

# Taxonomic status of the population of *Rhacophorus angulirostris* AHL, 1927 (Anura: Rhacophoridae) from Sumatera Barat (West Sumatra) and its description as a new species

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**Abstract.** The taxonomic status of the population of *Rhacophorus angulirostris* from West Sumatra is reassessed. This record was based on five specimens that had been collected in Padang, West Sumatra, more than a century ago, are stored in the collection of the Naturhistorisches Museum Wien, Austria, and were assigned to *R. angulirostris* from Borneo by INGER (1966). Reexamination revealed that the specimens from Sumatra share only few diagnostic characters with *R. angulirostris* from Borneo. Bornean and Sumatran specimens differ in the presence of a dermal projection at the tibio-tarsal articulation, male body size, snout shape, shape of the canthus rostralis and the supratympanic fold, extent of webbing between the fingers, size of the thenar tubercle, position of the nostrils, internarial distance, the eye-to-nostril distance, size of eye and tympanum, and size and position of the dentigerous processes of the vomers. The specimens from Padang were compared to all other Southeast Asian members of the genus and found to represent a distinct species, herein described as new, that appears to be not even closely related to *R. angulirostris*. Because the only record of *R. angulirostris* from Sumatra was based on these specimens, the geographic distribution of *R. angulirostris* is again restricted to northeastern Borneo. An identification key for the *Rhacophorus* species from Sumatra is provided.

Key words. Amphibia, *Rhacophorus pseudacutirostris* sp. n., identification key, Indonesia, Borneo, endemism.

## Introduction

Species of the genus *Rhacophorus* KUHL & VAN HASSELT, 1822 are distributed from India to China and southern Japan and southeastwards to the Greater Sunda Islands and the Philippines. The genus currently contains 82 species (FROST 2011, CHAN & GRISMER 2010).

Fourteen species of *Rhacophorus* have been reported from Sumatra: *R. achantharrhena* HARVEY, PEMBERTON & SMITH, 2002; *R. angulirostris* AHL, 1927; *R. appendiculatus* (GÜNTHER, 1858); *R. barisani* HARVEY, PEMBERTON & SMITH, 2002; *R. bifasciatus* VAN KAMPEN, 1923; *R. catamitus* HARVEY, PEMBERTON & SMITH, 2002; *R. cyanopunctatus* MANTHEY & STEIOF, 1998; *R. margaritifera* (SCHLEGEL, 1837); *R. modestus* BOULENGER, 1920; *R. nigropalmatus* BOULENGER, 1895; *R. pardalis* GÜNTHER, 1858; *R. poecilonotus* BOULENGER, 1920; *R. prominans* SMITH, 1924; and *R. reinwardtii* (SCHLEGEL, 1840). Recently, *R. norhayatiae* CHAN & GRISMER, 2010 has been described from southern Thailand and Peninsular Malaysia. The species was provisionally included in the herpetofauna of Sumatra by CHAN & GRISMER (2010) for closely matching the description of “*Rhacophorus reinwardti* var. *lateralis*” which had been described by WERNER (1900) from Laut Tador, Batu Bahra, Sumatra, and formerly been considered a synonym of *R. reinwardtii*. It is currently unclear, to which species the Sumatran population belongs that has been referred to as *R. reinwardtii* or if even both species occur on Sumatra.

Therefore, both *R. reinwardtii* and *R. norhayatiae* are included in the identification key to the Sumatran species of *Rhacophorus* provided below.

*Rhacophorus angulirostris* was originally described as “*Rhacophorus acutirostris*” by MOCQUARD (1890) from “Kina Balu” [= Gunung Kinabalu, Sabah, Malaysia, northeastern Borneo]. Subsequently, the species, which was originally described as *Ixalus acutirostris* by PETERS (1867) and which is now in the genus *Philautus*, was transferred to the genus *Rhacophorus*, rendering *R. acutirostris* MOCQUARD, 1890 a junior homonym. Therefore, MOCQUARD’s (1890) original name was replaced with *Rhacophorus angulirostris* by AHL (1927).

