

A New *Philautus* (Amphibia: Rhacophoridae) from Northern Laos

BRYAN L. STUART^{1,2,3,*} AND HAROLD F. HEATWOLE⁴

¹Field Museum of Natural History, Department of Zoology, Division of Amphibians & Reptiles, 1400 S. Lake Shore Drive, Chicago, Illinois, USA 60605-2496;

*Corresponding author: E-mail: bstuart@fieldmuseum.org

²University of Illinois at Chicago, Department of Biological Sciences, 845 W. Taylor, Chicago, Illinois, USA 60607-7060

³Wildlife Conservation Society, P.O. Box 6712, Vientiane, Laos

⁴North Carolina State University, Department of Zoology, P.O. Box 7617, Raleigh, North Carolina, USA 27695-7617; E-mail: harold_heatwole@ncsu.edu

Abstract. - A new *Philautus* is described from Phou Dendin National Biodiversity Conservation Area in northern Laos. *Philautus petilus* sp. nov. is most remarkable by having a very slender, elongate habitus. Other distinguishing characteristics include having a tympanum diameter 80% of the eye diameter, white asperities on the dorsum, and distinctive coloration consisting of a soft yellow-beige dorsolateral surface with broken black stripes posteriorly, a lavender wash on dorsal surface of limbs, upper lip, and sides, a black stripe below edge of canthus extending from snout tip to flanks near level of mid-body, and a black spot equal in diameter to the tympanum located just anterior to the inguinal region.

Key words. - Laos, new species, *Philautus*, Rhacophoridae.

Introduction

Bourret (1942) remains the major work on the amphibians of Laos, supplemented only recently by descriptions of new species (Inger and Kottelat 1998; Stuart and Papenfuss 2002). Consequently, the amphibian fauna of Laos is imperfectly known.

From 6-26 October 1999, we conducted a herpetofaunal survey of Phou Dendin National Biodiversity Conservation Area in eastern Phongsaly Province, northern Laos, near to the tri-border area of Laos, Vietnam, and China (Figure 1A). The area surveyed was mostly covered in hilly evergreen forest, sometimes mixed with stands of natural bamboo, with small, rocky streams flowing down hillsides into the larger, swift Nam Ou and Nam Khang Rivers, at elevations from 600-1000 m. During the course of that work we found a single, adult female specimen of an enigmatic, rhacophorid treefrog, which we describe here as a new species of *Philautus*.

Materials and Methods

The single specimen found was caught in the field by hand, preserved in 10% buffered formalin, and later transferred to 70% ethanol. A tissue sample was taken by preserving pieces of liver in 95% ethanol before the specimen was fixed in formalin. The specimen was

deposited at the Field Museum of Natural History (FMNH).

Measurements largely follow those of Bain et al. (2003) and were made with dial calipers to the nearest 0.1 mm. Abbreviations used are: SVL = snout-vent length; HDL = head length from tip of snout to the commissure of the jaws; HDW = head width at the commissure of the jaws; SNT = snout length from tip of snout to the anterior corner of the eye; EYE = eye diameter; IOD = interorbital distance; TMP = horizontal diameter of tympanum; TEY = tympanum-eye distance from anterior edge of tympanum to posterior corner of the eye; FPL = length of finger III disk from the base of the pad to its tip; FPW = width of finger III disc at the widest part of the pad; TPL = length of toe IV disk; TPW = width of toe IV disk. Measurement ratios are reported as percentages (%) rounded to the nearest integer.

Philautus petilus, new species
(Figure 1B)

Material examined. -Holotype: FMNH 257902, adult female, collected by the authors on 23 October 1999 in Phou Dendin National Biodiversity Conservation Area, Phongsaly District, Phongsaly Province, Laos, 22°05'44"N 102°08'10"E, at 600 m elevation.

