



REVALIDATION AND REDESCRIPTION OF  
*PHYLLODYTES WUCHERERI* (PETERS, 1873) (AMPHIBIA, ANURA, HYLIDAE) <sup>1</sup>

(With 5 figures)

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**ABSTRACT:** *Amphodius wuchereri* Peters, 1873 is revalidated and redescribed under the new combination *Phyllodytes wuchereri*, based on specimens obtained in remnants of the Atlantic Rain Forest in southern State of Bahia, Brazil. *Phyllodytes wuchereri*, a medium-sized species (snout-vent length in males, 25.1-26.0mm, n = 2; in females, 26.2-27.1mm,  $\bar{x}$  = 26.7, SD = 0.37, n = 3), is characterized by a poorly developed vocal sac; well-developed nuptial pad at base of first finger; tympanum exposed; snout pointed in dorsal view and subacute in profile; two dorsolateral, white stripes from posterior corner of eyes to groin, outlined by a dark brown to black line; and central area of dorsum and dorsal surfaces of thighs and tibiae, mottled brown. Based on dorsal color pattern, four species groups are defined for the genus *Phyllodytes*.

**Key words:** Anura, Hylidae; *Phyllodytes wuchereri*; Atlantic Rain Forest; taxonomy.

**RESUMO:** Revalidação e redescrição de *Phyllodytes wuchereri* (Peters, 1873) (Amphibia, Anura, Hylidae). *Amphodius wuchereri* Peters, 1873 é revalidada e redescrita sob a nova combinação *Phyllodytes wuchereri*, com base em exemplares obtidos em remanescentes da Floresta Atlântica no sul do Estado da Bahia, Brasil. *Phyllodytes wuchereri* possui tamanho médio para o gênero (comprimento rostró-cloacal em machos, 25,1-26,0mm, n = 2 ; em fêmeas, 26,2-27,1mm,  $\bar{x}$  = 26,7, SD = 0,37, n = 3), e é caracterizada por possuir saco vocal pouco desenvolvido; calo nupcial bem desenvolvido, na base do primeiro dedo; tímpano evidente; focinho pontiagudo em vista dorsal e subagudo em vista lateral; duas faixas brancas longitudinais dorsolaterais, estendendo-se do bordo posterior do olho até a região ingüinal, marginadas por uma linha marrom-escuro a preto; área central do dorso e superfícies dorsais das coxas e tibias marmoreadas em marrom. São definidos quatro grupos de espécies para o gênero *Phyllodytes* com base no padrão de colorido dorsal.

**Palavras-chave:** Anura, Hylidae; *Phyllodytes wuchereri*; Floresta Atlântica; taxonomia.

## INTRODUCTION

The species of the genus *Phyllodytes* Wagler, 1830 present large odontoids on the dentaries and close habitat affinity with bromeliads, which they use as sites for refuge, breeding, egg laying, and larval development. These characters provide compelling evidence that this genus is monophyletic (SILVA, 1998). Currently, eight species are recognized in Eastern Brazil: *P. acuminatus* Bokermann, 1966, *P. brevirostris* Peixoto & Cruz, 1988, *P. edelmoi* Peixoto, Caramaschi & Freire, 2003, *P. gyrinaethes* Peixoto, Caramaschi & Freire, 2003, *P. kautskyi* Peixoto & Cruz, 1988, *P. luteolus* (Wied-Neuwied, 1824), *P. melanomystax* Caramaschi, Silva &

Britto-Pereira, 1992, and *P. tuberculosus* Bokermann, 1966; *P. auratus* (Boulenger, 1917), a widely disjunct species, occurs in Trinidad, near the coast of Venezuela (PEIXOTO, CARAMASCHI & FREIRE, 2003).