*Rhacophorus angulirostris* has been recorded only once from Sumatra by INGER (1966) who referred specimens of a *Rhacophorus* species collected at Padang, West Sumatra, and deposited in the collection of the Naturhistorisches Museum Wien, Austria (NHW), to the Bornean species *R. angulirostris* (using the old name *R. acutirostris* MOCQUARD, 1890) based on the morphological characters he had studied. In the course of an ongoing study on the rhacophorids of the Sunda region, I examined the specimens of the genus *Rhacophorus* from Sumatra deposited in the collection of the NHW and noticed many morphological differences between the specimens from Padang assigned to *R. angulirostris* by INGER (1966) and specimens of *R. angulirostris* from Borneo. The former represent a species that appears to be not even closely related to *R. an-*

*gulirostris* and furthermore does not match any of the described species from Southeast Asia. Therefore, I formally describe it herein as new to science. As a consequence, the geographic distribution of *R. angulirostris* is restricted to northeastern Borneo.

### Material and methods

Type specimens are stored in the collection of the Naturhistorisches Museum Wien, Austria (NHW). I took the following measurements with a digital calliper (to the nearest 0.1 mm): snout–vent length (SVL, from tip of snout to vent); tibiofibula length (TFL, measured with both the knee and tibio-tarsal articulation flexed); knee to knee distance (KNE, distance between knees with thighs being held laterally at right angles to the body); thigh length (THL, half the knee to knee distance); tarsus + foot length (TarL; distance from tibio-tarsal articulation to tip of fourth toe); foot length (FOT, distance from proximal end of inner metatarsal tubercle to tip of fourth toe); total leg length (LEG, distance from vent to tip of fourth toe, measured with leg fully extended at a right angle to the body); length of fingers (1FL, 2FL, 3FL, 4FL, distance from proximal end of thenar tubercle to tip of first, second, third, and fourth finger, respectively); forearm + hand length (ARM, distance from elbow to tip of third finger); elbow to elbow distance (ELB, measured with upper arms held laterally at right angles to body and elbows flexed); head width (HW, distance between angles of jaw); head length (HL, distance from angle of jaw to tip of snout); horizontal eye diameter (ED); horizontal tympanum diameter (TD); upper eyelid width (EW); interorbital distance (IO, shortest distance between upper eyelids); eye to nostril distance (EN, distance between anterior margin of eye and centre of nostril); nostril to snout distance (NS, distance between centre of nostril and tip of snout); snout length (SL, distance between anterior margin of eye and tip of snout); internarial distance (NN, distance between centres of nostrils). The webbing formulae are given as proposed by MYERS & DUELLMAN (1982).

For comparisons, I examined museum specimens of several species of *Rhacophorus* (see Appendix). Museum abbreviations are as follows: The Natural History Museum (British Museum [Natural History]), London, United Kingdom (BMNH); The Field Museum (Field Museum of Natural History), Chicago, Illinois, USA (FMNH); Naturhistorisches Museum Basel, Switzerland (NHMB); Naturhistorisches Museum Wien, Austria (NHW); Naturhistorisches Museum der Burggemeinde Bern, Switzerland (NMBE); Museum und Forschungsinstitut Senckenberg, Frankfurt am Main, Germany (SMF); Sabah Parks Zoological Museum, Kinabalu Park Headquarters, Ranau District, Sabah, Malaysia (SP); Zoological Museum of the Department of Biology, Universiti Brunei Darussalam, Bandar Seri Begawan, Brunei Darussalam (UBD); Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Germany (ZMB). JMD field numbers refer to specimens in my working collection, which eventually will be deposited in the collection of the NMBE. To ensure that no available name is referable to the new species, I also examined the types of

all species that are currently regarded as synonyms of species occurring on Sumatra and/or Java, i.e., *Rhacophorus barbouri* AHL, 1923, *R. javanus* BOETTGER, 1893, *R. phyllopygus* WERNER, 1900, and *R. pulchellus* WERNER, 1900.

Additional information on characters used to compare Southeast Asian species of *Rhacophorus* and for working out the identification key to the Sumatran species was taken from: BOULENGER (1882, 1920), WERNER (1900), VAN KAMPEN (1923), AHL (1927), INGER et al. (1999), OHLER et al. (2000), ORLOV et al. (2001), HARVEY et al. (2002), INGER & ISKANDAR (2005), WILKINSON et al. (2005), MATSUI & PANHA (2006), ORLOV (2008), DEHLING & GRAFE (2008), ORLOV et al. (2008, 2010), OHLER (2009), and CHAN & GRISMER (2010). Where respective data was available, comparisons were made for males and females separately.

### *Rhacophorus pseudacutirostris* sp. n.

(Figs. 1–3)

*Rhacophorus acutirostris* (nec *Rhacophorus acutirostris* MOCQUARD, 1890, archeonym replaced by *Rhacophorus angulirostris* AHL, 1927): INGER (1966, partim).

