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NEW SPECIMENS OF *ANOLIS PHYLLORHINUS* (SQUAMATA, POLYCHROTIDAE): THE FIRST FEMALE OF THE SPECIES AND OF PROBOSCID ANOLES

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ABSTRACT

Among a series of eight specimens of Anolis phyllorhinus *obtained in the northern part of the state of Mato Grosso, Brazil, one was determined to be the first female known for the species and the first so far reported for proboscid anoles. The female lacks the characteristic male proboscis and, excepting a few consistent differences, is morphologically similar to females of* Anolis punctatus, *a species closely related and broadly sympatric with* A. phyllorhinus. *Males and females of the new series are described and new data on their ecology and behavior presented. The new data are consistent with the hypotheses that the male proboscis probably evolved as a sexual signal and that visual signals for intra and interspecific recognition are redundant in anoles.*

KEYWORDS: *Anolis phyllorhinus*, sexual signals, *Anolis*, Brazil, Polychrotidae.

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Resumo

Em uma série de 8 exemplares de Anolis phyllorhinus *coletados em Aripuanã, no norte do estado de Mato Grosso encontra-se a primeira fêmea da espécie, que também vem a ser a primeira fêmea conhecida para os anolis dotados de apêndice nasal. A fêmea não apresenta a probóscide característica dos machos e, exceto por pequenas diferenças, embora consistentes, é morfologicamente muito semelhante às fêmeas de* Anolis punctatus, *espécie relacionada e amplamente simpátrica com* Anolis phyllorhinus. *Descrevem-se os machos e a fêmea da nova série, acrescidos de informações obtidas no campo sobre sua ecologia e comportamento. Os novos dados, concordam com hipóteses anteriores sugerindo que a probóscide do macho possívelmente evoluiu como um sinal sexual e que os sinais visuais para reconhecimento intra e interespecífico são redundantes no gênero* Anolis.

Palavras-chave: *Anolis phyllorhinus*, sinalização sexual, *Anolis*, Brasil, Polychrotidae.

Introduction

A distinctive feature of some species of the highly diverse genus *Anolis* is the presence of a nasal appendage, or proboscis, at the front of the snout. Only three species of proboscid anoles have been so far described: *Anolis laevis*, Cope, 1876; *Anolis phyllorhinus*, Myers & Carvalho, 1945; and *Anolis proboscis*, Peters & Orcés, 1956. They are rare arboreal forest lizards with distributions encompassing the Pacific Choco in Ecuador (*Anolis proboscis*), Amazonian Peru (*Anolis laevis*), and Brazilian central Amazonia (*Anolis phyllorhinus*). Despite this wide total distributional area, only a total of nine specimens of proboscid anoles are known (Williams, 1979; Avila-Pires, 1995) These specimens, all males, along with a few ecological and color notes, are all we know for the entire group (Williams,1979; Ávila Pires, 1995).

In October 1996 the State Secretariat of Planning for the State of Mato Grosso, Brazil, in a cooperative venture funded by the World Bank launched a large project aimed at planning agricultural, economic and conservation strategies for the State. This project, contracted by the firm Consórcio Nacional de Engenheiros Consultores (CNEC), involved selection of a series of 12 sampling sites, mostly in the Amazonian part of the State of Mato Grosso, to be the targets of intensive faunal, floral, geological and socioeconomic surveys. The first faunal survey trip, headed by P.E. Vanzolini and his students, was situated in Aripuanã, in the extreme northwestern part of the State. Two days after the arrival of our group at Aripuanã, his party left the area and our group continued

field work. Arriving at the field site we were astonished to learn that four specimens of the extremely rare lizard *Anolis phyllorhinus* had been already collected. During the 14 days of our collecting at Aripuanã two additional specimens were sighted but attempts at capture were unsucessful. It was only during a second campaign to the area, almost a year later, that four additional specimens of this species were caught. The second sample includes the first female known for the species and the first so far reported for any of the proboscid anoles. In an effort to improve knowledge of this rare group of lizards we here describe the new sample and comment upon the ecological and behavioral notes assembled in the field.

Description of *Anolis phyllorhinus*

Males

(Figs. 1-4) MZUSP 82542-82545; MZUSP 82609-82611

Rostral not visible from above, subtriangular, almost horizontally placed, wider than long, projecting over the mental; marginated and deeply indented posteriorly by 12 small post-rostrals. Post-rostrals mostly elongate, central ones longer, forming the ventral basis of the proboscis. Proboscis large and thin, about the same size as the head, highest at nostril level; emerging on top of head at the level of the third canthal, from the anterior margin of the frontal depression. Ventral margin of the proboscis straight in lateral view; dorsally curved, with the inflection pointing slightly toward the rounded tip of the nasal appendage. Dorsal part of proboscis covered with large, juxtaposed, and irregular scales, generally as wide as long, smooth or keeled; largest scales near snout, decreasing in size toward the tip of the appendage. Basal third of the leaf, especially from its medial portion to nasal level, with scales longer than wide, elongate and keeled. Distal portion of the proboscis with irregular scales, as wide as long. Between the scales of the proboscis, several diminutive granules are irregularly present. Sixteen to nineteen irregular longitudinal scale rows across proboscis at the level of anterior margin of rostral.