*Amphodius wuchereri* Peters, 1873 was described on the basis of one specimen collected from "Bahia" by O. Wucherer, and considered closely related to *Hyla luteola* Wied-Neuwied, 1824 (PETERS, 1873). The species was tentatively synonymized with *H. luteola* by BOULENGER (1882) but this proposition was not followed by subsequent authors (NIEDEN, 1923; MIRANDA-RIBEIRO, 1926; GOIN, 1961; LUTZ, 1968). The genus *Amphodius* Peters, 1873 was synonymized with *Phyllodytes* Wagler, 1830 by BOKERMANN

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(1966a), and *Amphodus wuchereri* Peters, 1873 was considered a synonym of *Phyllodytes luteolus* (Wied-Neuwied, 1824) (BOKERMANN, 1966a,b). These synonymies were implicitly or explicitly accepted and followed by subsequent authors (DUELLMAN, 1977; PEIXOTO & CRUZ, 1988; CARAMASCHI, SILVA & BRITTO-PEREIRA, 1992; FROST, 2002; PEIXOTO, CARAMASCHI & FREIRE, 2003).

Although BOKERMANN (1966a) proposed the synonymy between *P. luteolus* and *A. wuchereri*, he emphasized that he could not find the color pattern described by PETERS (1873) among the specimens of *P. luteolus* he examined. During herpetofaunal surveys of remnants of the Atlantic Rain Forest in southern State of Bahia, specimens of *Phyllodytes* with the clearly distinctive color pattern described by PETERS (1873) were obtained. These specimens also perfectly agree in all other characters with the description and figure of *Amphodus wuchereri*. Herein we revalidate and redescribe this species under the new combination *Phyllodytes wuchereri*.

#### MATERIAL AND METHODS

Specimens examined are deposited in: EI (Eugenio Izecksohn Collection, Universidade Federal Rural do Rio de Janeiro, RJ, Brazil), MNRJ (Museu Nacional, Rio de Janeiro, RJ, Brazil), MZUSP (Museu de Zoologia, Universidade de São Paulo, SP, Brazil), MZUFV (Museu de Zoologia João Moojen de Oliveira, Universidade Federal de Viçosa, MG, Brazil), USNM (National Museum of Natural History, Smithsonian Institution, Washington, DC, USA), WCAB (Werner C.A. Bokermann Collection, currently in the MZUSP), ZUEC (Museu de História Natural, Universidade Estadual de Campinas, SP, Brazil), and ZUFRJ (Departamento de Zoologia, Universidade Federal do Rio de Janeiro, RJ, Brazil).

Abbreviations used in the account are: SVL (snout-vent length), HL (head length), HW (head width), IND (internarial distance), END (eyenostril distance), ED (eye diameter), UEW (upper eyelid width), IOD (interorbital distance), TD (tympanum diameter), HAL (hand length), THL (thigh length), TL (tibia length), and FL (foot length). All measurements are in millimeters and follow DUELLMAN (1970) and HEYER *et al.* (1990). Webbing formula notation follows MYERS & DUELLMAN (1982).

#### RESULTS

*Phyllodytes wuchereri* (Peters, 1873), revalidated, new combination (Figs. 1-5)

*Amphodus wuchereri* PETERS, 1873 [1872]; BOULENGER, 1882; BAUMANN, 1912; NIEDEN, 1923; MIRANDA-RIBEIRO, 1923, 1926; GOIN, 1961; BOKERMANN, 1966a,b.

Holotype – Zoologisches Museum, Universität Humboldt, Berlin, Germany (ZMB 7506), according to BAUER, GÜNTHER & KLIPFEL (1995).

Type-locality – “Bahia, probably Caravelas”, according to BOKERMANN (1966b). “Bahia”, Brazil, according to FROST (2002).

Diagnosis – A medium-sized species (SVL males 25.1-26.0mm, n = 2 ; females 26.2-27.1mm,  $\bar{x}$  = 26.7, SD = 0.37, n = 3), characterized by: (1) a poorly developed vocal sac; (2) well-developed nuptial pad at base of first finger; (3) tympanum exposed; (4) snout pointed in dorsal view, subacute in profile; (5) two dorsolateral white stripes from posterior corner of eyes to groin, outlined by a dark brown to black line; (6) central area of dorsum and dorsal surfaces of thighs and tibiae mottled brown.