*Rhacophorus angulirostris* (nec *Rhacophorus angulirostris* AHL, 1927): MANTHEY & GROSSMANN (1997, partim); HARVEY et al. (2002, partim); MALKMUS et al. (2002, partim); DEHLING (2008, partim); TEYNIÉ et al. (2010, partim).

Holotype: NHW 16301:5, adult male, from Padang, Sumatera Barat (West Sumatra), Indonesia, collected between 1890 and 1904 by Consul JOHANNES SCHILD.

Paratypes: NHW 16301:1, NHW 16301:3, two adult females, NHW 16301:2, 16301:4, two adult males, same data as holotype.

Diagnosis: A species of the genus *Rhacophorus*, distinguishable from its congeners by the combination of the following characters: (1) small to medium size (SVL of adult males 37.0–39.9 mm, adult females 51.8–52.3 mm); (2) snout obtusely pointed in both dorsal view and profile; (3) head wider than trunk and wider than long; (4) canthus rostralis distinct; (5) nostrils closer to tip of snout than to eye, separated from each other by distance subequal to distance between eye and nostril; (6) eyes moderately large; (7) eye diameter greater than eye-to-nostril distance; (8) interorbital distance wider than upper eyelid and greater than internarial distance; (9) tympanum diameter half the eye diameter; (10) dentigerous processes of vomers about three times as long as broad and separated from each other by distance slightly less than their length; (11) dorsal faces, ventral side of limbs, chin, throat, and chest region smooth; (12) supratympanic fold thick and conspicuous, not concealing tympanum; (13) low transverse ridge present in supraclacal region; (14) dermal flaps absent on postaxial edges of forearm and tarsus; (15) large conical tubercle present at tibio-tarsal articulation; (16) fingers webbed for about one-third of their lengths, toes for three-fourth; (17) nuptial pads absent in males.

Description of holotype: Measurements are given in Table 1. Body moderately slender, widest at temporal region, ta-

pering to groin (Fig. 1); head large (HL/SVL 0.31), wider than trunk and wider than long (HW/HL 1.16); snout longer than eye diameter (SL/ED 1.32); snout projecting beyond mandible, obtusely pointed in both dorsal view and profile (Fig. 2); canthus rostralis distinct, sharp, slightly curved in profile, concave in dorsal view; loreal region sloping, moderately concave; nostrils directed dorsolaterally, situated in low protuberances, closer to tip of snout than to eye (EN/NS 1.23), separated from each other by distance subequal to distance between eye and nostril (NN/EN 0.98); eyes directed anterolaterally, protruding, moderately large (ED/HL 0.41); pupil horizontal; eye diameter greater than eye-to-nostril distance (ED/EN 1.30); interorbital distance wider than upper eyelid (IO/EW 1.38) and greater than internarial distance (IO/NN 1.21); tympanum visible, separated from orbit by distance equal to half its diameter; tympanic diameter subequal to half eye diameter (TD/ED 0.48); tympanic annulus visible; skin not co-ossified to forehead; upper jaw with dentition; teeth on premaxillary larger than those on maxillary; choanae located far laterally, at margins of roof of mouth; dentigerous processes of vomers strongly developed, beginning at anteromedial edge of choanae, directed posteromedially, about three times as long as broad, bearing small teeth, separated from each other by distance slightly less than their lengths; tongue moderately broad, bifurcated at distal end, and free for about half its length; median lingual process absent; median subgular vocal sac present; vocal slits on both sides near base of tongue.

Dorsal surfaces, ventral side of limbs, chin, throat, and chest region smooth; abdomen coarsely granular; supratympanic fold thick and conspicuous, extending from posterior edge of upper eyelid to scapular region, not conceal-

Table 1. Morphological measurements of the type series of *Rhacophorus pseudacutirostris* sp. n. (in mm). For abbreviations, see Material and methods.