Nasal latero-anteriorly oriented, separated from supralabial by one scale; contacting post-rostrals. Snout scales rounded, convex and granular between the leaf and canthals, increasing progressively in size from canthals towards the highest part of the nasal leaf; among them several scattered and diminutive granules. Eight to ten scales across head at the level of second canthal. Canthus rostralis well defined, formed by four to five keeled canthals with their larger surface in the dorsal part of head, decreasing in size anteriorly. Anterior canthal separated from nasal by 2-3 rows of postnasal granules. A long superciliar follows posteriorly the first canthal; keeled, practically reaching the center of eye;

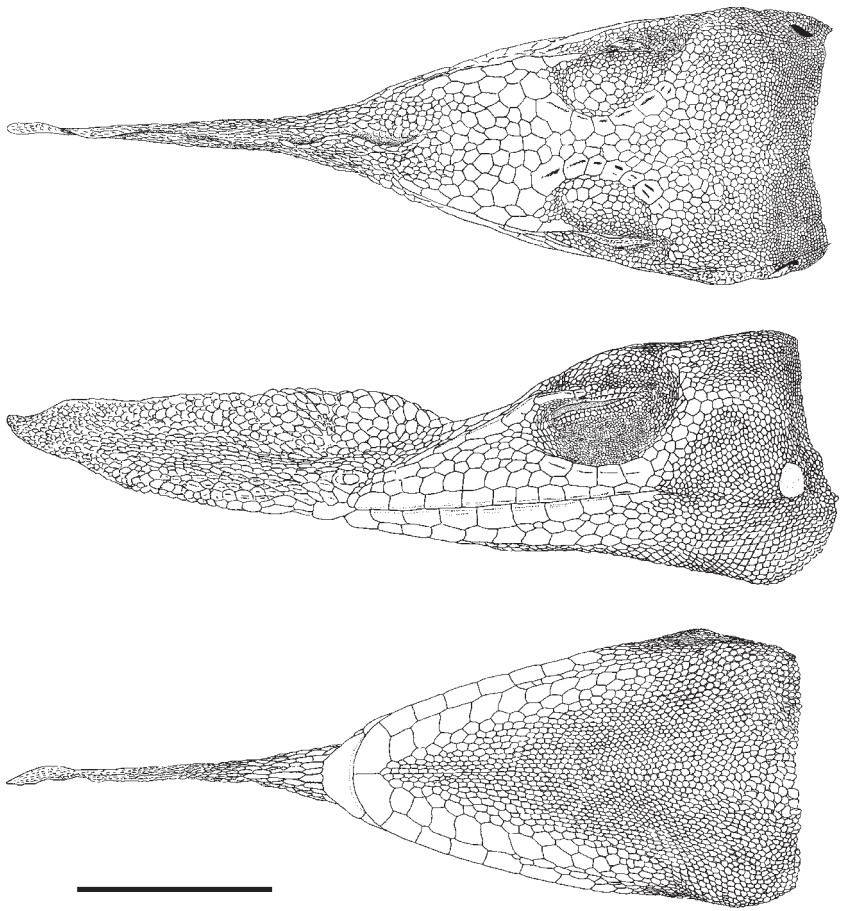

Figure 1. Dorsal, lateral, and ventral views of the head of a male of *Anolis phyllorhinus* (MZUSP 82.609) from Aripuanã. The bar represents 10 mm.

followed by small granules. A series of enlarged, juxtaposed and smooth scales, mostly elongate, contacting canthals on top of head. A very conspicuous concave frontal depression between the root of the nasal appendage and the middle of the supraorbital semicircles. Frontal depression with flat, polygonal, irregular, juxtaposed and somewhat rounded and enlarged scales, larger than those of the tip of snout and decreasing gradually in size towards the occipital. Fourteen to sixteen scales from the base of the nasal appendage to the occipital. Supraorbital semicircles with 7-9 scales, first and second the largest; separated medially by 1-2 scales. Supraocular disks with a group of 5-6 very irregular rows of enlarged, juxtaposed and flat scutes occuping almost 2/3 of the semicircles, decreasing

Figure 2. *Anolis phyllorhinus* male (MZUSP 82.609)

gradually in size and becoming conical granules in the rest of supraocular area. Supraocular disks separated from the supraorbital semicircles by a series of 1-2 elongate granules. Occipital larger than adjacent scales, separated from semicircles by 1-3 scales; pineal organ in the center of scale. Scales surrounding occipital polygonal, smooth, juxtaposed, slightly rugose, smaller than those on the top of head, decreasing progressively in size and becoming granular towards the temporal and occipital regions.

