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TWO NEW SPECIES OF FROGS FROM SOUTHEASTERN SARAWAK

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ABSTRACT. - Two new species of frogs, *Philautus refugii* and *Pelophryne rhopophilius*, are described from the Lanjak-Entimau Wildlife Sanctuary, Sarawak. Both new species, which are in different families, are members of genera in which separation of intra- and interspecific variation has been difficult. The new taxa are based on samples that help distinguish between these types of variation.

INTRODUCTION

Under the auspices of the International Tropical Timbers organization, one of us (RBS) carried out a seven month herpetological survey of the Lanjak-Entimau Wildlife Sanctuary (1°19'-1°51'N/111°53'-112°28'E) an area of 167,200 hectares of rugged terrain comprising mostly mixed dipterocarp hill forests with some old (>100 yrs) secondary growth on banks of the main rivers. The highest point is Bukit Lanjak, at 1284 m. At about 1000 m mossy submontane forest replaces the lowland hill dipterocarp forest.

Between August, 1993, and March, 1994, a series of visits was made to the area for the purpose of an inventory of the herpetofauna, the first such survey in this area of Sarawak. The entire herpetological fauna of the wildlife sanctuary is described in Stuebing (1996). It is not surprising that among the 51 species of amphibians collected, two species are new; they are described below.

MATERIAL AND METHODS

Sampling was carried out in the Lanjak-Entimau Reserve using several procedures: night transects along streams, night transects in forest, and quadrats on the forest floor. All the specimens mentioned in this publication were collected in primary forest transects covered at 0645-2100 hrs, starting at the summit of Bukit Lanjak and following a track down to 750 m. Specimens were preserved in 10% formalin and transferred after an interval to 70% ethanol.

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We also examined other Bornean and Philippine specimens in the collections of Field Museum of Natural History (FMNH), and borrowed material from American Museum of Natural History, New York (AMNH), The Natural History Museum, London (BMNH), Museum of Comparative Zoology, Harvard University (MCZ), and Rijksmuseum van Natuurlijke Historie, Leiden (RMNH). Abbreviations are used for snout-vent length (SVL), tibia length (T), and head width (HW). Specimens without standard museum acronyms are deposited in the collection of Sarawak Forest Department, Kuching, Sarawak, Malaysia.

PHILAUTUS GISTEL

In Borneo, as elsewhere within the range of this speciose genus, evaluating intra- and interspecific variation has been difficult. Dring's (1987) review of the Bornean species of this genus was the first attempt to separate these two types of variation. Specimens we have collected in Sarawak and Sabah confirm most of Dring's conclusions with respect to three of the species Dring placed in the *aurifasciatus* species group: *petersi* (Boulenger), *longicrus* (Boulenger), and *mjobergi* Smith. The other two Bornean species in this group, according to Dring, are *amoenus* Smith, which is known from the unique holotype from high elevation on Mt. Kinabalu, and *umbra* Dring, which is the only species with black coloration dorsally and ventrally.

A sample of *Philautus* collected in the Lanjak-Entimau Reserve resembles *longicrus*, the smallest of these Bornean species, in size. However, as these frogs differ from *longicrus* in coloration, skin characteristics, and shape of the snout in females, we believe it to be a new species, which we describe below as

Philautus refugii, new species
(Figs. 1, 2)

Material examined. - Holotype: FMNH 252418 (RBS 9002), a mature male, collected at Bukit Lanjak, 840 m, Lubok Antu District, Second Division, Sarawak, on 20 February, 1994, by Robert B. Stuebing.

Paratypes: FMNH 252419-21 (RBS 8996-8998), RBS 8958, 8960, 8965-66, 8974, 8976-79, 8981-82, 8984, 8992-95, 8999, 9000, 9003 1/n 05, three adult females and 21 adult males, collected with the holotype on leaves of shrubs at night.

Diagnosis. - Cutaneus pectoris muscle present; lingual papilla absent; male with round, white nuptial pad; female with small rostral cone; fifth toe webbed to distal edge of distal subarticular tubercle or beyond; anterior face of thigh with conspicuously barred pattern; rear of thigh reddish brown; males <19 mm, females <21 mm.

Description. - Habitus stocky, head as wide as body. Snout of males obtusely pointed, not projecting, round in profile; snout of females with a small, distinct rostral cone, projecting; nostril nearer to tip of snout than to eye; canthi rounded, constricted behind nostrils; lores weakly sloping, concave; eye diameter equal to snout in males, shorter in females; interorbital as wide as eyelid; tympanum less than half eye diameter; no lingual papilla; no vomerine teeth.