NHW	16301:5	16301:2	16301:4	16301:1	16301:3
Status	holotype	paratype	paratype	paratype	paratype
Sex	male	male	male	female	female
SVL	39.6	39.9	37.0	52.3	51.8
HW	14.1	14.9	13.6	18.6	17.8
HL	12.1	12.4	11.7	14.9	14.6
ED	5.0	4.7	4.7	6.4	5.7
TD	2.4	2.5	2.4	2.8	2.6
EW	3.3	3.4	3.1	4.5	4.2
IO	4.5	4.7	4.3	5.0	5.1
EN	3.8	3.7	3.6	4.3	4.4
NS	3.1	3.2	3.0	3.9	3.8
SL	6.6	6.6	6.3	7.9	7.5
NN	3.8	3.9	3.8	4.8	4.4
TFL	21.5	21.4	20.0	26.0	25.7
KNE	38.1	35.9	34.2	48.4	48.5
THL	19.0	18.0	17.1	24.2	24.3
TarL	29.2	28.5	25.8	37.6	37.0
FOT	17.8	17.6	16.2	23.9	24.0
LEG	65.3	63.5	60.3	83.9	83.8
1FL	6.4	6.2	6.3	8.6	9.0
2FL	8.2	8.5	8.4	11.2	11.3
3FL	13.1	12.8	12.3	17.0	17.3
4FL	11.2	11.2	10.6	14.7	14.9
ARM	20.1	19.5	19.3	27.2	27.4
ELB	25.5	27.1	24.6	36.0	36.1



Figure 1. Dorsal (left) and ventral views (right) of the male holotype of *Rhacophorus pseudacutirostris* sp. n. (NHW 16301:5). Scale bar = 5 mm.

ing tympanum; low transverse ridge in supraocular region, bearing row of small tubercles; few small tubercles in infraanal region and on ventral sides of thighs; small, indistinct white tubercles along postaxial edge of forearm; large conical tubercle at tibio-tarsal articulation.

Forelimbs moderately slender; hand longer than forearm (3FL/ARM 0.65); tips of fingers enlarged into broad oval discs, each with circummarginal groove; disc of Finger III wider than tympanum diameter; relative lengths of fingers:  $I < II < IV < III$ ; subarticular tubercles rounded, well developed, numbering one on Fingers I and II, two on Fingers III and IV; distal subarticular tubercles on Fingers III and IV much larger than proximal ones; webbing formula of the hand:  $I_{2.5-2.5}II_{2-3}III_{2.25-2.25}IV$  (Fig. 3); thenar tubercle oval, comparatively small, about one-third of base of Finger I; inner and outer palmar tubercles oval, small; narrow dermal ridge on postaxial edge of Finger IV between base of disc and outer palmar tubercle; metacarpals with several supernumerary small tubercles; nuptial pads or asperities absent.

Hindlimbs slender, moderately long (LEG/SVL 1.65); distance between knees considerably larger than between elbows (KNE/ELB 1.49); tibio-tarsal articulation reaching to tip of snout when legs are adpressed to body; tibiofibula moderately long (TFL/SVL 0.54), longer than thigh (TFL/THL 1.13); heels overlapping each other considerably when knees are flexed and thighs are held laterally at right an-

gles to the body; foot shorter than tibiofibula (FOT/TFL 0.83); relative lengths of toes:  $I < II < III < V < IV$ ; discs of toes smaller than those of fingers; subarticular tubercles numbering one on Toes I and II, two on Toes III and V, and three on Toe IV; pedal webbing formula:  $I_{1.5-1.75}II_{1-2.25}III_{1.5-2.5}IV_{2.25-1}V$  (Fig. 3); inner metatarsal tubercle oval, low and small (length 1.4 mm), no outer one; few supernumerary small tubercles on metatarsals; dermal ridge on postaxial edge of Toe V from disc to base of metatarsus.

In preservative, dorsum greyish with darker markings. Markings irregular on dorsum, as broad crosslines on dorsal faces of limbs. Ventral side of body cream-coloured, of limbs darker, more yellowish. Flanks and postaxial lateral face of thigh speckled with light, irregularly shaped blotches. Tubercles on ventral sides of thighs, along postaxial edge of forearm, and in supraanal and infraanal region whitish. Colour of iris bluish grey. No information is available regarding the colouration in life.

Variation: Measurements of the paratypes are given in Table 1. The male paratypes are very similar to the holotype in measurements and proportions. They likewise have median subgular vocal sacs and lack nuptial pads and asperities. Variation of webbing in males is summarized by  $I_{2.5-2.5}II_{2-3}III_{2.25-(2^+-2.25)}IV$  for the hand and  $I_{1.5-(1.75-2)}II_{1^+-(2.25-2.5)}III_{(1^+-1.5)}-(2.5-2.75)IV_{(2^+-2.5)-1}V$  for the foot. Females are larger than males, have slightly shorter



Figure 2. Lateral (left) and dorsal views (right) of the head of the male holotype of *Rhacophorus pseudacutirostris* sp. n. (top, NHW 16301:5) and a topotypic male *Rhacophorus angulirostris* (bottom, ZMB 61674) (not to the same scale).



