

NOTES ON THE POORLY KNOWN PHYLLOMEDUSINE FROG *HYLOMANTIS ASPERA* PETERS, 1872 (ANURA, HYLIDAE)

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ABSTRACT: The genus *Hylomantis*, anteriorly restricted to the Northeastern Brazilian Atlantic Forest, was recently augmented with the inclusion of the species of the former *Phyllomedusa buckleyi* group. The discovery of new populations of *Hylomantis aspera*, a poorly known species occurring in the southern region of the State of Bahia, Brazil, allowed the collection of new data regarding tadpole external morphology, advertisement call, color in life, habitat, and geographic distribution. Tadpoles of the *H. aspera* species group present an anteroventral short funnel-shaped structure on the oral disc. The occurrence of bright orange coloration on flanks and hidden portions of legs, a presumed evidence for the monophyly of the *H. buckleyi* species group, also occurs in *H. aspera* and could be interpreted as supporting the clade *Hylomantis* + the former *P. buckleyi* group. A remarkable character found in species of the *H. aspera* group is a white hepatic peritoneum, anteriorly known only for some centrolenid frogs, which is absent on species of the *H. buckleyi* group.

KEYWORDS: *Hylomantis aspera*, tadpole external morphology, advertisement call, adult morphology, geographic distribution, *Hylomantis aspera* species group.

INTRODUCTION

Phyllomedusinae Günther, 1858 is a sub-family of Middle and South-American hylid frogs with 58 known species (Faivovich *et al.*, 2005; Frost, 2007; Caramaschi *et al.*, 2006; Giaretta *et al.*, 2007). The family Hylidae Rafinesque, 1815 was recently reviewed by Faivovich *et al.* (2005), and this study provides a general framework for the study of the relationships among the genus and major species groups within Phyllomedusinae. However, the relationships among lower taxonomic units of this sub-family are not well understood.

Before Faivovich *et al.* (2005), the genus *Phyllomedusa* Wagler, 1830 consisted of the following five species groups, with some species unassigned to any group: *P. buckleyi* Boulenger, 1882, *P. burmeisteri* Boulenger, 1882, *P. hypochondrialis* (Daudin, 1800), *P. perinesos* Duellman, 1973, and *P. tarsius* Cope, 1868. Cannatella (1980) reviewed the *P. buckleyi* species group and provided characters to differentiate this group from other phyllomedusines. Cannatella (1980) agreed with Duellman (1968, 1969) that the *P. buckleyi* group deserves a distinct generic status due to their “unspecialized” hands and feet (i.e., with no opposable first finger and toe), rudimentary webbing, broad flat heads, no elevated parotoid glands, and unmarked palpebral membranes. However, these

authors continued to recognize this group as a member of the genus *Phyllomedusa* until its monophyly could be tested. A recent molecular analysis provisionally included the six species of the *P. buckleyi* group in the genus *Hylomantis* Peters, 1872 (Faivovich *et al.*, 2005). Since then, *Hylomantis* consists of two species groups: the *H. aspera* group that occurs in the Atlantic Rainforest Domain (sensu Ab’Sáber, 1977) of Northeastern Brazil and the *H. buckleyi* group found in Central America, the Colombian Choco, and the western Amazon basin of South America (Frost, 2007).

Hylomantis aspera (Fig. 1) was described from four syntypes (ZMB 7507 and 52690-92) probably collected at Caravelas, State of Bahia, Brazil (Peters, 1872; Bokermann, 1966). Subsequently, Cruz (1988) reported a specimen found in 1972 at Itabuna, Bahia. These were the only specimens known until a recent extension of the species’ geographic range (Pimenta *et al.* 2005); however, the study did not report specific localities or the entire range extension. Herein, we present recently collected data regarding tadpole external morphology, advertisement call, coloration in life, habitat, adult morphology, and distribution range. We also discuss the impact of morphological characters of adults and larvae and color characters to assess the phylogeny of the genus *Hylomantis*.



FIGURE 1: Adult male of *Hylomantis aspera* (MNRJ 42552) in life, RPPN Estação Veracel, Porto Seguro, State of Bahia, Brazil.

MATERIAL AND METHODS

Museum acronyms used in the text are MNRJ (Museu Nacional, Rio de Janeiro, Brazil), UFBA (Museu de Zoologia, Universidade Federal da Bahia, Salvador, Brazil), and MZUSP (Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil).

Tadpoles were collected with a dip net from a temporary pond inside the forest at Reserva Particular do Patrimônio Natural (RPPN) Estação Veracel (formerly Estação Veracruz; 16°23'S, 39°10'W; 90 m above sea level), Municipality of Porto Seguro, State of Bahia, Brazil. The region of Porto Seguro is situated in the Atlantic Forest Domain (*sensu* Ab'Sáber, 1977) of the southern region of the State of Bahia, and the RPPN Estação Veracel is a large remnant with 6069 ha comprising several different habitats. The pond where tadpoles were collected was large (approx. 3.0 m x 12.0 m) and 1.0 m deep after heavy rains. Marginal vegetation consisted of trees and bushes, the margins were muddy and the bottom was covered with abundant leaf litter; many fallen tree trunks were in the water. Tadpoles were reared in the laboratory and one specimen reached metamorphosis confirming species identity. A lot of 24 tadpoles (MNRJ 43395) and one metamorphosed specimen (MNRJ 47691) are deposited at Museu Nacional, Rio de Janeiro, Brazil. Descriptions and measurements are based on six tadpoles ranging from stage 36 to 37 (Limbaugh and Volpe, 1957, as modified by Gosner, 1960). Tadpole illustration is based on a specimen in stage 37; for reference purposes the illustrated individual was placed in a small glass tube inside the jar containing the other tadpoles used on the analysis and labeled accordingly. Tadpoles at stages 28 to 35 ($n = 14$) and 39 to 41 ($n = 4$) were used to analyze variations in mea-