Loreals variable in size and shape, in two (anteriorly) to 4-7 (posteriorly) longitudinal rows, generally longer than wide posteriorly. Nine to eleven loreal scales in the loreolabial row; 4-7 loreals at the level of the second canthal. Preoculars 4-5, followed by 3-4 large suboculars contacting labials and a small additional subocular separated from labial. Suboculars longer than wide, with a sharp keel on the superior third of the scale accompanying their curvature. Supralabials 9-11, ninth generally under the eye; anterior ones longer, the last being a small elongate, and flat granule reaching the bucal comissure.

Temporal region covered with small conical granules similar to dorsal ones, separated from the eye and from the occipital region by an arc extending from the posterior part of supraorbital semicircles to the suboculars and formed by a series of 2-3 larger and flatter scales. An intertemporal ridge of this arc of enlarged flat scales extends posteriorly, showing a light inflection toward the ear, although not reaching it. This somewhat longitudinal ridge originates at the level of the palpebral suture and separates clearly a temporal and an occipital region of small granules. Granules from the temporal area flattened, slightly conical, smaller than those from occipital area where some flattened and larger scales are present. Ear opening small, about the size of the occipital, vertically oval; its inferior margin wider, placed at the level of the bucal comissure. Margin of the ear with small granules, anterior ones largest; external auditory meatus long.

Mental concave, much wider than high, smooth, almost completely divided in the midline, suture incomplete anteriorly; contacting laterally first infralabial and centrally the sublabials and four small granules, two on each side of median sulcus. Infralabials 8-10, first six subequal, the two posterior the smallest; sixth or seventh under the eye. A series of 6-7 enlarged, keeled, juxtaposed sublabials, as wide as and as long as the adjacent infralabials; the first 5 contacting infralabials. Sublabials internally marginated by elongate, juxtaposed, and usually smooth scales, distinctively largest than the adjacent chin granules. Chin region with small and elongate granules anteriorly, smaller and more rounded at mid-line, becoming enlarged and rounded at the beginning

Figure 3. A male of *Anolis phyllorhinus* in a glue trap (MZUSP 82.610).

of dewlap ridge. Dewlap moderate in size, extending from the ear level to just after the interbrachial region. Skin yellow in preservative, scales gray with scattered melanophores. Scales along rim subtriangular, enlarged, increasing in size posteriorly, much larger than the adjacent chin granules, with the approximate size or larger than the median ventrals; posterior scales of rim largest and more elongate.

Lateral face of neck with diminutive and juxtaposed conical granules, smooth, eventually keeled, somewhat smaller than those on temporal and occipital region. Dorsal and lateral parts of body with granules similar in size and shape to those on neck. Two vertebral rows of slightly enlarged scales, twice as large as adjacent granules, weakly keeled and not mucronate, forming an incipient dorsal crest extending from the occipital region to near the base of tail. Ventrals larger than dorsals, rounded, pseudocycloid, imbricate, smooth, in irregular transversal rows; decreasing in size towards flanks where they are granular and slightly more elongate than the middorsal granules. Total scales around body, 157-171. Anal region with granules similar to the dorsal ones.

Dorsal and lateral parts of basal portion of tail with irregularly tranverse rings of scales, subsquared, smooth or eventually keeled, slightly larger than the dorsal granules. Scales increase progressively in size posteriorly, becoming more elongate, sharply keeled and mucronate toward the tip of tail, where two distinct crests are present. Near the base of tail scales increase in size from the dorsal to ventral part where they are smooth at base of tail; at least the two

Figure 4. Dewlap of a male of *Anolis phyllorhinus* (MZUSP 82.609).

medioventral rows of scales of tail clearly larger than long. As in the dorsal part of tail, scales of ventral part of tail become elongate, larger and sharply keeled, forming three and then two ventral longitudinal crests. Tip of tail with 4 crests forming a clavate verticil of strongly keeled, imbricate and mucronate scales. Usually a pair of enlarged postanals with the posterior margin rounded.

Scales of the dorsal surface of arm smooth, granular, juxtaposed, varying in size from about the size of dorsals to the enlarged vertebrals; eventually keeled, grading ventrally to smaller conical granules. Postero-dorsal region and ventral surface of forearm with similar scalation. Antero-dorsal portion of forearm with larger scales, keeled, imbricate, grading progressively to the larger scales of the dorsal surface of hand where the supradigital lamellae are wider than long and weakly keeled. Leg with granular scales identical to those of arm, except at the knee where they are largest and antero-superiorly where they are large, imbricate and keeled. Tibia with smaller granules dorsally than ventraly; all smooth. Subdigital lamellae on Finger IV 23-26; 38-41 on Toe IV. Palm and sole covered with rounded and smooth scales, varying from juxtaposed to slightly imbricate.