Figure 3. Volar view of right hand (left) and plantar view of left foot (right) of the holotype of *Rhacophorus pseudacutirostris* sp. n. (NHW 16301:5). Scale bar = 2 mm.

heads with an HL/SVL of 0.28 (vs. 0.31–0.32), and have comparatively shorter tibiofibulae with a TFL/SVL of 0.50 (vs. 0.54 in males), TFL/THL 1.06–1.07 (vs. 1.13–1.17), and TFL/FOT 1.07–1.09 (vs. 1.21–1.24). Variation of webbing in females is summarized by  $I_{2.5-2.5}II_{1.75-3}III_{2.25-2^+}IV$  for the hand and  $I_1^+-2^+II_1^+-2^+III_1^+-2.5IV_2^+-1^+V$  for the foot.

Distribution: So far, the new species is only known from a single locality, which was given as “Padang, Sumatra” by JOHANNES SCHILD, the collector of the type series (Fig. 5). The specimens were probably not collected in the city itself but more likely in the forests in the vicinity of Padang. No further specimens have been collected or reported from Sumatra since the collection of the type series more than 100 years ago.

Etymology: The species epithet is composed of *pseud-*, the Latinized form of the Greek prefix  $\psi\epsilon\upsilon\delta-$ , meaning “false”, and the Latin words *acutus*, meaning “sharpened”, and *rostrum*, meaning “snout”; in allusion to the former confusion of the new species with *Rhacophorus acutirostris* MOCQUARD, 1890 (name replaced with *R. angulirostris* AHL, 1927) from Borneo. As common name, I suggest Sumatran Sharp-nosed Tree Frog.

Comparisons: *Rhacophorus angulirostris* and *R. penanorum* DEHLING, 2008, differ from *R. pseudacutirostris* (characters in parentheses) in the following characters: The males are smaller with an SVL of 29.9–33.2 mm in *R. angulirostris* and 33.6–34.2 mm in *R. penanorum* (vs. 37.0–39.9 mm); the tibio-tarsal articulation lacks a dermal projection (large, pointed dermal projection present at tibio-tarsal articulation); the snout is sharply pointed and projects considerably beyond the lower jaw, sloping forward from nostril than back to mouth in profile (obtusely pointed, projecting less; Fig. 2); the canthus rostralis is more pronounced; the webbing between the fingers is more developed (Fig. 4), formula being  $I_2-2II_{1,5}-(2.75-3)III_{(1.5-2)}-(1.5-2)IV$  in *R. angulirostris* and  $I_{2.75-2.75}II_{1.75-3}III_{2-(2-2)}IV$  in *R. penanorum* (vs.  $I_{2.5-2.5}II_{[1.75-2]}-3III_{2.25-[2^+-2.25]}IV$ ); the nostrils are situated about half way between eye and tip of



Figure 4. Volar view of hand of the male holotype of *Rhacophorus penanorum* (left, ZMB 70718) and a male *Rhacophorus angulirostris* sp. n. (right, SP 2913) (not to the same scale).

snout with EN/NS 0.93–1.10 in male *R. angulirostris* (Fig. 2), 0.92–0.95 in female *R. angulirostris*, and 0.94–0.99 in male *R. penanorum* (females of *R. penanorum* unknown) (vs. situated closer to the tip of snout than to eye with EN/NS 1.17–1.23 in males [Fig. 2] and 1.10–1.15 in females); the interorbital distance is relatively larger with NN/EN 1.50–1.62 in *R. angulirostris* and 1.39–1.43 in *R. penanorum* (vs. 0.98–1.06 in males, 1.01–1.11 in females); the eye-to-nostril distance is relatively smaller in relation to the eye diameter with ED/EN 0.50–0.60 in male *R. angulirostris* and 0.56–0.61 in male *R. penanorum* (vs. 0.76–0.79; Fig. 2); the eye is relatively larger with ED/HL 0.44–0.48 in male *R. angulirostris* and 0.45–0.49 in male *R. penanorum* (vs. 0.38–0.41; Fig. 2); the tympanum is relatively smaller with TD/ED 0.32–0.37 in male *R. angulirostris* and 0.32–0.34 in *R. penanorum* (vs. 0.48–0.55 in males; Fig. 2); the supratympanic fold conceals the tympanum for one-fifth on the upper edge (not concealing tympanum; Fig. 2); the dentigerous processes of the vomers are shorter and separated from each other by a distance equal to twice their length in *R. angulirostris* and four-thirds their length in *R. penanorum* (processes longer, separated by distance equal to less than the length of an individual process); the thenar tubercle is much larger, being almost the size of the base of Finger I (Fig. 4; vs. smaller, about one-third of base of Finger I, Fig. 3). Additionally, *R. angulirostris* differs by a relatively smaller interorbital distance in males with IO/EW 1.03–1.12 (vs. 1.35–1.38) and a relatively larger such distance in females with IO/EW 1.78–1.85 (vs. 1.12–1.23). *R. penanorum* has a slightly shorter tibia with TFL/SVL 0.50–0.53 in males (vs. 0.54) and a slightly wider head with HW/HL 1.22–1.23 (vs. 1.16–1.20).

