

Papéis Avulsos de Zoologia

PAPÉIS AVULSOS ZOOLOGIA, S. PAULO, 31 (8) : 141-162

31.X.77

TAXONOMIC NOTES ON FROGS FROM THE MADEIRA AND PURUS RIVERS, BRASIL

W. RONALD HEYER

Examination of collections of frogs from the western lowland Amazonian basin has clarified certain taxonomic problems and raised others, as expected for a poorly understood fauna. The collections were made on two expeditions: (1) Joint Museu de Zoologia, Universidade de São Paulo (MZUSP) and Smithsonian (USNM) expedition on the Rio Purus from 2 December 1974 to 19 January 1975. Carlos Roberto F. Brandão, W. Ronald Heyer, and Paulo E. Vanzolini were the collectors on this expedition; (2) Joint Expedição Permanente da Amazonia (EPA) — MZUSP and USNM expedition on the Rio Madeira from 31 October to 19 December 1975. Miriam H. Heyer, W. Ronald Heyer, Paulo E. Vanzolini, and Francisca Carolina do Val were the collectors on this trip. The localities worked and species collected from each locality are presented in Appendices 1 and 2.

The purpose of this paper is to discuss the findings of interest to a taxonomist that have resulted from study of the specimens. An ecological analysis of the collections is presented elsewhere (Heyer, 1976). Comments are arranged alphabetically by species for those species for which specific information is presented. The list of species collected (Appendix 2) is arranged alphabetically within families.

ACKNOWLEDGMENTS

Dr. Paulo E. Vanzolini invited me to join his expeditions. In addition to the educational opportunity of learning from his experience, he made the trips most enjoyable.

Carlos Roberto F. Brandão, Miriam Heyer, Francisca Carolina do Val, and Paulo E. Vanzolini aided in the collection of frogs, their help and companionship continue to be invaluable.

John D. Lynch identified the frogs of the genus *Eleutherodactylus*. Stephen R. Edwards examined the *Colostethus* from the Purus. William E. Duellman concurred that the species of *Hyla* I was unable to identify are presently unidentifiable.

Division of Reptiles and Amphibians, National Museum of Natural History, Smithsonian Institution, Washington, D. C. 20560, U.S.A.

William F. Pyburn examined some frogs of the *Hyla rubra* group and loaned material of the new genus and species of lepidodactylid.

James R. Dixon and Max A. Nickerson allowed me to examine specimens in their care.

George R. Zug kindly reviewed the manuscript. Barton Kavruck prepared Figures 1 and 2.

My participation was supported by MZUSP and the Smithsonian Research Foundation. This is a contribution of the Amazon Ecosystem Research Program (Smithsonian Institution).

SPECIES ACCOUNTS

Colostethus sp.

The single specimen listed as *Colostethus* sp. in Appendix 2 represents a new species for which S. R. Edwards has a manuscript name (Edwards, 1974, p. 264). This species was previously known from the Amazonian slopes of the Andes in Bolivia and southern Ecuador.

Eleutherodactylus sp.

The specimens listed as *Eleutherodactylus* sp. in Appendix 2 represent a new species being described by Lynch and Hoogmoed. These specimens represent the first record from southern draining affluents of the Amazon.

Hydrotaetare schmidti

There are few reported specimens of *H. schmidti* (Cochran and Goin), 1959, but specimens are beginning to accumulate in collections. The specimens captured on the Purus and Madeira expeditions represent the first specimens for which reliable habitat data are available. All three specimens were captured at night sitting on the margins of small forest streams. All specimens were located by eyeshine. Individuals were easy to catch; they made no attempt to jump until they were in hand. Two of the specimens gave what sounded like distress calls intermittently for over a half hour after capture. The sound was similar to loud housecat meowing. Although few specimens were captured, all were taken from relatively undisturbed forest, and all were next to 1 to 2 meter wide, slow moving (under non-thundershower runoff conditions) streams. At Bernuri, efforts were made to sample the stream where *H. schmidti* was taken for larvae. The stream was full of fish, ranging from tadpole size to 50 cm size. No tadpoles were collected. If *H. schmidti* has a stream larva, it must have an adaptation for coexisting with carnivorous fish. Documented specimens are now known from Amazonian Colombia, Peru, and Brasil.