Color (Figs. 2 -5): Uniform leaf-green above; ventral parts lighter with a slightly creamy green tonality. Area surrounding eye yellowish. As usual in green anoles the color can change progressively or abruptly to dark brown. Dewlap bright red in life, becoming blue-greenish near the throat; dewlap scales bluish green.

Female

(Fig. 5) MZUSP 82608

The female matches very closely the above description; major differences concern the head and are described below. The head is normal, the snout not swollen, and definitely not prominent. The nasal appendage is absent, although a distinctive vestige of it is present: from the level of the third canthal, just at the anterior border of the frontal depression, there are 7 aligned and elongate scales forming a low but distinctive keeled crest. First scale of the crest the largest, longer than wide, other scales decreasing in size and becoming more elongate forward. As in the male, scales marginating dorsally canthals are enlarged, elongate. Scales between the crest and the supracanthals are the smallest of the top of head, granular, keeled, the smaller ones just above nasal, increasing gradually in size posteriorly; mostly as wide as long, almost rounded; 7 scales between the crest and the canthal series. The two most anterior scales of the crest are smooth and are part of the 10 scales that marginate posteriorly the almost normal and vertically oriented rostral. Posterior margin of rostral indented, highly irregular. Scales on the frontal depression with lateral borders elevated, juxtaposed, much larger than those of the tip of snout but smaller than

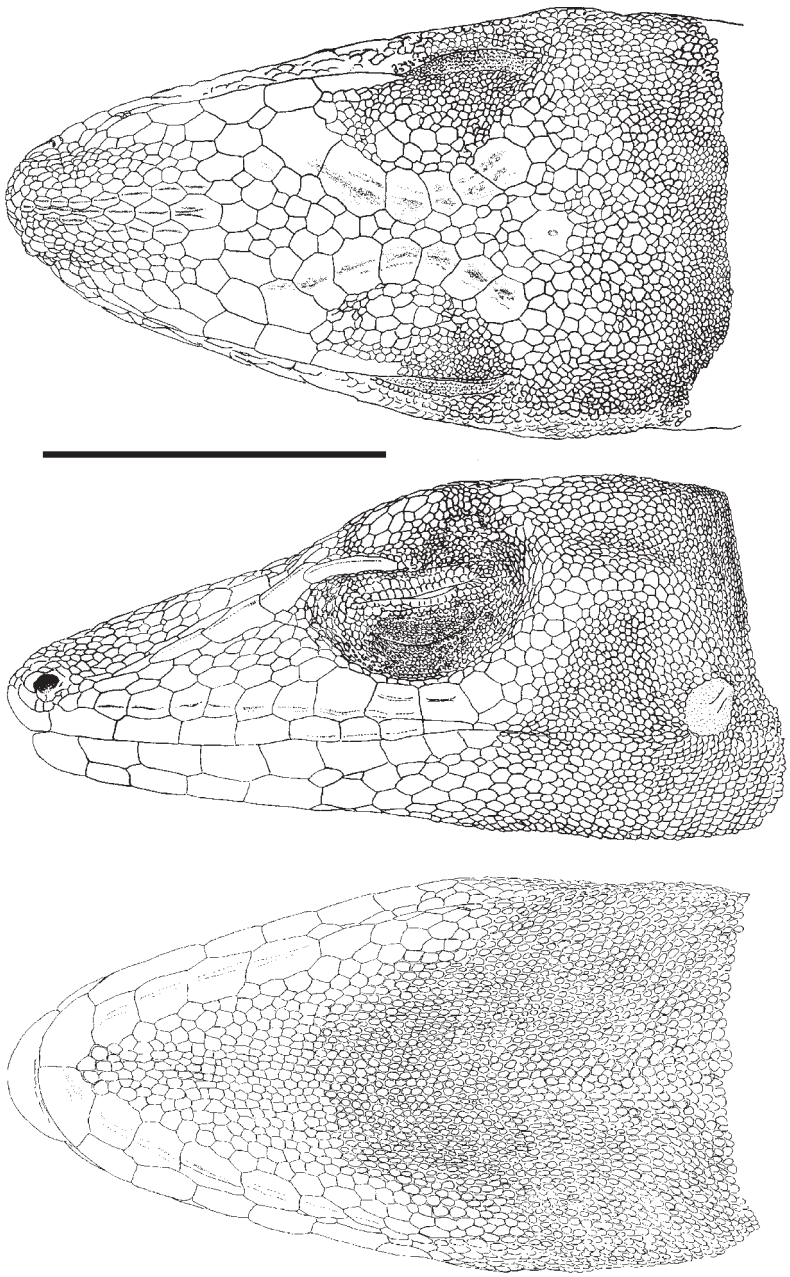

Figure 5. Dorsal, lateral, and ventral views of the head of a female of *Anolis phyllorhinus* (MZUSP 82.608) from Aripuanã. The bar represents 10 mm.