Comparisons with other species – *Phyllodytes wuchereri* is clearly a member of the genus *Phyllodytes* by possessing large mandibular odontoids and inhabiting bromeliads. *Phyllodytes wuchereri*, *P. auratus*, *P. gyrinaethes*, and *P. tuberculatus* have some kind of dorsal markings; however, *P. wuchereri* presents two dorsolateral white stripes from posterior corner of eyes to groin, outlined by a dark brown to black line, and central area of dorsum and dorsal surfaces of thighs and tibiae mottled brown; *P. auratus* also has a dark brown dorsum with two dorsolateral white yellowish stripes which originate on the head and reach the groin but behind the eyes these stripes are wider and irregular enclosing irregular brown blotches; additionally, the central area of dorsum is uniformly dark brown and the dorsal surface of limbs are cream with fine brown flecks (BOKERMANN, 1968; KENNY, 1969; MURPHY, 1997); *P. gyrinaethes* has a variably marbled pattern on the dorsum and limbs, and this pattern can define two irregular patterned areas but never distinctive longitudinal white stripes on the body (PEIXOTO, CARAMASCHI & FREIRE, 2003); and *P. tuberculatus* shows only blackish

flecks or small dots on the dorsum (BOKERMANN, 1966a). The remaining species of the genus have a plain dorsal color.

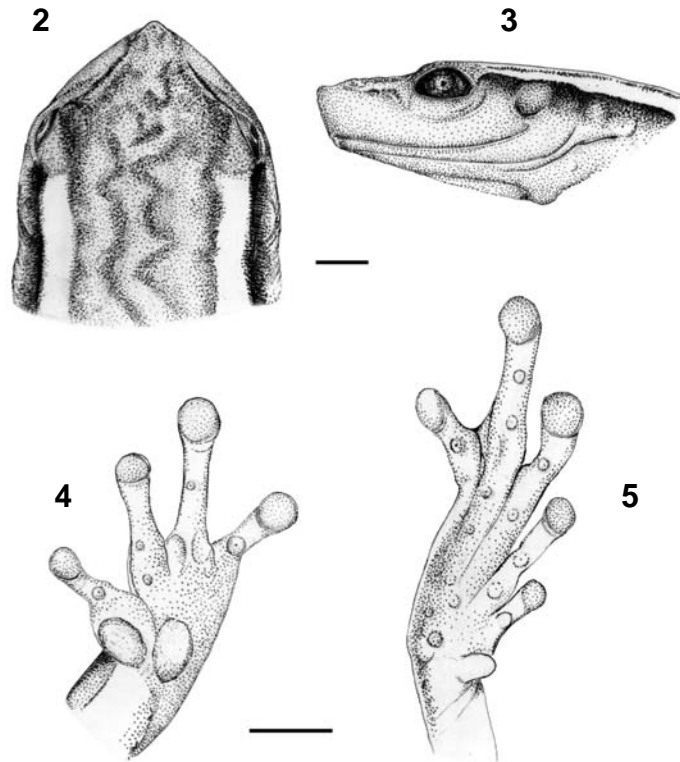
Description – Body robust (Fig.1); head wider than long; snout pointed in dorsal view (Fig.2), subacute in profile (Fig.3); nostrils small, elliptical, directed dorsolaterally; canthus rostralis poorly defined; loreal region oblique, concave; eyes large, directed anterolaterally; eye diameter 28% (27-31%) of head length; interorbital space and dorsum of snout flat; tympanum exposed, nearly round, its diameter 62% (58-68%) of eye diameter; weak supratympanic fold, partially covering the superior border of tympanum; vocal sac subgular, poorly developed; vocal slits near the angle of jaws, under the border of tongue; tongue large, covering entire floor of mouth, attached behind; two groups of 7-10 vomerine teeth almost touching in the midline, in a straight line behind choanae; each side of mandible with 8 odontoids in males, 10 odontoids in females, first two of medium size and others small, subequal; odontoids of males larger than in females; several small odontoids on ventral surface of parasphenoid; pupil horizontal.