Hyla acreana

Bokermann (1964) in describing this species, commented that it might be a subspecies of *H. marmorata* (Laurenti), 1768, as he

had no localities where both occurred sympatrically and some Bolivian specimens appeared to be intermediate between the two forms. Both *Hyla acreana* and *marmorata* were collected at Pauni. *Hyla acreana* was breeding, *H. marmorata* was not at the time of collection. *Hyla acreana* is a full species; the sympatric specimens demonstrate the same differences Bokermann described for allopatric specimens. I have examined one of the Bolivian specimens Bokermann thought might be intermediate (USNM 102665). As Bokermann stated, the specimen is poorly preserved. I think the specimen represents another distinct species in the *H. marmorata* complex.

Hyla nr. *boesemani*

Dr. William E. Duellman identified the single specimen as being allied with *H. boesemani* Goin, 1966. I have compared the specimen with the holotype of *H. boesemani* (USNM 159140) and find they are not conspecific. The specimen probably represents a new species.

Hyla garbei

Specimens show a range of all the types of thigh patterns shown in Figure 1 of Duellman's *Hyla rostrata* group paper (1972). The figured patterns were given as diagnostic characteristics of several species in the group. Additionally, there is variation in the development of the heel tubercle in the specimens at hand. Although this additional material demonstrates that *H. garbei* (Miranda-Ribeiro), 1926, is more variable than previously thought, I think all the specimens refer to a single species.

Hyla garbei is a nocturnal forest species, but a few specimens were located in the daytime. For example, on 13 November 1975 two specimens were found adpressed to (different) tree trunks in the afternoon. Both specimens were the same color as the trunk and very difficult to see. In both cases, the individuals were pointed head down and were about 20 cm high on the trunk from the ground. One specimen, when approached closely, ran around the tree trunk with the same rapidity as a lizard and escaped. All *H. garbei* seen in the day were on tree trunks.

Hyla granosa — *punctata* — *rhodoporus* complex

Two species of green tree frogs in life were collected on the expeditions. These represent the species usually identified as *H. granosa* Boulenger, 1882 (broader head, no light dorsolateral stripes) and *H. punctata* (Schneider), 1799 (narrower head, light dorsolateral stripes present).

Duellman (1974) discussed the taxonomic status of *Hyla punctata*, synonymizing several names including *Hyla papillaris* Spix, 1824, *Hyla variolosa* Spix, 1824, and *Hyla rhodoporus* Günther, 1869, which actions I interpret to be premature in part. The figures in Spix (1824) of *papillaris* and *variolosa* appear to belong to two species, not one as indicated by Peters (1873) who was the last herpetologist to have seen Spix's specimens. The figure of *Hyla*

papillaris has a broad head and lacks dorsolateral stripes, the figure of *Hyla varicosa* has a narrower head and has dorsolateral stripes. Both figures are quite stylized. There is no reason to question the synonymy of *Hyla varicosa* with *Hyla punctata*. However, the figure of *Hyla papillaris* certainly suggests what most authors refer to as *Hyla granosa*. Peters (1873) states that the holotype of *H. papillaris* is a 30 mm juvenile with a 5 mm tail stub. All juvenile specimens of this complex at hand of the 30 mm size range have no suggestion of a tail stub. Because of the conflicting evidence, the best nomenclatural decision appears to be acceptance of Peters' arbitrary designation of *Hyla papillaris* as a synonym of *Hyla punctata*.

Cochran and Goin (1970) pointed out that *H. rhodoporus* was distinct from *H. punctata*. They compared the type with specimens from the USNM. I concur that the USNM specimens Cochran and Goin examined are distinct from both *Hyla granosa* and *Hyla punctata*. *Hyla rhodoporus* lacks dorsolateral stripes, as does *granosa*. However, the following features distinguish *rhodoporus* from *granosa*: *rhodoporus* has a narrower head, the top of the head is smooth rather than shagreened, a supratympanic fold is present, and *rhodoporus* has less webbing than *granosa*. Boulenger's description and figure (1882) of *granosa* clearly apply to the broad headed form.