surements and labial tooth row formula. Six measurements follow Altig and McDiarmid (1999a): TL (total length); BL (body length); TAL (tail length); MTH (maximum tail height); TMH (tail muscle height); and TMW (tail muscle width). Other measurements are IND (internostril distance: straight-line distance between the inner margins of the nostrils); IOD (interorbital distance: straight-line distance between the inner margins of the eyes); BH (greatest body height); BW (greatest body width); ED (eye diameter: horizontal diameter of the eye in lateral view); ODW (oral disc width: greatest horizontal width of the oral disc in frontal view); DFH (dorsal fin height: greatest height of dorsal fin); VFH (ventral fin height: greatest height of ventral fin); END (eye-nostril distance: straight-line distance between the anterior corner of the eye and the posterior margin of the nostril); NSD (nostril-snout distance: straight-line distance between the anterior margin of nostril and the tip of snout). Measurements (in millimeters) were taken using an ocular grid in a Zeiss stereomicroscope, except for TL, BL, and TAL, which were measured with calipers to the nearest 0.05 mm. Terminology follows Altig and McDiarmid (1999a), except for the position of the intestinal mass, which follows Faivovich (2002). Tadpoles of *H. aspera* were directly compared to two tadpoles of *H. granulosa* Cruz, 1988 (MNRJ 47803); data on the external morphology characters of tadpoles of other species of *Hylomantis* were obtained from Cannatella (1980; referred as *Phyllomedusa*).

Advertisement calls were recorded with a Sony TCD-D8 DAT digital recorder coupled to a Sennheiser K6/ME66 shotgun microphone set (nine calls from one male at Fazenda Montecristo, Canavieiras, State of Bahia, Brazil, and seven calls from one male at RPPN Estação Veracel, Porto Seguro, State of Bahia, Brazil) or with a Panasonic RQ-L31 portable cassette recorder coupled to a Le Son SM-48 cardioid microphone (30 calls from two males at Parque Estadual da Serra do Conduru, Uruçuca, State of Bahia, Brazil). Call recordings are BVSP (Bruno V.S. Pimenta collection of anuran calls) -DAT series 33-02 and 30-03, and BVSP-cassette series 25-01 and 26-01, respectively. Vocalizations were digitized and edited with the software Avisoft-SASLab Light for Windows, version 3.74, at a sampling frequency of 22 KHz, FFT with 256 points, 100% frame, window Hamming, 93.75% overlap, and 16 bit resolution. Sonograms were produced and analyzed with the software SoundRuler for Windows, version 0.9.6.0. Air temperature was recorded with a digital thermometer to the nearest 0.1 °C. Terminology follows Duellman

(1970). Data on the advertisement calls of other species of *Hylomantis* were obtained from Cannatella (1980) and Jungfer and Weygoldt (1994; referred as *Phyllomedusa*).

Adult specimens were identified after comparison with specimens of both species of *Hylomantis* occurring in northeastern Brazil (see Appendix I). Measurements were taken from 19 adult specimens (17 males and two females). Abbreviations used are SVL (snout-vent length), HL (head length), HW (head width), THL (thigh length), TBL (tibia length), FL (foot length, including tarsus), TD (tympanum diameter), ED (eye diameter), END (eye-nostril distance), IND (internarial distance), IOD (interorbital distance), and UEW (upper eyelid width). All measurements are in millimeters and, except for FL, follow Duellman (1970). SVL, HL, HW, THL, TBL, and FL were measured with a digital caliper, whereas other measurements were made with an ocular grid on a stereo dissecting microscope. Coloration in life was first observed in the field and recorded in field notes and subsequently complemented with examination of color slides. Natural history observations were made during specimen collection.

RESULTS

Tadpole external morphology – Body oval in dorsal view and slightly triangular in profile, deeper than wide (Fig. 2); body length 25.9-29.4% of total length; snout subelliptical in lateral view and semi-circular in dorsal view; eyes lateral, located slightly above the median line of the body; nostrils small, elliptical, directed and located antero-laterally, closer to the tip of the snout than to the eyes; presence of a shallow groove from the posterior margin of nostril to the eye. Spiracle single (Fig. 2), short, wide, ventral, located at the end of the first half of the body, sinistral; spiracular opening wide, directed backwards, fused with body wall along all its length; vent tube short, dextral, displaced dorsally and anteriorly, its right wall attached to the margin of ventral fin; intestinal mass longitudinally positioned to the body axis. Tail approximately 70.6-74.1% of total length, its distal portion dorso-ventrally arched; tail musculature slender, gradually tapering to the tip; myomeres poorly developed; dorsal fin small, widely arched, not extending onto the body; ventral fin origin at the middle of posterior third of the body, 2.84 times higher than dorsal fin, on average (SD = 0.21; range = 2.65-3.23). Oral disc anteroventral, modified into a short funnel-shaped structure (retracted in preserved specimens);

its width 48.8-61.4% of body width; tooth row formula 2(2)/3(1); row A-2 interrupted medially by a wide gap, and row P-1 interrupted medially by a narrow gap; rows A-2 and P-2 slightly shorter than P-1; row P-1 slightly shorter than A-1; row P-3 three times shorter than P-2; an uniserial row of marginal papillae interrupted by a wide gap on upper lip, sub-marginal papillae absent; beak finely serrated; upper jaw sheath wide arched, lower jaw sheath 'V'-shaped (Fig. 2).