Forearms slightly more robust than upper arms; a row of tubercles along external surface of forearm. Hand large (Fig.4), its length 28% (26-30%) of SVL; fingers slender, relatively short, in order of length,  $I < IV < II < III$ ; subarticular tubercles small, round; supernumerary tubercles absent; palmar tubercle well developed, ovoid; thenar tubercle ovoid; finger discs developed; diameter of disc on third finger 47% (44-50%) of eye diameter; webbing absent; males with large nuptial pad at base of first finger, approximately equal to palmar tubercle.

Legs slender; tibia slightly longer than thigh; sum of thigh and tibia lengths 94% (92-96%) of SVL; lateral edges of legs smooth; a row of tubercles along external surface of tarsus; a large, spatulate tubercle near tibio-tarsal articulation; several tubercles on knee. Foot (Fig.5) with small, round subarticular tubercles; supernumerary tubercles round, small, shallow; inner metatarsal tubercle ovoid, spatulate; outer metatarsal tubercle small, round; toes slender, in order of length,  $I < V < II < III < IV$ ; toe discs approximately equal to finger discs in size; webbing absent between toes I-II, vestigial between toes II-III; webbing formula,  $I - II \ 2 \frac{1}{2} - 3 \ \frac{1}{2} \ III \ 2 \ \frac{1}{2} - 3 \ \frac{1}{2} \ IV \ 2 \ \frac{1}{2} - 2 \ V$ .



Fig.1- *Phyllodytes wuchereri* (Peters, 1873) (MZUSP 63674, SVL 25.1mm): dorsal view .



*Phyllodytes wuchereri* (Peters, 1873) (MNRJ 28950, SVL 26.0mm): fig.2- dorsal view of head; fig.3- lateral view of head; fig.4- hand; fig.5- foot. Scale bars = 2mm.

Skin smooth on dorsal surfaces of body and limbs, and on ventral surfaces of arms and tibiae; throat and belly shagreened, with shallow round tubercles arranged in six rows; ventral surfaces of thighs with distinct round tubercles and a pair of more projecting tubercles at thigh insertion.

Color in preservative – Dorsum with two dorsolateral white stripes from posterior corner of eyes to groin, outlined by a dark brown to black line; central area of dorsum and dorsal surfaces of thighs and tibiae mottled brown; canthus rostralis with a brown to black line. Ventral surfaces cream.

Variation – Males and females present sexual dimorphism in external characters, mainly by the presence of nuptial pad on finger I of males and larger number of smaller odontoids on mandible of females than in males. Females are slightly larger than males (Tab.1).

Remarks – *Phyllodytes wuchereri* was originally described on the basis of one specimen from Caravelas (17°44'S, 39°16'W), obtained by Otto E.H. Wucherer (1820-1873), a renowned physician, who

is considered the founder of Brazilian helminthology. The specimens currently studied come from three localities in the southern part of the State of Bahia, a region primarily covered by the Atlantic Rain Forest: Caravelas (at the coast), São José da Vitória, Fazenda Unacau (15°09'S, 39°18'W, 38km from the coast), and Itamari, Fazenda Alto São Roque (13°47'S, 39°41'W, 73km from the coast).

The specimens of *P. wuchereri* obtained at São José da Vitória (BA) were collected from agglomerates of large bromeliads attached to trunks of large trees at approximately 6 to 8m above ground. A couple of specimens were found in each bromeliad assemblage. Two specimens of *P. kautskyi* were in the same area in similar agglomerates of large bromeliads respectively fixed at 5 and 8m on the trunks of adjacent large trees. The general area consisted of a primary forest selectively logged to accommodate cacao plantations in a hilly region. Emergent trees where bromeliad tickets were attached reached 40m high and 80cm diameter at breast high. Additional data on this area are in RODRIGUES (1997) and RODRIGUES *et al.* (2002). The advertisement call and tadpole are unknown.