Tips of fingers expanded into round discs, that of first finger about half that of third, disc of third finger wider than tympanum; first finger shorter than second; subarticular tubercles

distinct; many small supernumerary tubercles under fingers and palm. Tips of toes as in fingers; third and fifth toes equal in length; full webbing on first toe to edge of subarticular tubercle, on second toe to beyond tubercle, on third and fifth toes to distal edge of distal tubercle or beyond, on fourth toe to center or distal edge of middle tubercle; supernumerary tubercles under toes and sole; low oval inner but no outer metatarsal tubercle.

Skin on top and sides of head with small, round tubercles; back and sides with numerous round tubercles; eyelid with 3-5 low conical tubercles; an elevated conical tubercle at tibiotarsal joint followed by row of lower tubercles along outer edge of tarsus and fifth toe; venter coarsely granular.

Ground color in preservative of dorsal and lateral surfaces medium to dark brown with darker spots or H- or X-shaped markings; inguinal area with large brown-edged white spots; anterior face of thigh white with narrow brown bars or brown with large white spots; rear of thigh uniformly reddish brown; venter white, throat heavily marked with brown, abdomen with scattered. small brown dots; limbs with dark crossbars.

Nuptial pad of male a small, round, white pad of very fine spinules on dorsal surface of first finger; vocal sac median, subgular.

SVL of males 15.3-18.0 mm (mean±SE 16.32±0.18, n=21), females 17.5-19.6 (n=3); T/SVL of males 0.55-0.66 (median 0.610, n=19), of females 0.61-0.64; HW/SVL of males 0.40-0.41 (n=7).

Measurements (mm) of holotype: SVL 16.0, T 9.8, HW 6.6, diameter of eye 2.9, diameter of tympanum 1.0, disc of third finger 1.2.

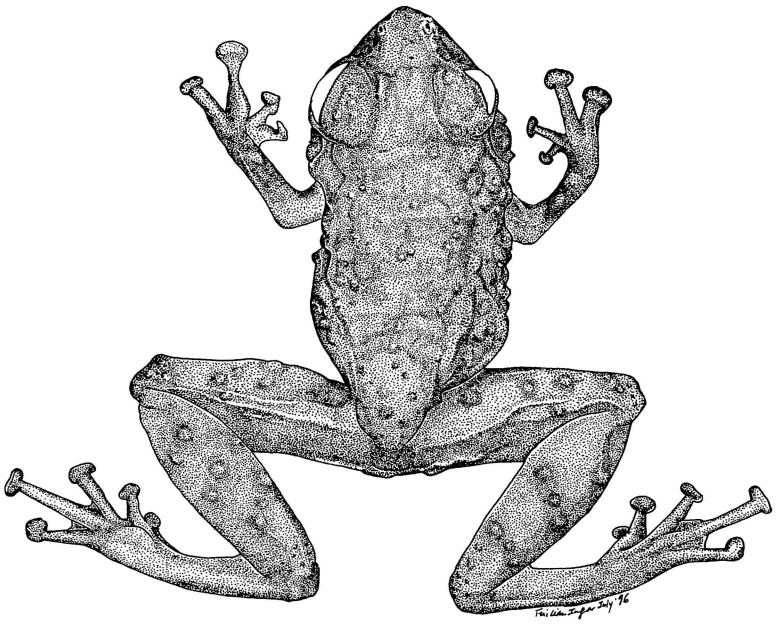

Fig. 1. Dorsal view of *Philautus refugii*, new species. Scale bar = 5mm.