Diagnosis. - An elongate, slender *Philautus* having a head width only 27% of SVL; tympanum diameter 80%

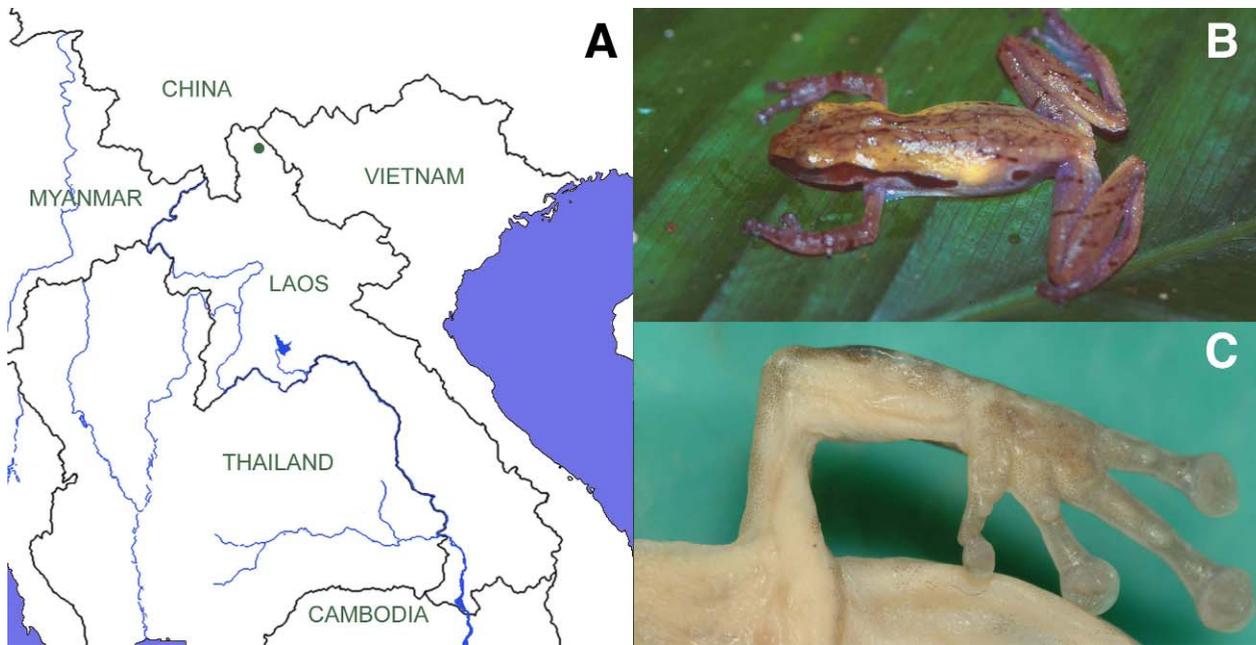


Figure 1A-C. A. Map showing the type locality (black dot) of *Philautus petilus* sp. nov. in Phongsaly Province, northern Laos. B. The adult female holotype (FMNH 257902) of *Philautus petilus* sp. nov., anesthetized prior to preservation. Photograph by Bryan L. Stuart. C. The hand of the adult female holotype (FMNH 257902) of *Philautus petilus* sp. nov. in preservation. Photograph by Nikolai L. Orlov.

of eye diameter; white asperities on head, eyelids, back, dorsal surface of tibia and forelimbs, and anterior half of sides; no fringes, row of enlarged tubercles, or accessory flaps of skin on outer margins of limbs; black stripe below edge of canthus extending from tip of snout to flanks near level of mid-body; black spot slightly anterior to inguinal region, equal in diameter to the tympanum.

Description of Holotype. - Habitus elongate, slender; head width 27% of SVL; head slightly longer than wide; snout obtusely pointed in dorsal view, projecting beyond lower jaw, round in profile, not depressed; nostril lateral, near tip of snout; canthus rounded but distinct, constricted behind nostrils; lores slightly concave, oblique; eye diameter less than snout length, interorbital distance wider than upper eyelid; tympanum visible, not depressed relative to skin of temporal region, tympanic rim slightly elevated relative to tympanum, tympanum diameter 80% of eye diameter; weak supratympanic fold from eye to shoulder; vomerine teeth very small, in oblique rows closer to choanae than to each other; tongue deeply notched posteriorly.

Tips of all four fingers expanded, about two times the width of phalanges, with circummarginal grooves, width of finger I disc 60% the width of finger III disc, width of finger III disc 71% the diameter of tympanum; relative finger lengths $I < II < IV < III$; webbing absent; fingers III and IV with large middle subarticular tuber-

cle and smaller palmar tubercle at base; fingers I and II with large palmar tubercle at base.