Hyla leali

Duellman (1974) placed *Hyla leali* Bokermann, 1964, in the synonymy of *H. rossilemi* Goin, 1959. He based this decision on comparison of specimens from Bolivia, Peru, and Ecuador with the types of *H. rossilemi* from Letícia, Colombia. Although not taken in sympatry, specimens that match both species descriptions were taken at adjacent localities along the Purús. The specimens clearly represent distinct species, although only one specimen is available for what I identify as *H. rossilemi*. The differences previously reported between these species also are found in the present material: *H. rossilemi* has a distinct light interocular stripe not found in *leali*, the dorsal pattern of *H. rossilemi* is nondescript, *H. leali* usually have distinct scapular and sacral markings.

Hyla "membranacea"

Duellman (1974) synonymized *H. membranacea* Andersson, 1975, with *Hyla triangulum* Gunther, 1869. The specimens here identified as "*membranacea*" have a fairly uniform patterned dorsum, but differ from the uniform phase of *H. triangulum*. *Hyla "membranacea"* has a uniform dorsum with irregular little dark spots, the same pattern is on the sides of the body. The uniform phase of *H. triangulum* has a contrasting higher dorsal and darker side of head and body pattern. The *Hyla "membranacea"* are probably a different species from the species described by Andersson, but I prefer to use "*membranacea*" to point out the distinctness of this form for the next reviser of the *H. leucophyllata* group. Morphologically, the specimens are similar to *H. ohineae* Cochran and Goin, 1970, but the "*membranacea*" did not have the gold spots in life of *H. ohineae*.

Hyla species

There additionally appear to be at least six new species of *Hyla*, reflecting the fact that the Amazonian frog fauna is still in the discovery phase. A series of specimens representing three species are related to *Hyla blairi* Fouquette and Pyburn, 1972, and are being studied by William F. Pyburn. Two of the other species listed as *Hyla* sp. in Appendix 2 are represented by one or two specimens and the group relationships are unclear (both are small species). One of the species is a distinctive new member of the recently revised *Hyla parviceps* group and is described as:

Hyla pauniensis, new species

(Fig. 1)

Holotype — MZUSP 49892, an adult male from Brazil: Amazonas: Boca do Pauini. Collected by C. R. Brandão, W. R. Heyer, and P. E. Vanzolini on 12 December 1974 between 19 and 21 hours.

Paratopotypes — MZUSP 49893, female; USNM 202034-35, male and female. Collected with holotype at same pond.

Diagnosis — A member of the *Hyla parviceps* group, differing from *bokermanni* Goin, 1960, *brevifrons* Duellman and Chump, 1974, *tateocollata* Roux, 1927, and *subocellaris* Dunn, 1934, in lacking light dorsolateral stripes in both sexes. From *brevifrons*, in which most males lack light dorsolateral stripes, *pauniensis* differs in lacking light spots on the dorsal surface of the thigh and having one rather than two light suborbital spots. From *microlops* Peters, 1872, *pauniensis* differs in having dark dorsal transverse bands (dorsum plain or marked with irregular dashes) and lacking a large light spot on the posterior face of the thigh (orange in life in *microlops*). From *parviceps* Boulenger, 1882, *pauniensis* differs in lacking a proximal discrete large light spot on the ventral surface of the tibia (orange in life in *parviceps*). *Hyla pauniensis* differs from all members of the group in having a tuberculate dorsum.

Description of Holotype — Snout slightly truncate in dorsal outline; snout rounded-acute in profile; canthus rostralis obtuse; tympanum indistinct, greatest diameter about 1/3 eye; vomerine teeth in two transverse patches posterior to choanae; vocal slits present; vocal sac single, external; outer finger disks moderate, about equal to tympanum; finger webbing formula I trace II 1 1/2 — 2 1/2 III 2 1/3 — 2* IV; subarticular tubercles single except for bifid tubercle under finger IV; white glandular nuptial asperities weakly developed; no ulnar ridge or tubercle; moderate patagium; dorsal texture smooth with scattered, large, white-tipped tubercles; throat texture to finger disks; toe webbing formula I 2 — 2* II 1* — 2 1/3 III 1 — 2* IV 2 — 1 V; outer metatarsal tubercle indistinct; no tarsal fold or tubercle; heel very slightly rugose.