In the following congeners the webbing reaches the disc on the postaxial side of the third finger (f), on preaxial and postaxial sides of the fourth toe (t) or both (f & t), and these species are thus readily distinguished from *Rhacophorus pseudacutirostris* (webbing reaching at most to proximal edge of distal subarticular tubercle on postaxial side of third finger, preaxial side of fourth finger, and preaxial and postaxial sides of the fourth toe); *Rhacophorus annamensis* SMITH, 1924 (f & t); *R. dennysi* BLANFORD,

1881 (t); *R. dultensis* BOULENGER, 1892 (t); *R. exechopygus* INGER, ORLOV & DAREVSKY, 1999 (f & t); *R. fasciatus* BOULENGER, 1895 (f & t); *R. feae* BOULENGER, 1893 (f & t); *R. georgii* ROUX, 1904 (f & t); *R. harrissoni* INGER & HAILE, 1959 (f & t); *R. jarujini* MATSUI & PANHA, 2006 (t); *R. kio* OHLER & DELORME, 2006 (f & t); *R. maximus* GÜNTHER, 1858 (f & t); *R. nigropalmatus* (f & t); *R. norhayatiae* (f & t); *R. pardalis* (including its synonym *R. pulchellus*; f & t); *R. poecilnotus* (t); *R. prominanus* (t); *R. reinwardtii* (f & t); *R. rhodopus* LIU & HU, 1960 (f & t); *R. robinsonii* BOULENGER, 1903 (f & t); *R. rufipes* (f & t).

Webbing between the fingers is confined to the bases in *R. dugritei* (DAVID, 1872), *R. everetti* BOULENGER, 1894, *R. hungfuensis* LIU & HU, 1961, and *R. kajau* DRING, 1983.

The following Southeast Asian species differ from the new species in having conspicuous dermal flaps or fringes along the postaxial edge of the forearm (F), the tarsus (T), or both (F & T): *Rhacophorus achantharrhena* (F & T); *R. appendiculatus* (including *R. phyllopygus*; F & T); *R. baluensis* INGER, 1954 (F & T); *R. barisani* (F & T); *R. bifasciatus* (F & T); *R. bipunctatus* AHL, 1927 (F & T); *R. calcaneus* SMITH, 1924 (T); *Rhacophorus chuyangsinensis* ORLOV, NGUYEN & HO, 2008 (F & T); *R. edentulus* MÜLLER, 1894 (F & T); *R. hoanglienensis* ORLOV, LATHROP, MURPHY & HO, 2001 (F); *R. margaritifera* (including *R. javanus* and *R. barbouri*; F & T); *R. monticola* BOULENGER, 1896 (F & T); *R. turpes* SMITH, 1940 (F & T).