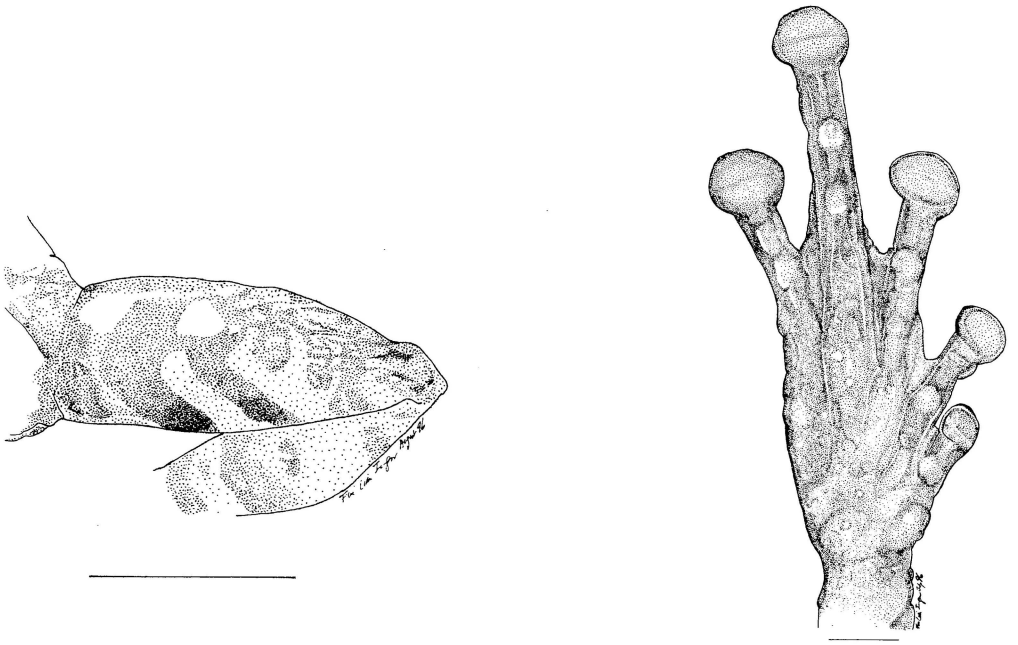

Fig. 2. *Philautus refugii*, new species. (A) Anterior face of thigh. Scale bar = 5 mm. (B) Ventral surface of foot. Scale bar = 1mm.

Etymology. - Specific name genetive singular of *refugium* (Latin) meaning refuge, referring to the nature reserve from which the type series comes.

Comparisons.- *Philautus refugii* resembles *P. longicrus* in size (*longicrus* males 15-20 mm), in lacking a lingual papilla, and in having the fifth toe webbed to edge of distal tubercle or beyond. However, *P. longicrus* lacks a tubercle at the tibiotarsal joint (present in *P. refugii*) and females lack a rostral cone (present in *refugii*). The anterior face of the thigh in *P. longicrus* is brown, either uniform or with the distal two-thirds brown with light spots that do not interrupt the dark area; this contrasts with the barred pattern in *P. refugii* (see above). (Observations on *P. longicrus* based on examination of 35 specimens from Sabah and Sarawak.) *Philautus refugii* differs from *P. petersi, P. mjobergi*, and *P. umbra* in size (mean size of males of these three >21 mm, of females >25 mm), and in lacking a lingual papilla. *Philautus umbra* is almost uniformly black dorsally and ventrally. Clutch size in *P. refugii* (2-3 in left ovary) resembles that in *P. longicrus* (2-4), but appears to be smaller than that of *P. mjobergi* (6-10) and *P. petersi* (17-20). The presence of the cutaneus pectoris muscle distinguishes *P. refugii* from other species groups of *Philautus* Dring (1987) reported from Borneo.

Pelophryne Barbour

Three Bornean species with expanded truncate finger tips have been recognized (Inger, 1966): *P. brevipes* (Peters), *P. guentheri* (Boulenger), and *P. macrotis* (Boulenger). Until relatively recently, these forms have been known in Borneo only from small samples from scattered localities, which has made definition of species difficult. Seven adult males of a species of *Pelophryne* were collected in the Lanjak-Entimau sanctuary. In size and body proportions, coloration, webbing, and skin texture, these specimens show little deviation,

and make possible evaluation of variation between types of several nominal taxa and among specimens from other Bornean localities.

Pelophryne guentheri (type locality Matang, Sarawak) and *P. macrotis* (type locality Akah River, Sarawak) are the largest Bornean species of this group. Adult female holotypes of those species measure 29.6 and 28.2 mm, respectively (types examined in BMNH). These types are so similar we believe they are conspecific. An additional specimen, a male from "Sarawak" matching *guentheri* in most details, measures 29.9 mm. Specimens from Mindanao, Philippine Islands (type locality of *P. brevipes*) measure 16.6-17.4 (females) and 16.8-17.8 (males); specimens from Borneo identified as *P. brevipes* by Inger (1966) measure $16.2^{1}/_{n}17.0$ (females) and 13.8-15.5 (males). The males from Bukit Lanjak are intermediate in size and, as we will show below, also differ in secondary sex characters from both the large and small species. One male from Kalimantan matches the Bukit Lanjak males in size and sex characters and we include it in the new species we describe below.

Pelophryne rhopophilius, new species
(Fig. 3)

Material examined. - Holotype: FMNH 252422 (RBS 9006), an adult male collected at Bukit Lanjak, 815 m, Lubok Antu District, Second Division, Sarawak, on 20 Feb.1994, by Robert B. Stuebing.

Paratypes: FMNH 252423-24 (RBS 9007, 9011), RBS 9001 $9008^{1}/_{n}10$, with same collection data as holotype. RMNH 14555, from Mt. Damus (1200 m), Sambas, West Kalimantan.