Variation in tadpole external morphology – The shallow groove from the posterior margin of nostril to the eye is first observed on larvae at stage 36, disappearing around stage 41. From stages 28 to 41 body length represents 24.9-29.4% of total length, whereas tail length is 70.6-75.1% of total length and oral disc width between 45.6-70.5% of body width; measurements are presented in Table 1.

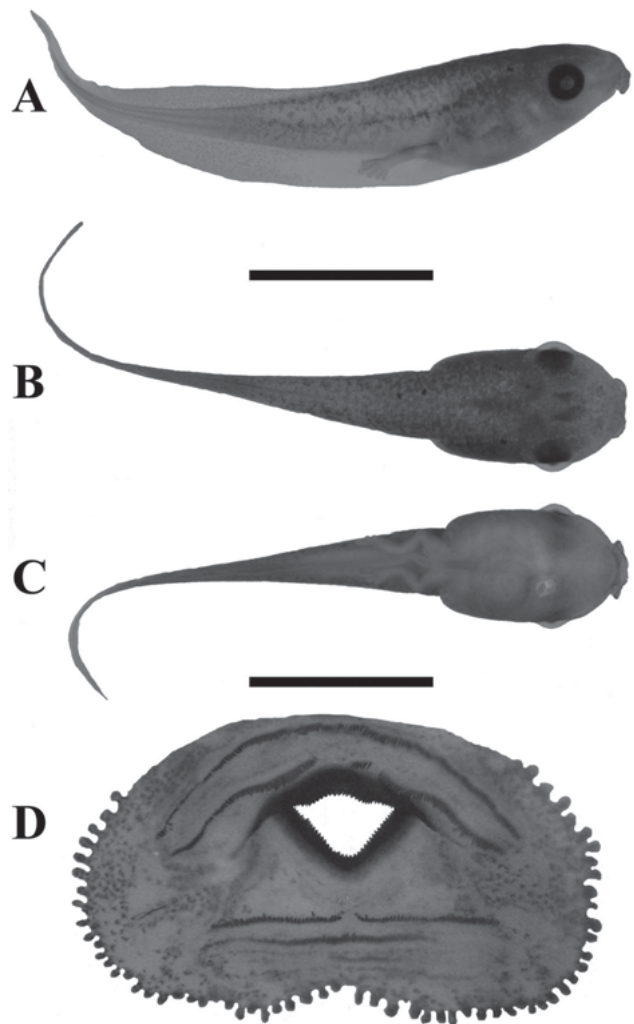


FIGURE 2: Tadpole of *Hylomantis aspera* (MNRJ 43395), stage 37 (Gosner, 1960): (A) lateral, (B) dorsal, and (C) ventral views (scale = 15 mm); (D) oral disc (scale = 1.5 mm).

Color of tadpole – Body and tail musculature cream, dorsal and lateral surfaces light green. Belly lighter than the rest of the body, translucent, immaculate. Gills reddish. Intestines grey, visible laterally and ventrally through a transparent body wall. Tail fins and musculature more heavily pigmented on dorsal areas, tail musculature more pigmented than fins. Keratinized structures of oral disc black. In 5% formalin, body and tail musculature cream to pale brown; dorsal and lateral surfaces become dark-brown; belly grey, immaculate. Intestinal mass grayish-brown, hardly visible through lateral and ventral body walls.

Advertisement call – *Hylomantis aspera* (N = 4) was recorded calling from the marginal vegetation of temporary ponds inside the forest. These advertisement calls consist of three or four very short, close pulses (Fig. 3), with ascendant amplitude modulation. Mean call duration was 30 ms (SD = 0.9 ms, range = 14-50 ms, N = 46 calls) and mean domi-

nant frequency was 1827.50 Hz (SD = 82.51, range = 1679.59-2110.00, N = 46 calls), with slightly ascendant frequency modulation; sidebands on audio-spectrograms occurred when recordings were made with the cardioid microphone.

Notes on adult morphology and color in life – Cruz (1988) re-described the external morphology of the species based on the female specimen from Itabuna, Bahia. We add to this re-description the occurrence of median subgular vocal sac and brown nuptial asperities covering the metacarpal of the first digit in males. General color pattern in life is bright green or purple on dorsum, with a few scattered white warts; some green specimens present irregular purple markings on the dorsum and vice-versa. Fingers, toes, upper-arms, flanks, and hidden portions of arms and legs are bright orange, and ventral surfaces are light-pink. Glandular ridges on arms and legs are white. The liver is covered by a white hepatic peritoneum. Males

TABLE 1: Measurements (in mm) of tadpoles of *Hylomantis aspera*. Values are presented as mean \pm standard deviation (range).