The remaining Southeast Asian *Rhacophorus* species differ in the following characters from the new species (characters given in parentheses). *Rhacophorus belalongensis* DEHLING & GRAFE, 2008, *R. bimaculatus* (PETERS, 1867), *R. gadingensis* DAS & HAAS, 2005, and *R. gauni* (INGER, 1966) are somewhat smaller species (SVL of males <31 mm, of females <39 mm); have a more or less rounded, obtuse snout (pointed); and have more extensive webbing between toes and fingers. *Rhacophorus cyanopunctatus* and *R. orlovi* ZIEGLER & KÖHLER, 2001 have more extensively webbed fingers and toes, formulae being I2.5–2.5II1.5–2.5III2–1.5IV and I2–2.5II1–2III1.5–1.5IV, respectively, for the hand (versus I2.5–2.5II(1.75–2)–3III2.25–(2+–2.25)IV) and I1–1.5II1–(1.5–2)III1–2IV1.5–1V and I1–1.5II1–1.5III1–2IV1.5–1V, respectively, for the foot (vs. I(1+–1.5)–(1.75–2)II1+–(2+–2.5)III(1+–1.5)–(2.5–2.75)IV(2+–2.5)–1+V for males and females combined); and lack a pointed projection at the tibio-tarsal articulation (present). In addition, *R. cyanopunctatus* lacks vomerine processes and teeth (present) and is smaller with SVL of males to 35 mm, of females to 43 mm (vs. 37.0–39.9 mm and 51.8–52.3 mm, respectively). *Rhacophorus catamitus* is smaller with SVL of adult males 31.0–35.2 mm (vs. 37.0–39.9 mm); has a more rounded, subacuminate snout (pointed); a small, low, swollen rostral tubercle at the tip of the snout (absent); nuptial excrescences on the preaxial and dorsal surfaces of Finger I in males (absent); less developed webbing between fingers and toes, the formulae being I3–3II(2+–2.5)–3.5III2.75–(2+–2.75)IV and I1.75–(2+–2.5)II(1.25–1.75)–(2.75–3)III(1.5–1.75)–(2.5–3.25)IV(2.25–2.75)–(1.25–1.75)V, respectively (vs. I2.5–2.5II2–3III2.25–(2+–2.25)IV and I1.5–(1.75–2)II1+–(2.25–2.5)III(1+–1.5)–(2.5–2.75)IV(2+–2.5)–1+V, respectively); the supratympanic fold concealing the tympanum and its annulus (not overlapping); a wider upper eyelid with EW/IO 0.80–1.03 in males (vs. 0.72–0.74); a relatively larger inner metatarsal

tubercle; a low crenulated fold along the postaxial edge of the tarsus (absent); and smaller, shorter dentigerous processes which are only slightly longer than broad (three times as long as broad) and separated from each other by a distance equal to three times their length (separated by distance slightly less than their length). *Rhacophorus dorsoviridis* BOURRET, 1937 has shorter legs with TFL/SVL 0.40–0.42 (0.50–0.54) and the tibio-tarsal articulation extending only to the posterior margin of the eye (extending to tip of snout); a rounded snout (pointed); and lacks a pointed projection at the tibio-tarsal articulation (present). *Rhacophorus duboisi* OHLER, MARQUIS, SWAN & GROSJEAN, 2000 is considerably larger with SVL of the male holotype 61.5 mm (vs. 37.0–39.9 mm); has shorter legs with TFL/SVL 0.50 (vs. 0.54); the nares closer to the eye than to tip of snout with EN/NS 0.88 (closer to tip of snout, EN/NS 1.10–1.22); more extensively webbed fingers and toes, formulae being I2–2.5II1–2.75III2–1IV and I1–III1–III1–2IV2–1V, respectively (vs. I2.5–2.5II2–3III2.25–(2+–2.25)IV and I1.5–(1.75–2)II1+–(2.25–2.5)III(1+–1.5)–(2.5–2.75)IV(2+–2.5)–1+V, respectively, in males); and lacks a pointed projection at the tibio-tarsal articulation (present). *Rhacophorus marmoridorsum* ORLOV, 2008 has a rounded snout (pointed); is larger with SVL of adult males 49.6–50.0 mm (vs. 37.0–39.9 mm); and has nuptial pads in males (absent). *Rhacophorus modestus* has a rounded snout (pointed) which is as long as the orbit (considerably longer than orbit); has the flanks darker than back (flanks as light as back); and lacks a pointed projection at the tibio-tarsal articulation (present). *Rhacophorus omeimontis* STEJNEGER, 1924 is larger with SVL of males 59–67.2 mm (vs. 37.0–39.9 mm) and of females up to 73.6 mm (vs. 51.8–52.3); has a rounded snout (pointed); a larger tympanum with TD/ED 0.70 in males (vs. 0.54) and 0.83 in females (vs. 0.44–0.46); and lacks a pointed projection at the tibio-tarsal articulation (present). *Rhacophorus spelaeus* ORLOV, GNOPHANXAY, PHIMMINITH & PHOMPHOUMY, 2010 has a rounded snout (pointed); a relatively longer head with HL/SVL 0.37–0.38 (vs. 0.31–0.32) and HL/HW 0.96–1.04 (vs. 0.83–0.86); a larger tympanum with TD/ED 0.75–0.83 (vs. 0.48–0.55); a relatively wider upper eyelid with EW/IO 0.84–0.94 (vs. 0.72–0.74); nuptial pads (absent); more extensively webbed fingers and toes with formulae being I2–2II1.5–2.5III2–1.5IV and I1–2II1–1.5III2–1IV1.5–1.5V, respectively, in males (vs. I2.5–2.5II2–3III2.25–(2+–2.25)IV and I1.5–(1.75–2)II1+–(2.25–2.5)III(1+–1.5)–(2.5–2.75)IV(2+–2.5)–1+V, respectively); and the dentigerous processes of the vomers directed transversally (posteriomedially).