Color pattern in preservative. Light rostral stripe joining a light narrow caudal stripe; loreal region uniform tan; one light subocular spot; dorsum tan with brown cross bars (Figure 1); limbs barred; anterior face of thigh dark with a single large light spot (bright golden yellow in life); posterior face of thigh uniform, dark, almost

black; throat suffused with melanophores; belly dotted with melanophores.

Measurements. Snout-vent length 20.2 mm, head width 6.8 mm, femur 9.5 mm, tibia 9.9 mm, foot 7.8 mm.

Variation. The snout is truncate and acute in the paratypes. The webbing variation of all specimens for fingers is I trace II 1 1/2 — 2 — 2 1/2 — 3+ III 2 1/3 — 2 2/3 — 2+ — 2 1/3 IV, for toes I 2 — 2+ — 2 — 2 II 1 — 1 1/2 — 2 1/3 — 2 1/2 III 1 — 1 1/2 — 2 — 2 1/2 IV 2 — 2+ — 1 — 1+ V. The outer metatarsal tubercle is absent. The anterior face of the thigh has small light spots or an irregular light stripe under the dark portion. The posterior face of the thigh may be bordered above and below the black areas by irregular light stripes. The male paratype lacks a distinct rostral stripe and the cantal stripes extend on the eyelid to the tympanic region. The dorsal transverse bands may be indistinct.

Based on the four specimens, the following appear to be sexual differences. The female disks are large, larger than the tympanum. The females lack a light cantal stripe and the belly is heavily mottled, contrasting with the light male belly. The two females are 23.0 and 24.0 mm SVL, the male paratype is 20.3 mm SVL.

Remarks — The four specimens were taken from a forest pond at night on vegetation over the water. The call is cricket-like.

The species has few derived character states of those analyzed by Duellman and Grump (1974), but the relationships appear to be closest with *H. microps* and *parvicaps*.

Etymology — The species is named for the location of Boca do Pauini, the type locality, where several very productive days were spent in profitable collecting and feeding mosquitoes.

Family Leptodactylidae, new genus and species

Four small, distinctive leptodactylid frogs were taken from under logs at Puruzinho on the Rio Madeira. In their general aspect upon collecting, my first impression was that they represented a new species of the genus *Adenomera*. Upon closer examination, the toes had distinctly grooved disks with pointed tips. Lynch (1976) described two small leaf litter frogs from the Amazonian slopes and placed them in the genus *Euparkerella*. The four specimens are clearly distinct at the species level from the two described by Lynch. In order to determine whether the new species were conspecific with the species described by Lynch, a character analysis was undertaken. At the time the analysis was done, only the four specimens were available, so no specimen was cleared and stained. Osteological observations were made from superficial dissections and X-rays. After the data were gathered, Dr. William F. Pyburn indicated he also had specimens and calls. He kindly loaned these materials to me for inclusion in this paper.

Groups for Comparison. As data were being taken on the new species, the suite of states confirmed that the species is an eleutherodactyline. The question is to which species of lowland eleutherodactyline the species has closest affinities — the genera in question are *Barycholos*, *Eleutherodactylus*, and *Euparkerella*. The character states for *Eleutherodactylus* come from the species *cogni* Thomas, 1965, *fleschnnemi* (Boettger), 1892, *guentheri* (Steindachner), 1864 and *nigrovittatus* Andersson, 1945, together with previously published

data. I remain convinced that the genus *Eleutherodactylus* as presently constituted is a composite, but for present purposes, the composite nature of the genus does not affect the results of the analysis in terms of the question being asked. As study began, it became apparent that *Euparkerella brasiliensis* (Parker), 1926, and *myrmecoides* Lynch, 1976, should be analyzed separately. Specimens of *E. lochites* Lynch, 1976, were not available for study at the time of the analysis.