Measures	Stages 28-29 N = 3	Stage 31 N = 4	Stages 33-35 N = 7	Stages 36-37 N = 6	Stages 39-41 N = 4
TL	41.28 \pm 1.28 (40.25-42.85)	45.61 \pm 0.47 (45.05-46.00)	46.15 \pm 1.57 (44.10-48.50)	49.07 \pm 1.82 (47.60-52.50)	54.10 \pm 2.18 (50.85-55.50)
BL	10.67 \pm 0.38 (10.25-11.00)	11.69 \pm 0.38 (11.25-12.00)	12.21 \pm 0.59 (11.40-13.20)	13.73 \pm 0.37 (13.20-14.20)	15.24 \pm 0.65 (14.65-15.80)
BH	6.24 \pm 0.26 (5.98-6.50)	7.63 \pm 0.38 (7.15-7.93)	7.87 \pm 0.45 (7.15-8.32)	8.41 \pm 0.26 (8.06-8.84)	9.13 \pm 0.27 (8.84-9.49)
BW	5.53 \pm 0.20 (5.46-5.85)	6.93 \pm 0.31 (6.50-7.15)	7.02 \pm 0.29 (6.63-7.28)	8.08 \pm 0.34 (7.80-8.71)	9.13 \pm 0.07 (9.10-9.23)
TAL	30.62 \pm 1.07 (30.00-31.85)	33.93 \pm 0.10 (33.80-34.00)	33.94 \pm 1.28 (32.70-35.80)	35.34 \pm 1.71 (33.60-38.30)	38.86 \pm 1.81 (36.20-40.20)
TH	5.33 \pm 0.12 (5.20-5.44)	6.39 \pm 0.20 (6.15-6.56)	7.01 \pm 0.39 (6.40-7.60)	7.68 \pm 0.21 (7.20-8.08)	7.68 \pm 0.22 (7.50-8.00)
TMH	4.69 \pm 0.12 (4.56-4.80)	5.26 \pm 0.23 (4.96-5.44)	5.51 \pm 0.29 (5.04-5.84)	5.93 \pm 0.24 (5.76-6.40)	6.38 \pm 0.26 (6.00-6.56)
TMW	3.76 \pm 0.16 (3.60-3.92)	4.09 \pm 0.08 (4.00-4.16)	4.35 \pm 0.15 (4.24-4.56)	4.96 \pm 0.15 (4.80-5.20)	5.18 \pm 0.10 (5.04-5.28)
DFH	1.07 \pm 0.08 (0.98-1.12)	1.16 \pm 0.03 (1.11-1.18)	1.14 \pm 0.06 (1.04-1.20)	1.05 \pm 0.12 (0.96-1.20)	1.48 \pm 0.08 (1.42-1.60)
VFH	2.33 \pm 0.13 (2.18-2.40)	2.84 \pm 0.07 (2.76-2.90)	2.95 \pm 0.11 (2.85-3.10)	3.00 \pm 0.24 (2.76-3.32)	3.23 \pm 0.32 (2.80-3.65)
ED	2.39 \pm 0.10 (2.28-2.46)	2.55 \pm 0.04 (2.50-2.60)	2.58 \pm 0.04 (2.55-2.67)	2.80 \pm 0.04 (2.76-2.85)	2.95 \pm 0.11 (2.79-3.00)
IOD	3.60 \pm 0.16 (3.44-3.76)	4.00 \pm 0.00 (4.00-4.00)	4.27 \pm 0.17 (4.00-4.40)	4.67 \pm 0.17 (4.40-4.80)	5.12 \pm 0.22 (4.80-5.28)
IND	2.60 \pm 0.09 (2.50-2.65)	3.03 \pm 0.03 (3.00-3.05)	3.06 \pm 0.15 (2.80-3.25)	3.30 \pm 0.08 (3.25-3.40)	3.25 \pm 0.24 (3.00-3.50)
SND	1.42 \pm 0.15 (1.25-1.52)	1.87 \pm 0.05 (1.80-1.90)	2.13 \pm 0.04 (2.10-2.20)	2.13 \pm 0.06 (2.05-2.20)	2.37 \pm 0.02 (2.34-2.46)
NED	1.93 \pm 0.08 (1.85-2.00)	2.19 \pm 0.14 (2.00-2.30)	2.36 \pm 0.15 (2.25-2.60)	2.66 \pm 0.10 (2.50-2.75)	3.00 \pm 0.20 (2.75-3.25)
ODW	3.75 \pm 0.10 (3.65-3.85)	4.04 \pm 0.28 (3.65-4.25)	4.09 \pm 0.20 (3.80-4.25)	4.25 \pm 0.23 (4.00-4.60)	4.30 \pm 0.15 (4.15-4.50)