the 2-3 first scales of the supraorbital semicircles which are enormous, as in males, the largest on top of head. First scale of the right supraorbital semicircle in broad contact with first canthal, second larger, probably the result of a fusion rearrangement involving first and second scales of the right semicircle. One or two rows of elongate granules isolating semicircles from the supraocular disk. Occipital with about the same size of ear. Nasal separate from rostral and laterally oriented. One or two keeled enlarged vertebral rows of scales, only conspicuous at midbody, not extending to tail. Dewlap almost vestigial, creamy-white in life. Granules of the dewlap area rounded at tip, almost triangular, increasing gradually in size toward ventrals. Total scales around body, 168. In all other aspects scalation is identical to that described for males. As in males, color in life was uniformly leaf-green with a creamy green color ventrally. After capture the color changed irregularly to dark brown.

Comparisons: diagnosis and comparisons among anoles of the *proboscis* and *punctatus* species groups were made by Williams (1979). As females of the other species of the *proboscis* group are unknown, we restrict our comparisons of *Anolis phyllorhinus* to *A. punctatus*, the commonest species of *punctatus* group which is sympatric with *Anolis phyllorhinus* along part of central Amazonia. The only other species of the *punctatus* group occuring in the area is *Anolis philopunctatus*, a close relative of *A. punctatus* and differing from it only by the dewlap color in males; females of this species remain unknown (Rodrigues, 1988; Avila-Pires, 1995). *Anolis vaupesianus*, also a *punctatus* relative and differing from it by its black dewlap, is known only from the Vaupés region in Colombia, western Amazonia.

Except for the presence of the nasal appendage and a smaller dewlap in males, *Anolis phyllorhinus* is very similar to *A. punctatus.*. Both are green anoles of approximately the same body size (maximum snout-vent length 87 mm in *phyllorhinus*; 88 mm in *punctatus*; meristic data for all specimens of *A. phyllorhinus* known are shown in Table 1) The absence of the nasal leaf in females of *A. phyllorhinus* makes the apparent similarities with *punctatus* still more striking. In almost all external quantitative characters usually studied in anoles (Williams, 1976), they are identical (ranges for *punctatus* and *phyllorhinus*, respectively): canthals (4-8; 4-5); scales across second canthal (7-12; 8-10); scales between supraorbital semicircles (0-2; 1-2); supralabials (8-12; 8-11); infralabials (7-10; 8-10); loreal rows (5-7; 4-7); subdigital lamellae under Finger IV (21-27; 23-26); and subdigital lamellae under Toe IV (37-41; 38-41). The only quantitative difference among *A. phyllorhinus* and *A. punctatus* is the number of post-rostrals: there are 10-11 post-rostral scales in *phyllorhinus* and 5-9 in all the specimens (19) of *punctatus* examined. This character alone permits both species to be readily keyed out, regardless of sex. Additionally, the following features permit secure identification of the two species.

Table 1. Fresh weight (W), snout-vent length (SVL), tail length (TL), head length (HL), length of proboscis (PBL) and, lenght of head + proboscis length (THL) for all specimens of *Anolis phyllorhinus* known. All measurements are in millimeters; weight in grams.

Number	Sex	W	SVL	TL	HL	PBL	THL
MZUSP 82609	male	11.5	86	205	24.5	23	39.5
MZUSP 82611	male	9.5	83	181	22.5	20.4	35.3
MZUSP 82610	male	12.0	87	191	24.0	23.2	39.7
MZUSP 82608	female	–	72	171	20.1	–	–
MZUSP 82545	male	–	82	187	23.4	21.4	36.3
MZUSP 82542	male	–	83	193	23.7	21.5	37.3
MZUSP 82544	male	–	85	198	24.0	21.4	38.7
MZUSP 82543	male	–	–	–	–	–	–
MZUSP 7118	male	–	48	89	13.8	± 10	–
MNRJ 1804 (holotype)	male	–	73	153	20	21	–

The scales marginating anteriorly the sublabial area are larger and usually strongly keeled in *A. punctatus*; they are smooth and smaller in *A. phyllorhinus*. In *Anolis phyllorhinus* the first scale of the supraorbital semicircles is always in contact with the first canthal, and the first and second scale of the supraorbital semicircles are generally larger than those of *punctatus*. In *A. punctatus*, there is usually one (occasionally two) small scales in the anterior part of semicircles, but this character is not constant. In the female of *Anolis phyllorhinus* a distinctive vestige of the male appendage is present. There are 7 very distinctive and longitudinally aligned scales on top of snout forming a low but very characteristic crest of keeled scales between the snout and the anterior border of the frontal depression. The first (posterior) scale of the crest is the largest, longer than wide, the following scales decrease progressively in size and become more elongate anteriorly. The scales between the crest and the supracanthals, are the smallest of the top of head, granular, keeled, increasing gradually in size posteriorly, mostly as wide as long. We checked all females of *A. punctatus* at MZUSP collection (9 specimens) and none shows anything resembling the crest referred to above. It seems that the feature represents an incipient state of the highly developed nasal appendage of the males of *A. phyllorhinus*. In the females of *A. punctatus*, scales at the tip of the snout are variable in size and shape and diversely arranged, but never show any resemblance to the condition observed in *A. phyllorhinus*. The female of *Anolis phyllorhinus* has 1-2 rows of marginating canthals scales dorsally (supracanthals); these scales are enlarged longitudinally, distinctively larger than the scales of frontal depression, and are always in contact with the first enlarged scale of the supraorbital semicircle. In four females of *punctatus* from Borba, the type locality of *A. phyllorhinus*, and where the two species are sympatric, supracanthals are not enlarged, the scales from the frontal depression are larger than those of the female of *A. phyllorhinus* and the scales of the top of snout are elongate between the fifth canthal and the rostral, strongly