Table 1. Measurements (mm) of *Phyllodytes wuchereri* (Peters, 1873).

	MNRJ 28950	MZUSP 63674	MZUSP 63675	MZUSP 63676	MZUSP 63677
SVL	26.0	25.1	26.7	27.1	26.2
HL	9.3	9.0	9.3	9.2	8.5
HW	9.9	9.7	10.2	10.2	9.4
IND	1.7	1.7	1.9	1.8	2.0
END	2.9	3.0	3.0	3.2	3.0
ED	2.5	2.6	2.7	2.7	2.6
UEW	1.8	1.4	1.4	1.3	1.2
IOD	3.8	3.5	3.9	4.1	3.9
TD	1.7	1.5	1.7	1.6	1.6
HAL	6.8	6.8	8.0	7.4	7.4
THL	12.1	11.6	12.6	12.4	12.3
TL	12.8	12.1	12.8	12.6	12.3
FL	9.4	9.2	10.3	9.7	10.2
Sex	♂	♂	♀	♀	♀

## DISCUSSION

The genus *Phyllodytes* is currently composed of 11 species, but interspecific relationships remain unknown. Based on dorsal color pattern, PEIXOTO, CARAMASCHI & FREIRE (2003) defined three species groups for the genus, but in face of new data, some rearrangements are needed.

The *P. luteolus* group is composed of species having a plain dorsal color pattern, with a more or less defined dorsolateral dark brown to black line on canthus rostralis and/or behind the corner of eyes (*P. acuminatus*, *P. brevirostris*, *P. edelmoi*, *P. kautskyi*, *P. luteolus*, and *P. melanomystax*). Although PEIXOTO, CARAMASCHI & FREIRE (2003) considered *P. acuminatus* to have a pattern of randomly scattered brown dots on dorsum and associated it with *P. tuberculosus*, actually it has a plain pattern and belongs to the *P. luteolus* species group. The *P. tuberculosus* group includes species with dorsum pale brown with scattered, distinctive, isolated or coalesced brown dots (currently only *P. tuberculosus*). The *P. auratus* group embraces species showing a dorsal pattern of two dorsolateral, longitudinal white or yellowish stripes bordered by a dark brown to black line, from posterior corner of eyes to groin (*P. auratus* and *P. wuchereri*). Finally, *P. gyrinaethes* stands alone, presenting a variably marbled dorsum that can define two irregularly patterned dorsolateral light areas but never

distinctive longitudinal white or black stripes nor dots; *P. gyrinaethes* is also the only known species in the genus having red color on concealed surfaces and a highly modified tadpole.

The putative similarity between *P. auratus* and *P. wuchereri* is striking but not unexpected. Although the true relationships of *P. auratus* and *P. wuchereri* are unknown, similar examples of widely separated distributions involving Atlantic Rain Forest amphibians and reptiles are known. The frog genera *Aparasphenodon* Miranda-Ribeiro, 1920 (see POMBAL, 1993) and *Adelophryne* Hoogmoed & Lescure, 1984 (see HOOGMOED, BORGES & CASCON, 1994) have species showing this type of disjunction. The enigmatic presence of the lizard genus *Gymnodactylus* Spix, 1825 in Trinidad (MURPHY, 1997), which occurs in the "restingas" of eastern Brazil in thickets of the same terrestrial bromeliads inhabited by species of *Phyllodytes*, could be another example. Such widely disjunct distributions are compelling evidence suggesting that we lack an important part of the history of these lineages. We can not be sure if this lack is due to an unrecoverable history due to habitat modification or to lack of adequate surveying. Considering the fact that seven of the ten species of *Phyllodytes* presently known were described or resurrected only after 1988, it is very possible that the disjunction is overestimated. The restriction of *P. auratus* to the giant bromeliads of high elevation

forests (above 800m) of northern Trinidad (MURPHY, 1997) lead us to think that one of the hot spots for surveying these frogs in the near future is the bromeliad rich forests of isolated mountains of the State of Ceará, like the Serra do Baturité, where several endemic frogs and lizards with Atlantic Rain Forest relationships occur (HOOGMOED, BORGES & CASCON, 1994; RODRIGUES & BORGES, 1997). Even if the resulting evidence is negative, these records are crucial to recover the history of the South American herpetofauna.