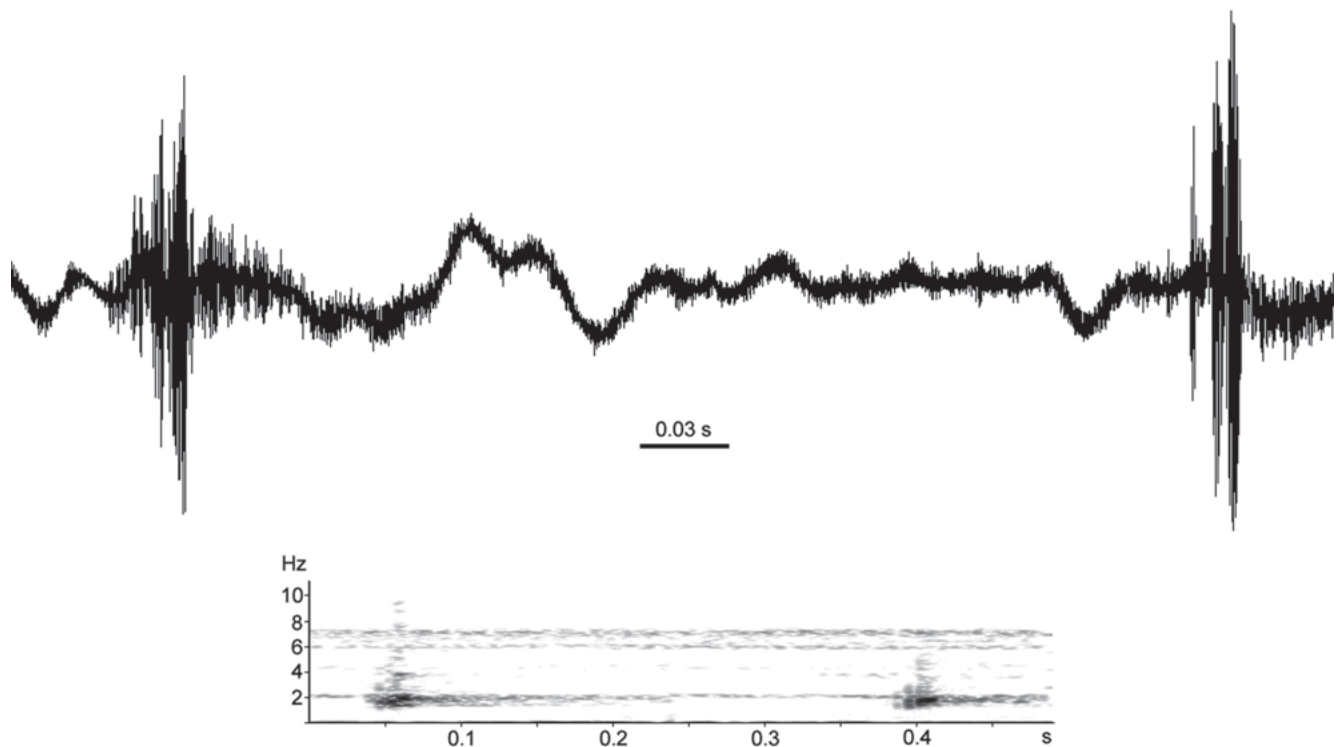


FIGURE 3: Waveform (above) and audiospectrogram (below) of the advertisement call of *Hylomantis aspera*, recorded at RPPN Estação Veracel, Porto Seguro, Bahia, on 15 February 2002, 07:06 P.M. Air temperature 23.2°C. Frequencies between 6-8 Hz refer to background noise.

SVL ranges from 38.8 to 45.8 mm, and females from 45.1 to 48.3 mm. Morphometric variation is shown in Table 2.

Eggs and juveniles – An amplexant pair was found at RPPN Estação Veracel, in the same temporary pond where tadpoles were collected, perching on a fallen trunk *ca.* 20 cm above water. The pair was maintained in a moist plastic bag during the night and deposited a clutch composed of 60 large, ovoid, individually encapsulated eggs, embedded in a gelatinous matrix. Egg + capsule have a mean greater diameter of 5.2 mm (N = 34, SD = 0.34, range 4.6-6.4); eggs alone have a mean greater diameter of 4.1 mm (N = 34, SD = 0.19, range = 3.8-4.3). In life, the yolk is pale yellow and the jelly capsule is clear. There were no empty egg capsules in the clutch.

The metamorphosed specimen (MNRJ 47691) presented the same color pattern as the adults, varying from bright green to reddish-brown. The color pattern in preservative is pink.

Habitat and distribution – *Hylomantis aspera* was found perched on leaves at the marginal vegetation of temporary ponds inside undisturbed or secondary for-

est patches. According to Bokermann (1966), the syntypes were probably collected at Caravelas, currently a Municipality in the southern coast of the State of Bahia. Cruz (1988) reported a single specimen collected from Itabuna. An examination of the records on the collection data for this specimen reveals it came from an area belonging to the Regional Office of the Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC; 14°46'S, 39°14'W), which is actually situated in the neighboring municipality of Ilhéus (A.J.S.

TABLE 2: Measurements (in mm) of males and females of *Hylomantis aspera*. Values are presented as mean \pm standard deviation (range) for males and range for females.