keeled, with keels longitudinally oriented; from there towards the frontal depression all scales are tranversally oriented. Finally, at least in females from Borba, there are no enlarged rows of vertebral scales; the female of *A. phyllorhinus* presents two slightly enlarged rows of vertebral scales, never as conspicuous as in males, but distinctively enlarged at midbody.

Male differences, are mostly restricted to the nasal leaf and size of dewlap. The extent of swelling in the tip of snout of *A. punctatus* is variable, (see, for example, figure of *A. transfasciatus* (= *A. punctatus*) in Myers and Carvalho, 1945) but never approaches the leaf-like appendage of male *A. phyllorhinus*. The dewlap of *Anolis punctatus* has been reported as almost invariable throughout its range, being very large, and orange or orange-yellow colored with green-yellowish or gray scales (Williams, 1982; Rodrigues, 1988). In *Anolis phyllorhinus* the dewlap is much smaller, bright red with bluish-green scales (Figure 5). Surprisingly, the only male of *Anolis punctatus* obtained at Aripuanã (MZUSP 81525) has a creamy white dewlap, very different in colour from the dewlaps of *punctatus* from other areas in Amazonia or Atlantic forest. In all other characters this specimen agrees with the other individuals of *Anolis punctatus*. We will return to this point in the discussion.

Habitat and natural history notes

Specimens of *Anolis phyllorhinus* were obtained in the border of a primary forest at the left bank of Rio Aripuanã, state of Mato Grosso (10°15'03"S, 59°32'57"W). The area was formerly covered by primary forests characterized by the abundance of very high and large trees, (up to 50 m and more than a meter at breast high), large lianas, an open understory, high abundance and diversity of palms and epiphytes, and a dense leaf-litter. As the result of logging activity, the large trees were cut; their fall and subsequent removal left large clearings connected by anastomosed trails along the forest. It was at these sunnier places in logged areas that all the specimens were seen. The largest distance between specimens collected did not exceeded 300 m. Although during our stay in the field we searched for specimens in the primary forest, our effort was unsucessful. Only one specimen (# 1 in table 2) was observed (not collected) outside of the aforementioned area; it was in a similar logged area at the right bank of the river (10°16'19"S, 59°23'18"W), in a spot where, 15 meters away, an adult male of *Anolis punctatus* was collected. One specimen of *Anolis phyllorhinus* was collected in a glue trap fixed to a tree (Fig. 3), all the others were shot with guns. Table 2 summarizes the data obtained for all specimens of green anoles sighted. Sample size is too small to indicate microhabitat perch preference, but it appears that *A. phyllorhinus* explores virtually all structural habitats on the trunk of thin to thick trees from the ground

Table 2. Field data for all specimens of *Anolis phyllorhinus* (phyl) *and A. punctatus* (punc) observed at Aripuanã, state of Mato Grosso. (#) individual, (M) male, (F) female, (TD) tree diameter; individuals (1) and (2) of *Anolis phyllorhinus* were observed but not collected.

#	Sex	Date and time	Habitat	TD (cm)	Height (m)	Sun/ shade	Color	Additional notes
phyl (1)	M	11. 96 8 hs	border of primary forest in an old logged area	60	1,5	sun	dark brown	climbed up to 15 m bobbing and flashing the red dewlap.
phyl (2)	M	11. 96 16 hs	border of primary forest in a recently logged area	5	2	sun	dark brown	jump to a 30 cm isolated tree trunk and climbed up to 20 m bobbing and flashing the red dewlap; jumped in branches and leaves.
phyl (3)	M	10. 97 ?	border of primary forest in a recently logged area	15	2	?	brown	caught in a glue trap; turned green when the trap was removed (see figure 4).
phyl (4)	M	10. 97 17 hs	border of primary forest in a recently logged area	15	4	shade	brown	looking down in an isolated tree. Turned green immediately after being shot.
phyl (5)	M	10. 97 14:30	border of primary forest in a recently logged area	35	1	sun	dark brown	Moving from sun to shade; at approach climbed intermitently up to 3 m with intensive bobbing and flashing the red dewlap at breaks.
phyl (6)	F	10. 97 15 hs	border of primary forest in a recently logged area	10	1	sun	green	in an abandoned mining ranch. jump to a 60 cm diameter tree and climb to 5 m. The green ground colour was maintained.
phyl (7-8)	M	11. 96 10:30 hs	border of primary forest in logged area	20	4 -5	sun	dark brown	These two specimens were involved in a fight, moving quickly and changing positions between 4 and 5 m high. Head bobbing and dewlap flashing were more frequent by the probable owner of the territoty that was continuously challenging the intruder.
phyl (9)	M	11. 96 11 hs	border of primary forest in a recently logged area	30	3	sun	dark brown	Looking down
phyl (10)	M	11. 96 10:30 hs	border of primary forest in a recently logged area	25	4	sun	dark brown	Looking down
punc	M	11. 96 17 hs	border of primary forest in a relatively old logged area	20	4	shade	green	looking down