Tips of toes expanded, width of toe IV disc slightly smaller than width of finger III disc; toe V longer than toe III; toe I webbing to midway between subarticular tubercle and disc, continuing only as narrow fringe to disc; toes II, III, and IV webbing to distal subarticular tubercle, continuing only as narrow fringe to disc; toe V webbing to midway between distal subarticular tubercle and base of disc, continuing only as narrow fringe to base of disc; inner metatarsal tubercle elongated, outer metatarsal tubercle very small, almost inconspicuous.

Skin on dorsal and ventral surfaces smooth, except for distinct, white asperities on head, eyelids, back, dorsal surface of tibia and forelimbs, and anterior half of sides; no fringes, row of enlarged tubercles, or accessory flaps of skin on outer margins of limbs.

Left ovary with fewer than 25, developing, creamy-white ova (color in preservative).

In life, top of head and back light brown with dark brown reticulations and scattered black spotting; dorso-lateral surface of head and body soft yellow-beige, with short, broken black stripe on dorsolateral surface from level of midbody extending toward groin; lavender wash on dorsal surface of limbs, upper lip, and sides; black stripe below edge of canthus extending from tip of snout to anterior border of eye, and from posterior border of eye along supratympanic fold to flanks near level of mid-body; black spot slightly anterior to inguinal region,

equal in diameter to the tympanum; black 'M'-shaped marking over anus; black spot on tarsus closer to articulation than foot, narrow black crossbars on hindlimbs, some black flecking on forelimbs; venter creamy-white, dark spotting on chin and throat, pigmentation on underside of hands, feet, and tibiotarsus. In preservative, yellow-beige and lavender coloration lost.

Measurements (mm) of holotype. - SVL 33.8; HDL 9.9; HDW 9.2; SNT 4.1; EYE 3.0; IOD 2.3; TMP 2.4; TEY 1.5; FPL 1.5; FPW 1.7; TPL 1.3; TPW 1.4.

Comparisons. - The generic assignments of small, rhacophorid (or rhacophorine) treefrogs are uncertain and debated (Bossuyt & Dubois 2001; Wilkinson et al. 2002). Therefore, we compare *P. petilus* with all other species of small to medium-sized rhacophorid (or rhacophorine) treefrogs having reduced finger webbing that are reported from the vicinity of northern Laos, regardless of what genus they are currently referred to. These include *Chirixalus doriae* Boulenger, *C. hansenae* (Cochran), *C. laevis* (Smith), *C. nongkhorensis* (Cochran), *C. palpebralis* (Smith), *C. vittatus* (Boulenger), *Philautus abditus* Inger, Orlov, & Darevsky, *P. albopunctatus* Liu & Hu, *P. banaensis* Bourret, *P. carinensis* (Boulenger), *P. gracilipes* Bourret, *P. gryllus* Smith, *P. jinxiuensis* Hu, *P. longchuanensis* Yang & Li, *P. maosonensis* Bourret, *P. menglaensis* Kou, *P. ocellatus* Liu and Hu, *P. odontotarsus* Ye and Fei, *P. parvulus* (Boulenger), *P. rhododiscus* Liu and Hu, *Rhacophorus appendiculatus* (Günther), *R. baliogaster* Inger, Orlov & Darevsky, *R. bisacculus* Taylor, *R. verrucosus* Boulenger, *Theioderma asperum* (Boulenger), and *T. stellatum* Taylor (Bourret 1942; Taylor 1962; Inger et al. 1999; Fei 1999; Orlov et al. 2002).