Measures	Males (n = 17)	Females (n = 2)
SVL	42.3 \pm 2.05 (38.8-45.8)	45.1-48.3
HL	13.6 \pm 0.92 (11.6-14.9)	14.3-14.9
HW	15.0 \pm 0.79 (13.5-16.2)	16.4-16.7
THL	21.8 \pm 1.2 (20.3-24.2)	25.0-25.7
TBL	20.8 \pm 1.02 (19.4-22.8)	23.3-24.7
FL	26.3 \pm 1.29 (24.1-28.5)	29.7-30.3
TD	2.0 \pm 0.37 (1.3-2.7)	2.0-2.0
ED	4.4 \pm 0.42 (3.4-5.0)	4.3-5.1
END	4.2 \pm 0.51 (3.5-5.2)	3.9-5.2
IND	3.2 \pm 0.44 (2.3-3.8)	3.2-3.6
IOD	7.5 \pm 0.91 (6.5-9.5)	6.9-9.1
UEW	3.4 \pm 0.41 (2.6-3.9)	3.3-3.3

Argôlo, pers. comm.). *Hylomantis aspera* is currently known from seven localities, extending its distribution range ca. 85 km airline northwards, comprising a narrow portion of the southern coast of Bahia (Fig. 4; Appendix I).

DISCUSSION

Comparisons with tadpoles of other species – Tadpoles of *H. aspera* are very similar to those of *H. granulosa* (MNRJ 47803, two specimens), whereas tadpoles of the *H. buckleyi* species group also resemble each other. However, there are consistent larval differences between these two species groups. The gap on the row of marginal papillae on the upper lip is a common characteristic among all the tadpoles of *Hylomantis*, but the number and distribution of rows of papillae is variable. *Hylomantis aspera* presents a single row of marginal papillae, whereas all tadpoles described in the *H. buckleyi* group (*H. buckleyi*, *H. lemur* and *H. psilopygion*) present two or three rows, with a few

or many papillae scattered elsewhere over the oral disc. The oral disc of *H. aspera* is modified into a short funnel-shaped structure, while those of *H. buckleyi*, *H. lemur*, and *H. psilopygion* are typical oral discs of suspension-feeding tadpoles of Phyllomedusinae (see Altig and McDiarmid, 1999b). Tooth row formula in *H. aspera* is 2(2)/3(1), while in *H. buckleyi*, *H. lemur*, and *H. psilopygion* it is 2(2)/3. Tadpoles of *Hylomantis aspera* are further distinguished from those of the *H. buckleyi* group by a body that is higher than wide (as high as deep or wider than high in tadpoles of the *H. buckleyi* group). Tail myomeres in *H. aspera* are less marked than in *H. buckleyi*, *H. lemur*, and *H. psilopygion*. The shape of the snout in *H. aspera* (semicircular in dorsal view and sub-elliptical in lateral view) distinguishes it from *H. buckleyi*, *H. lemur*, and *H. psilopygion* (truncate in dorsal view in all species; rounded in *H. buckleyi* and truncate in *H. lemur* and *H. psilopygion* in lateral view). Finally, the tooth row lengths $P-3 < P-2 = A-2 < P-1 < A-1$ differentiates *H. aspera* from *H. buckleyi*, *H. lemur* and