level to the canopy. Although most specimens were first sighted at low heights in trees, they climbed quickly when disturbed, jumping eventually on to branches and leaves. One specimen was observed moving between sun and shade before capture, most other specimens were brown colored when first sighted. These last specimens were basking at sunny patches on tree trunks, indicating that *Anolis phyllorhinus* practice behavioral thermorregulation. When spotted, most specimens were in position of territorial survey: pointing downwards, head elevated, and limbs extended. Upon noticing an observer, the green color immediately changed to brown (those already brown clearly changed to a darker tone), and most tried to escape; climbing the tree, displaying, head bobing and flashing the bright red dewlap.

The seven male specimens were preserved immediately after capture, their stomachs and intestines were removed and the contents spread on Petri dishes to examine food preferences. Prey items are shown in Table 3 identified to the lowest possible taxonomic category. No empty stomachs were found. Forty-seven prey items, belonging to fourteen categories of arthropods, were identified. Hymenoptera and Coleoptera were the commonest items by % of the total, and Lepidopteran larvae was the category present in most stomachs (5 of 7, or 71%). Four individuals (57%) containted nematodes in their digestive tracts. These results indicate that the diet of *Anolis phyllorhinus* is largely insectivorous and similar to other amazonian *Anolis* (Hoogmoed, 1973; Duellman, 1978).

Table 3. Diet composition of *Anolis phyllorhinus* from Aripuanã, state of Mato Grosso, based on the analysis of stomach contents of seven male specimens. (N) total number of a given prey category considering the digestive tracts of all lizards; (%) percentage of the item category in total, and (Frequency) the number of lizards containing a given item in stomach.

Prey type	N	%	Frequency
Aranae	2	4.3	2
Coleoptera (unidentified)	4	8.5	4
Cerambicidae	3	6.4	3
Curculionidae	2	4.3	1
Scarabaeidae	1	2.1	1
Heteroptera	–	–	–
Aradidae	1	2.1	1
Pentatomidae	3	6.4	3
Hymenoptera(unidentified)	4	8.5	4
Braconidae	1	2.1	1
Formicidae	6	12.8	2
Lepidoptera (larvae)	8	17.0	5
Mantodea	1	2.1	1
Orthoptera	6	12.8	4
Unidentified parts	5	10.6	3
Total	47	100.0	–

Discussion

Dewlaps in anoles are considered behavioral devices acting as signals for intra or interspecific recognition (Williams and Rand, 1977).This suggestion derives from the fact that dewlaps are reduced or absent in females, highly constant geographically, and that sympatric species generally differ strikingly in dewlap color, dewlap size, or both. Williams and Rand (1977) and Rand and Williams (1970) studied their potential as signals in anole communities of different sizes, and suggested frequent redundancy of signals conveyed by the dewlap to the intended recipient.

Females of *Anolis phyllorhinus* and *A. punctatus* are almost identical, whereas males differ in a series of attributes. Males of *Anolis phyllorhinus* and *Anolis punctatus* from Aripuanã are also identical in color and size, but have strikingly different dewlaps: in *punctatus* the dewlap is very large, creamy-white; all males of *phyllorhinus* have a small and bright red dewlap. The dewlap of the *phyllorhinus* female is vestigial but creamy white as in *punctatus*.

One question provoked by these new data is why the *punctatus* dewlap is creamy white at Aripuanã, rather than the orange-yellow present everywhere else across its range? Is this local pattern due to a local polymorphism, or indicative of an undescribed species? Is this creamy white dewlap the result of character displacement due to the presence of *phyllorhinus*? Many more questions than answers are possible given the lack of a well corroborated plylogenetic hypothesis for this group of anoles. However, some considerations might be appropriate at this time.