Diagnosis. - A species of *Pelophryne* having truncate, expanded finger tips; ventrally white (or cream) with small black spots, isolated or anastomosing, black area covering less than half of surface; no continuous light band on side of head and body; snout-vent length of adult males 21-24 mm; males with nuptial pads but no mandibular spines.

Description. - Habitus slender; head width about equal to body width. Snout truncate, with weak median projection, oblique in profile, projecting well beyond tip of lower jaw; nostril near end of snout, anterior to tip of lower jaw; canthi sharp, constricted; lores vertical, weakly concave; eye large, diameter equal to length of snout; interorbital about 1.5 times width of eyelid; tympanum superficial, slightly less than half eye diameter.

Finger tips expanded into truncate discs, disc of third finger wider than tympanum; first finger shorter than second; subarticular tubercles scarcely distinguishable; thick, fleshy web almost to end of first two fingers on lateral side, only at bases of two outer fingers. Tips of toes shaped like those of fingers, but not as wide; fifth toe longer than third; fleshy web leaving only tips of three inner toes free, fifth toe webbed to weak distal subarticular tubercle, fourth toe to middle tubercle; low inner and outer metatarsal tubercles present; no tarsal ridge.

Top of head and eyelids with round, pustulose tubercles; back with small and large, round tubercles, usually each tubercle with a cluster of small pustules and a small, central, whitish cone; area between tubercles usually with small, colorless spinules; sides and limbs with round tubercles; belly coarsely granular.

Color in preservative grayish brown above, with whitish tubercles and narrow, irregular black markings; dark markings outlining wide-limbed, X-shaped area in several frogs; sides

speckled dark gray and white; a sharp boundary between light and dark areas in one frog; limbs with dark crossbars; ventrally white. belly with dark spots, isolated or anastomosing, dark area occupying less than half total surface.

Males from Bukit Lanjak preserved with throats inflated; a non-pigmented, spinose nuptial pad on dorsal and medial surfaces of first finger; no spines under mandible.

SVL of adult males 21.7-23.8 mm (mean±SE 22.88±0.23, n=9); T/SVL 0.43-0.47 (median 0.460, n=7); HW/SVL 0.27-0.32 (median 0.294, n=8).

Measurements (mm) of holotype: SVL 23.3, T 10.7, HW 6.2, diameter of eye 2.8, diameter of tympanum 1.1, disc of third finger 1.4.

Etymology. - Specific name from *rhops* (Greek), meaning bush, and *philios* (Greek), meaning loving, referring to the leafy shrubs in which the type series was found.

Comparisons. - *Pelophryne rhopophilius* is smaller than *P. guentheri* (Boulenger) and *P. macrotis* (Boulenger) but is much larger than *P. brevipes* (Peters) (see above). The new species also differs from *P. brevipes* in lacking mandibular spines (present in *brevipes*), in having nuptial pads (absent in *brevipes*), and in lacking a continuous light band from beneath the eye to behind the arm. The single male of *P. guentheri* seen has both mandibular spines and nuptial pads. Two other species of *Pelophryne* from Borneo, *misera* (Mocquard) and *api* Dring, lack expanded finger tips and are smaller than *P. rhopophilius*; males of misera measure 16-22 mm and those of *api* 17.8-22.3 mm. Males of both these species have mandibular spines. The illustrations are the work of Tan Fui Lian.

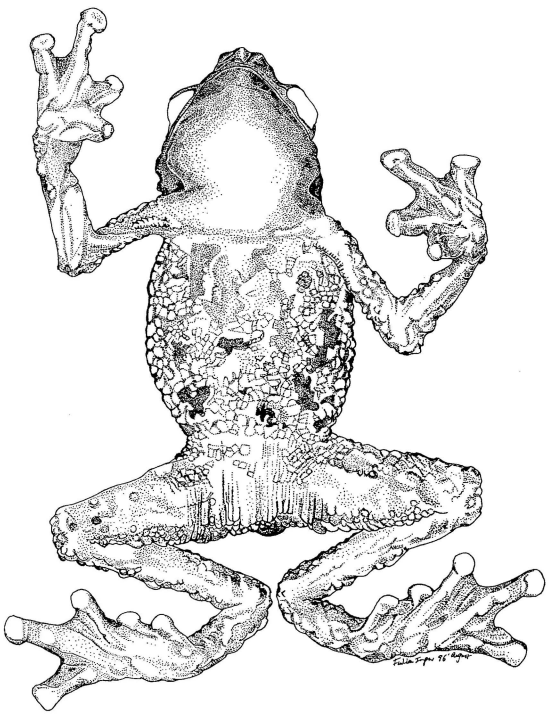

Fig. 3. Ventral view of *Pelophryne rhopophilius*, new species. Scale bar = 5 mm.

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