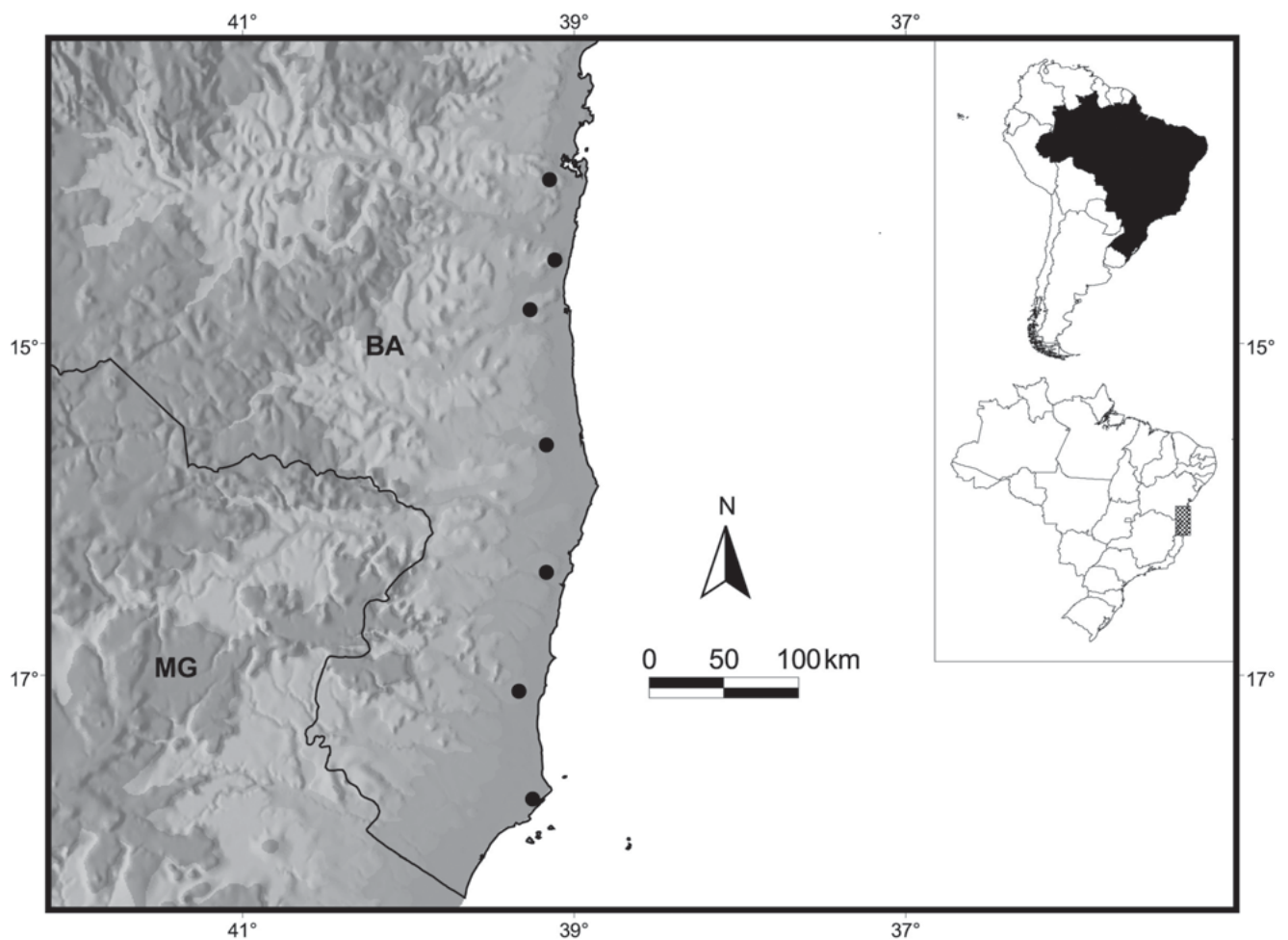


FIGURE 4: Geographic distribution of *Hylomantis aspera* (dots) in southern Bahia, Brazil. BA = State of Bahia; MG = State of Minas Gerais.

H. psilopygion (P-3=P-2=P-1<A-2=A-1, P-3<P--=P-1<A-2=A-1, and P-3<P-2=P-1=A-2=A-1, respectively).

Ontogenetic shifts on tooth row formula were reported for tadpoles of the *H. buckleyi* species group (Cannatella, 1980). We did not observe such changes in tadpoles of *H. aspera* examined (stages 28-41). Cannatella (1980) mentioned an unpublished manuscript on Phyllomedusinae tadpoles by Dr. A. Funkhouser, which contained a poorly detailed description of the tadpole of *Hylomantis medinai* (as *Phyllomedusa medinae*). The description does not include information on stages, but Cannatella (1980) identified the tadpole as an early stage with the tooth row formula 1/2 and indicated that older tadpoles should have a normal phyllomedusine tooth row formula of 2/3. Cannatella (1980) indicated that the tadpoles and eggs of *H. medinai* mentioned in Funkhouser (1962) are currently lost.

Comparisons with the advertisement call of other species – The advertisement call of *H. aspera* is distinguished from that of *H. psilopygion* based on its structure (pulsed in *H. aspera*, harmonic in *H. psilopygion*), but call duration and dominant frequencies are quite similar (14-50 ms and 1679.59-2110.00 Hz in *H. aspera*, 40-50 ms and 1900 Hz in *H. psilopygion*). The described pulsed advertisement calls of *H. lemur* present very different spectral properties (Cannatella, 1980; Jungfer and Weygoldt, 1994). Cannatella (1980) reported a much longer call (320-400 ms) with a lower dominant frequency (950-1000 Hz) than Jungfer and Weygoldt, 1994 (0.19-0.20 s and 1400-3100 Hz, respectively). Possible reasons for these distinct values are the low number of calls analyzed in both studies (four and two, respectively), differences on air temperature, social context, male size, and use of different equipments. The variation observed on calls descriptions does not allow a comparison with our data.

Remarks – Cruz (1990) hypothesized that the tadpoles of the *Hylomantis aspera* species group should present an anterior or anteroventral mouth, oral disc with a gap on upper lip, tooth row formula 2(2)/3(1), arched maxillae, and short cloacal tube attached to the ventral fin; characters that are found on larvae of other Phyllomedusinae occurring in temporary ponds inside or at forest edges. The external morphology of *H. aspera* larvae described herein supports this hypothesis.

Cannatella (1980) mentioned that species in the *H. buckleyi* group (as the *P. buckleyi* group) resemble the species of *Hylomantis* (*sensu* Cruz, 1990) and *Phasmahyla*. Tadpoles of *Phasmahyla* are unique among phyllomedusines because they inhabit streams and have modifications associated with surface film feeding, e.g., an anterodorsal position of the oral disc, reduction in number and size of labial tooth rows, distribution and shape of submarginal papillae, and upper jaw sheath with a medial projection (Cruz, 1982; 1990). The modification of the larval oral disc into an anterodorsal funnel-shaped structure is considered a synapomorphy for *Phasmahyla* within Hylidae (Cruz, 1990; Faivovich *et al.*, 2005).

According to Peixoto (pers. comm., in Altig and McDiarmid, 1999b), the tadpoles of the *H. aspera* group are similar to *Phasmahyla*; however, our observations do not support this statement. In the *H. aspera* group, the development of the oral disc into a funnel-shaped structure resembles an intermediate morphological condition between the typical oral disc of most phyllomedusines and that of *Phasmahyla*, where it is a dorsally directed funnel-shaped structure. A phylogenetic analysis of this group is needed to determine if the condition of the oral disc represents a synapomorphy for the *H. aspera* group; herein we consider it a taxonomically useful character for the diagnosis of this group. The number and distribution of marginal papillae (few papillae uniformly distributed over the entire oral disc and elongated papillae radially disposed around the beak in *Phasmahyla* and only a uniserial row of marginal papillae in the *H. aspera* group), and the tooth row formula (1/2 in *Phasmahyla* and 2/3 in the *H. aspera* group) are other differences between these two taxa.