The lack of knowledge on the biodiversity, particularly regarding the anurans, in the Atlantic Rain Forest brings a notable difficulty to evaluate the actual conservation status of these animals. The re-discovery of *P. wuchereri* in approximately 130 years after its first collection and description constitutes a remarkable occurrence and illustrates this current ignorance.

#### SPECIMENS EXAMINED

*Phyllodytes acuminatus* – BRAZIL - PERNAMBUCO: Recife (ZUEC 0372, 3 spec.). ALAGOAS: Usina Sinimbu, Mangabeiras (MZUSP 74153, ex-WCAB 2701, holotype; MZUSP 74441, ex-WCAB 2702, paratype).

*Phyllodytes auratus* – TRINIDAD (USNM 118240, 166629-166633, 166709-166710).

*Phyllodytes brevirostris* – BRAZIL - PARAÍBA: Alhandra (MZUSP 36784, holotype; MZUSP 36782-36783, 36785, paratypes).

*Phyllodytes edelmoi* – BRAZIL - PERNAMBUCO: Jaqueira, Usina Colônia (EI 9498-9502, ZUF RJ 7927-7929). ALAGOAS: Maceió, Mata do Catolé (MNRJ 24073, holotype; MNRJ 24127-24130, 24074-24083, 24090-24103, 24104-24105, 24108-24111, 24112-24113, 24114, 24120, paratypes).

*Phyllodytes gyrinaethes* – BRAZIL - PERNAMBUCO: Jaqueira, Usina Colônia (ZUF RJ 7931-7932). ALAGOAS: Murici, Fazenda Bananeiras (MNRJ 23986, holotype; MNRJ 23987, 23988-23989, 23990-23992, 23993-23997, 24000, 24001-24002, 24003-24004, 24005-24006, 24007-24016, paratypes).

*Phyllodytes kautskyi* – BRAZIL - MINAS GERAIS: Bandeira (MZUFV 5197). BAHIA: São José da Vitória, Fazenda Unacau (MZUSP 63672-63673). ESPÍRITO SANTO: Domingos Martins (EI 7728, holotype; MNRJ 19525, 24961).

*Phyllodytes luteolus* – BRAZIL - BAHIA: Itabuna, CEPLAC (MNRJ 10659-10682); Ilhéus (MNRJ

10683-10690); 15km NW Porto Seguro (MZUSP 63153); Nova Viçosa (MNRJ 33707-33714); Restinga de Alcobaça (MZUSP 20641-20642). ESPÍRITO SANTO: Vitória (MZUSP 321); Guarapari (MZUSP 34042-34055); Vila Velha, Pontal da Fruta (ZUEC 5975-5985); Fundão, Médio Goiapaba-açu (MNRJ 19399); Santa Teresa, Médio Goiapaba-açu (MNRJ 23984-23985).

*Phyllodytes melanomystax* – BRAZIL - SERGIPE: Areia Branca, Serra de Itabaiana (MZUSP 88968-88969). BAHIA: Valença, Guaibim (MNRJ 4823, holotype; MNRJ 4824-4856, 4857-4861, MZUSP 66102-66103, 66104-66105, ZUEC 6825-6826, paratypes).

*Phyllodytes tuberculosus* – BRAZIL - BAHIA: Maracás (MZUSP 74456, ex-WCAB 31922, holotype; MZUSP 74457, ex-WCAB 31923; MZUSP 74049-74058, ex-WCAB 31925-31926, 31933-31940; MZUSP 74164-74166, ex-WCAB 12273-12275, paratypes).

*Phyllodytes wuchereri* – BRAZIL - BAHIA: São José da Vitória, Fazenda Unacau (MZUSP 63674-63677); Itamari, Fazenda Alto São Roque (MNRJ 28950).

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