Character analysis. Data were gathered for the characters used previously by Heyer (1975) and Lynch (1976). Data are available for 18 characters which show variation among the study group and for which data are available for all taxa. Three osteological characters were not discernible for the new species, the nasal-maxillary relationship, squamosal shape, and fusion of the prootic with the frontoparietal bones. Where the determination of primitive and derived states is the same as used previously, the citation only is given for justification. All primitive states are coded as 0.

1. Tympanum visibility. 0 = tympanum present, visible, 1 = tympanum absent (Heyer, 1975, character 2).
2. Toe disks. 0 = disks lacking circumferential grooves, 1 = disks with circumferential grooves (Heyer, 1975, character 5).
3. Tarsal decoration. 0 = tarsus smooth, 1 = tarsal tubercle present in at least some species (Heyer, 1975, character 6).
4. Adductor mandibularis muscle. 0 = s + e condition, 1 = s only condition in at least some species (Heyer, 1975, character 11).
5. Depressor mandibulae muscle. 0 = muscle origin tripartite, 1 = muscle origin bipartite or single (Heyer, 1975, character 12).
6. Geniohyoides medialis muscle. 0 = muscles separated medially, 1 = muscles contiguous medially, in at least some species (Heyer, 1975, character 13; justification for directionality, Heyer and Liem, 1976).
7. Anterior petrohyoides muscle. 0 = attachment on ventral body of hyoid, 1 = attachment on lateral edge of hyoid (Heyer, 1975, character 14; justification of polarity, Heyer and Liem, 1976).
8. Sternohyoides muscle insertion. 0 = some attachment near midline of hyoid plate, 1 = attachment near lateral edge of plate in at least some species (Heyer, 1975, character 15; justification of polarity, Heyer and Liem, 1976).
9. Omohyoides muscle. 0 = muscle present, 1 = muscle absent in at least some species (Heyer, 1975, character 16).
10. Iliacus externus. 0 = muscle extends from 1/2-3/4 anterior on ilium, 1 = muscle extends from 3/4 to full length of ilium (Heyer, 1975, character 17).
11. Tensor fasciae latae muscle. 0 = muscle inserts posterior to anterior extent of iliacus externus muscle, 1 = muscle inserts on anterior end of ilium immediately anterior to iliacus externus and the tensor fasciae latae and iliacus externus are contiguous for considerable length in at least some species (Heyer, 1975, character 18).
12. Semitendinosus muscle. 0 = exterior head not rudimentary, 1 = exterior head rudimentary, attached by tendon to inferior portion (Heyer, 1975, character 19).

13. Adductor longus muscle, 0 = muscle present, 1 = muscle absent (Heyer, 1975, character 20).
14. Vomerine teeth, 0 = present, 1 = absent (Heyer, 1975, character 26).
15. Alary process of the hyoid, 0 = alary process narrow, stalked, 1 = process rudimentary, 2 = process absent in at least some species (Heyer, 1975, character 31).
16. Posterior sternum, 0 = simple cartilaginous plate, sides of plate broaden posteriorly, 1 = cartilaginous plate, sides parallel or narrow posteriorly, 2 = similar to 1 with deposition of mineral in the mesosternum in at least some species (Heyer, 1975, character 32).
17. Number of phalanges in digit 4 of hand, 0 = 3, 1 = 2, (Lynch, 1976).
18. Tips of fingers and toes, 0 = rounded, 1 = with distinct drawn out tips in at least some species. State 1 is found only in a few eleutherodactylines among all leptodactylid frogs and is clearly a derived condition.

The distribution of states among the taxa are presented in Table 1.