On the basis of the inclusion of one specimen of the former *Phyllomedusa buckleyi* group, *P. lemur*, Faivovich *et al.* (2005) transferred this group to *Hylomantis*. They stated that the allocation is provisional as evidence of its monophyly is weak and the support for the clade is low. Finally, they could not find any morphological synapomorphy supporting *Hylomantis* including the former *P. buckleyi* group. The only apparent morphological synapomorphy of the *H. buckleyi* group was the bright orange coloration in life found on flanks and hidden portions of legs (Cannatella, 1980), which we also observed in *H. aspera*. The finding in *H. aspera* may be considered as a synapomorphy for the clade *Hylomantis* + the former *P. buckleyi* group, with subsequent reversals of this character in *H. danieli* Ruiz-Carranza, Hernandez-Camacho, and Rueda-Almonacid, 1988

and *H. granulosa* (see Ruiz-Carranza *et al.*, 1988; Cruz, 1990). However, it has been considered a weak morphological evidence of the monophyly of the *H. buckleyi* group (see Ruiz-Carranza *et al.*, 1988; Faivovich *et al.*, 2005), so maybe it also applies to the use of this character as a synapomorphy of the genus *Hylomantis*.

The liver of *H. aspera* is covered by a white hepatic peritoneum. This remarkable character, also present in *H. granulosa* (M. de Lima, P.M. Fonseca, pers. comms.), is not found in any other phyllomedusine so far (C.A.G. Cruz, pers. obs.; D. Cannatella, pers. comm.) and was known only from some species of the centrolenid genera *Centrolene* Jiménez de la Espada, 1872 and *Hyalinobatrachium* Ruiz-Carranza and Lynch, 1991 (Ruiz-Carranza and Lynch, 1991; Noonan and Harvey, 2000; Duellman and Señaris, 2003). This character can hence be considered a synapomorphy for the *H. aspera* group.

We are not aware of any synapomorphies currently supporting the monophyly of the the *H. buckleyi* group. The exclusion of the former *P. buckleyi* species group from *Phyllomedusa* is consensual among researchers (see Duellman, 1968, 1969; Cannatella, 1980; Jungfer and Weygoldt, 1994, Faivovich *et al.*, 2005). Duellman (1968, 1969), Cannatella (1980), and Jungfer and Weygoldt (1994) suggested the allocation of the former *P. buckleyi* group to a separate genus, but Cannatella (1980) argued that the lack of data on other phyllomedusines hindered this taxonomic decision. We refrain from describing a new genus to allocate these species due to the lack of morphological characters to define it and also because molecular evidences, although weak, still support its inclusion in *Hylomantis* (Faivovich *et al.*, 2005). Such action, if deemed necessary, must be postponed until additional studies are completed on the phylogeny of the Phyllomedusinae. The group of *Hylomantis aspera* remains diagnosable by the following putative synapomorphies: adults with white hepatic peritoneum and, possibly, the possession of lanceolate discs on fingers and toes (see Cruz, 1990; Faivovich *et al.*, 2005).

RESUMO

O gênero *Hylomantis*, anteriormente restrito à Mata Atlântica do nordeste brasileiro, foi recentemente aumentado com a inclusão das espécies do antigo grupo de *Phyllomedusa buckleyi*. A descoberta de novas populações de *H. aspera*, espécie pouco conhecida ocorrente na região sul do estado da Bahia,

permitiu a aquisição de novas informações sobre a morfologia externa de girinos, canto de anúncio, cor em vida, habitat e distribuição geográfica. Girinos do grupo de *H. aspera* possuem uma estrutura anteroventral em forma de funil no disco oral. A ocorrência de coloração laranja nos flancos e partes ocultas das pernas, uma provável evidência para a monofilia do grupo de *H. buckleyi*, também está presente em *H. aspera* e poderia ser interpretada como suporte para o clado *Hylomantis* + o antigo grupo de *P. buckleyi*. Um caráter notável encontrado nas espécies do grupo de *H. aspera* é um peritônio hepático branco, anteriormente conhecido apenas para alguns centrolenídeos, que é ausente em espécies do grupo de *H. buckleyi*.

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APPENDIX I

Specimens Examined

Hylomantis aspera: BRAZIL: BAHIA: MNRJ 25591, MNRJ 28892-28893, MNRJ 42550-42554, MNRJ 42666 (egg clutch), MNRJ 47691 (metamorph), RPPN Estação Veracel, Porto Seguro; MNRJ 27204-27205, Projeto de Assentamento Zumbi dos Palmares, Camamu; MNRJ 27206, Fazenda Monte-cristo, Canavieiras; MNRJ 29200, Parque Nacional do Descobrimento, Prado; MNRJ 35370-35376, Parque Estadual da Serra do Conduru, Uruçuca; MZUSP 81484 (formerly WCAB 46780), Sede Regional da Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC), Ilhéus.

Hylomantis granulosa: BRAZIL: BAHIA: UFBA 7300-7302, Serra do Timbó, Amargosa.