Philautus petilus differs from all species of *Chirixalus* Boulenger by lacking the two outer fingers appearing to be opposable to the two inner ones (present in *Chirixalus*). *Philautus petilus* further differs from *C. doriae* and *C. nongkhorensis* by lacking outer finger webbing (outer fingers 1/3 webbed in *doriae* and *nongkhorensis*), from *C. hansenae*, *C. laevis* and *C. vittatus* by lacking light-colored dorsolateral stripes (present in *hansenae*, *laevis* and *vittatus*), and from *C. palpebralis* by lacking a yellow streak from below eye to shoulder (present in *palpebralis*). *Philautus petilus* differs from *P. abditus* by having a visible tympanum (hidden in *abditus*) and lacking large black spots on the legs (present in *abditus*). *Philautus petilus* differs from *P. albopunctatus* by having dorsal asperities (absent in *albopunctatus*) and lacking white blotches on the snout, dorsum and above anus (present in *albopunctatus*). *Philautus petilus* differs from *P. carinensis* by having the snout longer than the eye diameter (snout shorter

than eye diameter in *carinensis*) and by having a slender habitus (stocky habitus in *carinensis*). *Philautus petilus* differs from *P. gracilipes* by having a head width 27% of SVL (head width 45% of SVL in *gracilipes*), having the width of finger III disc 71% the diameter of tympanum (width of finger III disc equal to the diameter of tympanum in *gracilipes*), and lacking mostly green coloration with dark-brown eyelids (present in *gracilipes*). *Philautus petilus* differs from *P. jinxiuensis* by lacking a large interorbital dark blotch extending posteriorly into two broad, dark dorsolateral stripes (present in *jinxiuensis*). *Philautus petilus* differs from *P. longchuanensis* by having a tympanum diameter larger than width of finger III disc (tympanum diameter smaller than width of finger III disc in *longchuanensis*). *Philautus petilus* differs from *P. maosonensis* by having the head slightly longer than wide (head wider than long in *maosonensis*), by having the snout projecting beyond the lower jaw (snout not projecting beyond lower jaw in *maosonensis*), by having the tympanum diameter 80% of eye diameter (tympanum diameter approximately 2/3 eye diameter in *maosonensis*), and by lacking a thin band between the eyelids, a large dark marking on the back, and a dark spot behind the axilla (present in *maosonensis*). *Philautus petilus* differs from *P. menglaensis* by having smooth skin with asperities on the dorsum (warty skin on dorsum in *menglaensis*) and by having a tympanum diameter larger than the width of finger III disc (tympanum diameter smaller than or equal to width of finger III disc in *menglaensis*). *Philautus petilus* differs from *P. ocellatus* by lacking a round black blotch on the occiput (present in *ocellatus*). *Philautus petilus* differs from *P. parvulus* by having the snout longer than the eye diameter (snout shorter than eye diameter in *parvulus*), having a visible tympanum (hidden in *parvulus*), and having the nostril close to the tip of snout (nostril midway between eye and tip of snout in *parvulus*). *Philautus petilus* differs from *P. rhododiscus* by lacking dark brown coloration with black spots, grayish-white ventral marbling, and reddish-orange finger and toe discs (present in *rhododiscus*). *Philautus petilus* differs from *P. banaensis*, *P. gryllus*, *P. odontotarsus*, *R. appendiculatus*, *R. bisacculus*, and *R. verrucosus* by lacking dermal fringes or tubercles on the limbs (present in *banaensis*, *gryllus*, *odontotarsus*, *appendiculatus*, *bisacculus*, and *verrucosus*). *Philautus petilus* differs from all species of *Theioderma* Tschudi by having smooth skin with dorsal asperities (skin rugose in *Theioderma*).

Etymology. - The species name *petilus* (L.) means slender, referring to the distinct habitus of the holotype.

Ecology. - The holotype was collected at 2215 h on a bamboo leaf 1 m above the ground in hilly evergreen

forest mixed with bamboo, approximately 200 m from the bank of the Nam Ou River, at 600 m elevation.

Remarks. - The generic assignments of small, rhacophorid (or rhacophorine) treefrogs are uncertain, debated, and likely to be considerably revised in the near future (Bossuyt & Dubois 2001; Wilkinson et al. 2002). Many species have been moved among the genera *Chirixalus* Boulenger and *Philautus* Gistel (Frost 2002). *Philautus petilus* does not have the two outer fingers appearing to be opposable to the two inner ones (Figure 1C), which is diagnostic of the genus *Chirixalus* (Liem 1970). Historically, *Philautus* was diagnosed by the absence of vomerine teeth (Liem 1970; Bossuyt and Dubois 2001), but this character is known to vary within a species, and consequently Liem (1970) included species in the genus *Philautus* that sometimes have vomerine teeth. *Philautus petilus* has very small vomerine teeth. Bossuyt and Dubois (2001) proposed that only species having direct aerial development (lacking a free-swimming aquatic tadpole) be included in the genus *Philautus*. The mode of reproduction in *P. petilus* is unknown, but it does have a small clutch size (the left ovary of the holotype holds fewer than 25 ova). Dring (1987) reported total clutch sizes of only 2-26 eggs in five species of *Philautus*, including the type species, *P. aurifasciatus*. In the absence of a phylogeny and more substantial reproductive data, we recognize that our placement of *petilus* into the genus *Philautus* is tentative.