Isolated or combined, dewlap size (large vs. small) and dewlap color (creamy white vs. bright red), are useful characters for interspecific visual recognition signs between the two species. Nevertheless, the most conspicuous permanent difference (i.e. in animals not involved in displays) between males of *Anolis punctatus* and *A. phyllorhinus* is the nasal leaf. The size of the appendage (almost equaling the size of head) and its absence in females suggests that the structure is possibly related to sex recognition, although it could also be operating at an interspecific level. The strong differences between *Anolis punctatus* and *A. phyllorhinus* in dewlap size, dewlap color and presence/absence of the nasal leaf, all important in intra and interspecific discrimination, indicate some redundance of signals, *sensu* Williams and Rand (1977), even for animals of very similar body size, shape, color, and possibly in ecological preferences.

To answer these puzzling questions field-oriented behavioral studies and an explicit phylogenetic framework to study these behavioral characters are much in need. As present anole communities are the result of complex and overlapping interactions occurring in time and space, much more data are needed in order to address other evolutionary issues. For example, are the proboscid

anoles monophyletic? How did the proboscis evolved? How is *Anolis phyllorhinus* related to the green species of the *punctatus* group? Are the populations of *Anolis punctatus* monophyletic? What is the relationship between the black dewlap (*A. vaupesianus*), and spotted dewlap (*A. philopunctatus*) forms, or between the Aripuanã's creamy white dewlap and the rest of populations of *punctatus* with orange-yellowish dewlaps? Are the distributions of these restricted morphs the result of recent differentiation *in situ* or they are the relicts of older radiations with larger distributions? All of these issues should be first addressed before considering more complex matters. To approach such themes, like the history of intra and/or interspecific signals conveyed by the proboscis or the size, shape, and color of dewlap in anole communities necessarily we need a reliable phylogeny. A final sobering note, is that these investigations are carried out against a background of rapid habitat loss, at least in Aripuanã. Time to resolve these questions before their subjects disappear may be limited.

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Appendix I : Material Examined

Anolis punctatus. BRASIL. Alagoas: São Miguel dos Campos: MZUSP 55568. Acre: Alto Purús: MZUSP 2481; Porto Walter: MZUSP 5339, 53341. Amazonas: Barreira do Matupirí, Rio Madeira: MZUSP 42159; Benjamin Constant: MZUSP 9146; Berurí: MZUSP 38196; Boca do Acre: MZUSP 36978; Borba, Rio Madeira: MZUSP 41358, 41359, 42635, 42636; Cabeceira do Rio Urucú: MZUSP 75210, 75211; Itapiranga: MZUSP 16907, 33058; Lago Maparí, Rio Japurá: MZUSP 47069-47074; Moura: 25603, 25869, 25902-25904; Paraná de Jacitara, Rio Japurá: MZUSP 47426, 47427; Puruzinho, Rio Madeira: MZUSP 41758-41760; Reserva Ducke: MZUSP 13415, 57338; Vila Bitencourt: MZUSP 46673. Bahia: São José, Fazenda Unacau: MZUSP 66420, 66421. Espírito Santo: Rio Itaúnas: MZUSP 36951. Mato Grosso: Aripuanã: MZUSP 81525; Cláudia, Fazenda Iracema: MZUSP 81717, 81718; Gaúcha do Norte: MZUSP 81792; Vila Rica: MZUSP 82888. Pará: As Pedras, Rio Cuminá-Mirí: MZUSP 18551-18556; Belém: MZUSP 9928, 9732-9739; Cachimbo: MZUSP 3708-3712; Cachoeira do Espelho, Rio Xingú: MZUSP 66398; Canindé, Rio Gurupi: MZUSP 9060, 9061; Carajás: MZUSP 63806; Juruá, Rio Xingu: MZUSP 67363; Lago Jacaré, Rio Trombetas: MZUSP 53823; Monte Cristo, Rio Tapajós: MZUSP 20997, 20998, 21001, 21081-21086; Serra de Kukoinhokren, Rio Riozinho: MZUSP 78404, 79198; Óbidos: MZUSP 5932; Oriximiná: MZUSP 16390; Uruá, Parque Nacional da Amazônia, Rio Tapajós: MZUSP 52585-52588, 53619-53622. Paraíba: Mamanguape: MZUSP 59102, 59103. Pernambuco: Recife: MZUSP 57793, 57794. Rio de Janeiro: Floresta da Tijúca: MZUSP 75159. Rondônia: Cachoeira de Nazaré, Rio Machado: MZUSP 66328; Mutúm-Paraná: MZUSP 3717. Roraima: São Luís do Anauá: MZUSP 72813, 72814; Missão Catrimani: MZUSP 73436. Sergipe: Santo Amaro das Brotas: MZUSP 49360-49375. ECUADOR. Pastaza: Canelos: MZUSP 3376; Sarayacu: MZUSP 3379; Loreto: MZUSP 3380; Rio Bobonaza: MZUSP 11369; Puyo: MZUSP 54708. PERU. Loreto: Igarapé Champuia, Alto Curanja: MZUSP 3322; Estirón, Rio Ampiyacu: MZUSP 13473.

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