As explained previously (Heyer, 1975), I concur that relationships are best expressed by shared derived states. The total numbers of shared derived states among the taxa are:

	A	B	C	D	E
A — <i>Barycholos</i>	10	10	3	8	5
B — <i>Eleutherodactylus</i>		15	6	10	8
C — <i>E. brasiliensis</i>			10	7	2
D — <i>E. myrmecoides</i>				13	5
E — new species					9

Hecht and Edwards (1976) recently proposed a method of grouping characters into categories of different phylogenetic weight. Several of the characters used herein can not be assigned to the groupings they propose. However, 2 kinds of characters can be identified, corresponding to their groups I and II, involving loss of morphological elements. As they document, these characters carry little information in deducing relationships because there is usually no developmental evidence to indicate that loss occurred independently or was the result of directional selection on a common ancestor. Characters 1, 4, 9, 13, 14, 15, 17 are group I and II characters of Hecht and Edwards (1976). When these characters are deleted, the matrix of numbers of shared derived states appears as:

	A	B	C	D	E
A — <i>Barycholos</i>	8	8	1	6	4
B — <i>Eleutherodactylus</i>		12	3	7	7
C — <i>E. brasiliensis</i>			3	1	1
D — <i>E. myrmecoides</i>				7	4
E — new species					7

Comparison of these two matrices allows the following conclusions to be drawn: (1) Most of the evidence for close relationships between *E. brasiliensis* and *E. myrmecoides* is based upon characters of loss, therefore the relationship is suspect; (2) *E. myrmecoides* has a closer relationship with *Barycholos* and *Eleutherodactylus* than with *E. brasiliensis*; (3) The new species is not closely related to *E. brasiliensis*; and (4) The new species has its closest relationships with *Barycholos*, *Eleutherodactylus* or *E. myrmecoides*.

Before discussing the generic allocation of the new species, additional comment is needed on the generic allocation of *E. myrmecoides* as the results of this analysis clearly indicate that *myrmecoides* is not congeneric with *E. brasiliensis*, conflicting with Lynch's arrangement.

Lynch gave the following list of shared characters of the two species as evidence of both belonging to a common genus: (1) presence of two large metatarsal tubercles, (2) no digital webbing, (3) pointed disks on the toes, (4) a reduced phalangeal formula for the fourth finger, (5) lack of vomerine teeth, (6) short, broad head, (7) small adult size, (8) partially fused epicoaracoid cartilages. The only skeletal differences Lynch (1976) listed between the two were: (1) presence of a plectrum (and tympanum) in *E. myrmecoides*, absent in *E. brasiliensis*, (2) terminal phalanges are more knob-like in *E. myrmecoides*, (3) minor proportional differences.

Both species are leaf litter frogs with certain adaptive complexes reflecting this habitat specialization, including large metatarsal tubercles, no digital webbing, pointed disks on toes (also found on leaf litter *Eleutherodactylus* in the West Indies, clearly a result of convergence), and small adult size. The reduced phalangeal formula and lack of vomerine teeth could well be due to independent loss rather than reflecting relationships as pointed out by Hecht and Edwards (1976). The question is then, are the leaf litter adaptations due to common ancestry or convergence. The way to answer the question is to examine the characters which unite and separate the taxa excluding those characters associated with the leaf litter habitat and characters of loss.

The remaining derived character states that unite the two species are: (1) short, broad head, (2) partially fused epicoaracoid cartilages. Partially fused epicoaracoid cartilages are also found in a few other species of leptodactylids, all of which are small species, suggesting a locomotory skeletal compensation for small size. No shared derived states are added from this analysis.

The remaining character state separating the two species as given by Lynch (1976) is the nature of the shape of the terminal phalanges. Both are distally expanded, but as Lynch shows (1971, figs. 42-43, pp. 65-66), the condition of *E. brasiliensis* is distinctive and difficult to homologize with other T-shaped conditions. Contrary to Lynch, I find the following skeletal differences between the two species: 1) Nature of the nasal-maxillary relationship. The nasals of *E. brasiliensis* are large and in contact with the maxilla. The nasals of *E. myrmecoides* are small and well separated from the maxilla. The condition of *E. myrmecoides* is derived with respect to *E. brasiliensis* (Heyer, 1975). 2) The prootic and frontoparietal bones are fused in *E. brasiliensis* as Lynch indicated, but I find the elements to be separate in *E. myrmecoides*. The fused condition is derived (Heyer, 1975). 3) Lynch and I have different interpretations of sternal con-