Acknowledgments

The opportunity to work in Laos was made possible by the Wildlife Conservation Society / Division of Forest Resource Conservation Cooperative Program. The Ministry of Agriculture and Forestry (Vientiane, Laos) permitted export of specimens to the Field Museum of Natural History. Bee Thaovanseng assisted with fieldwork in Laos. Financial support was provided by The John D. and Catherine T. MacArthur Foundation (with Harold Voris and Robert Inger), the National Geographic Society (Grant no. 6247-98), and the Wildlife Conservation Society. Harold Voris, Alan Resetar, Jamie Ladonski, and Jennifer Mui facilitated examining specimens at the Field Museum of Natural History. Sophie Molia translated French descriptions and Tan Fui Lian translated Chinese descriptions. Robert Inger, Nikolai Orlov, and Jeff Wilkinson shared their taxonomic opinions on the specimen. Nikolai Orlov photographed the preserved specimen. Robert Inger, Raoul Bain, and an anonymous reviewer improved the manuscript.

Literature Cited

- Bain, R. H., A. Lathrop, R. W. Murphy, N. L. Orlov, and Ho Thu Cuc. 2003. Cryptic species of a cascade frog from Southeast Asia: taxonomic revisions and descriptions of six new species. *American Museum Novitates* 3417:1-60.
- Bossuyt, F. and A. Dubois. 2001. A review of the frog genus *Philautus* Gistel, 1848 (Amphibia, Anura, Ranidae, Rhacophorinae). *Zeylanica* 6(1):1-112.
- Bourret, R. 1942. Les batraciens de l'Indochine. *Mémoires de l'Institut Océanographique de l'Indochine* 6:1-547.
- Dring, J. 1987. Bornean treefrogs of the genus *Philautus* (Rhacophoridae). *Amphibia-Reptilia* 8(1987):19-47.
- Fei, L. 1999. Atlas of Amphibians of China. Zhengzhou: Henan Publishing House of Science and Technology. 432 pages. [in Chinese].
- Frost, D. R. 2002. Amphibian Species of the World: an online reference. Version 2.21 (15 July 2002). Electronic database available at <http://research.amnh.org/herpetology/amphibia/index.html>.
- Inger, R. F. and M. Kottelat. 1998. A new species of ranid frog from Laos. *The Raffles Bulletin of Zoology* 46(1):29-34.
- Inger, R. F., N. Orlov & I. Darevsky. 1999. Frogs of Vietnam: a report on new collections. *Fieldiana, Zoology New Series*, 92:1-46.
- Liem, S. S. 1970. The morphology, systematics, and evolution of the Old World treefrogs (Rhacophoridae and Hyperoliidae). *Fieldiana Zoology* 57:1-145.
- Orlov, N. L., R. W. Murphy, N. B. Ananjeva, S. A. Ryabov, & Ho Thu Cuc. 2002. Herpetofauna of Vietnam, a checklist. Part I. Amphibia. *Russian Journal of Herpetology* 9(2):81-104.
- Stuart, B. L. and T. J. Papenfuss. 2002. A new salamander of the genus *Paramesotriton* (Caudata: Salamandridae) from Laos. *Journal of Herpetology* 36(2):145-148.

- Taylor, E. H. 1962. The amphibian fauna of Thailand. University of Kansas Science Bulletin 63(8): 265-599.
- Wilkinson, J. A., R. C. Drewes, and O. L. Tatum. 2002. A molecular phylogenetic analysis of the family Rhacophoridae with an emphasis on the Asian and African genera. *Molecular Phylogenetics and Evolution* 24: 265-273.