - **Diagnóstico Socioeconômico da Região Cacaueira. Recursos Hídricos**. Ilhéus: Comissão Executiva do Plano da Lavoura Cacaueira. v.5, xvi, 133p.
- CEPLAC, 1976b - **Diagnóstico Socioeconômico da Região Cacaueira. Recursos Florestais**. Ilhéus: Comissão Executiva do Plano da Lavoura Cacaueira. v.7, xvii, 246p.
- DUELLEMAN, W.E., 2001 - **The Hylid Frogs of Middle America**. Ithaca: Society for the Study of Amphibians and Reptiles. 2 v., xvi, 1158p., 92 pls.
- LUTZ, B., 1973 - **Brazilian Species of *Hyla***. Austin and London: University of Texas Press. xix, 265p., 7pls.
- MARTINS, M., POMBAL JR., J.P. & HADDAD, C.F.B., 1998 - Escalated aggressive behaviour and facultative parental care in nest building gladiator frog, *Hyla faber*. **Amphibia-Reptilia**, Leiden, **19**(1):65-73.
- MYERS, C.W. & DUELLEMAN, W.E., 1982 - A new species of *Hyla* from Cerro Colorado, and other tree frog records and geographical notes from Western Panama. **American Museum Novitates**, New York, **2752**:1-32.
- NAPOLI, M.F. & CARAMASCHI, U., 1998 - Duas novas espécies de *Hyla* Laurenti, 1768 do Brasil Central afins de *H. tritaeniata* Bokermann, 1965 (Amphibia, Anura, Hylidae). **Boletim do Museu Nacional, Nova Série, Zoologia**, Rio de Janeiro (391):1-12.
- SAVAGE, J.M. & HEYER, W.R., 1967 - Variation and distribution in the tree-frog genus *Phyllomedusa* in Costa Rica, Central America. **Beiträge zur Neotropischen Fauna**, Stuttgart, **5**:111-131.