## Discussion

The five type specimens of *Rhacophorus pseudacutirostris* were collected by J. SCHILD more than 100 years ago and deposited in the collections of the NHW. They remained unreported and probably unidentified until INGER (1966) mentioned them for the first time and assigned them to the Bornean species *Rhacophorus angulirostris* (using the old name *R. acutirostris*). He did not describe the specimens from Padang explicitly but stated “the Sumatran frogs are identical to the Bornean ones in the characters studied.” He did not specify, however, which characters exactly he had studied in the Sumatran frogs. There are a number

of characters that show little or no intraspecific variation (but sometimes are sexually dimorphic) and are therefore well suited to distinguish species of the genus *Rhacophorus*, including the presence/absence of dermal flaps or appendages on the limbs, snout shape, extent of webbing, and others more. *Rhacophorus pseudacutirostris* and *R. angulirostris* in fact do share some of these characters. They both lack dermal flaps or fringes on the postaxial edges of forearm and tarsus, have a smooth dorsal skin, and a similar extent of foot webbing. These characters, however, are also shared by a number of other species. Two characters, male body size and the pointed snout, are similar in the two species, but show constant differences on closer examination. On the other hand, *R. pseudacutirostris* differs from *R. angulirostris* in a number of diagnostic characters, among them some that were already used by WOLF (1936) (who considered *R. angulirostris* one of many subspecies of a wide-ranging *R. schlegelii*) to differentiate *R. angulirostris* from other subspecies of *R. schlegelii* (which were later re-elevated to species rank), i.e., the presence of dermal appendages on the heel and the size and relative position of vomerine odontophores. These characters were also mentioned by INGER (1966) in his description of *R. angulirostris*. Therefore, it is unclear why INGER (1966) chose to assign the Padang specimens to *R. angulirostris*. *Rhacophorus pseudacutirostris* differs in a number of other diagnostic characters from *R. angulirostris* (see above). In fact, *R. angulirostris* has more diagnostic characters in common with its sister species *R. penanorum* and also with some other congeners like *R. rufipes* and *R. cyanopunctatus*, all of which have a sharply pointed snout and lack dermal appendages on the heel, by which characters they differ from *R. pseudacutirostris*.

Furthermore, the distribution range of the Sumatran endemic *R. pseudacutirostris*, which is known only from Padang, is widely separated from those of the Bornean endemics *R. angulirostris* and *R. penanorum*, the former of

which has been recorded so far from Gunung Kinabalu, Gunung Trusmadi and the Crocker Range in Sabah and the latter is known only from Gunung Mulu in Sarawak (DEHLING 2008, DEHLING et al. 2010; Fig. 5).

To validate that no available name is referable to the population from Padang, West Sumatra, I examined the types of all species that are currently regarded as synonyms of *Rhacophorus* species occurring on Sumatra and/or Java. In the process, I was able to confirm the status as synonyms of *R. barbouri* (type locality: West Java; junior synonym of *R. margaritifera*), *R. javanus* (type locality: Vulkan Tjisurupan, West Java; junior synonym of *R. margaritifera*), *R. phyllopygus* (type locality: Indragiri, Sumatra; junior synonym of *R. appendiculatus*), and *R. pulchellus* (type locality: Djapura, Indragiri, Sumatra; junior synonym of *R. pardalis*). All these taxa are clearly distinguishable from *R. pseudacutirostris* (see above). I furthermore examined the type of *Rhacophorus depressus* AHL, 1927, a species originally described from West Java and currently regarded as “incertae sedis” by FROST (2011). The type of this species is a male measuring 45.0 mm in SVL. Its toes are completely webbed, but there is no webbing between the fingers. The tips of fingers and toes are enlarged into broad discs. Contrary to character states observed in species of the genus *Rhacophorus*, metatarsal tubercles are absent, and the dorsal face of Finger I bears a nuptial pad covered with many large spines. This species is probably not at all a member of the Rhacophoridae but more likely belongs to the Hylidae, possibly *Litoria*. Because members of the hylid family do not occur autochthonally on Java, the type specimen might not even originate from this island.

Although the description of *R. pseudacutirostris* presented here is based on five specimens only and bioacoustic and molecular data are unfortunately lacking, detailed morphological comparisons revealed that the available specimens exhibit a unique combination of characters that distinguish the species from all other known Southeast

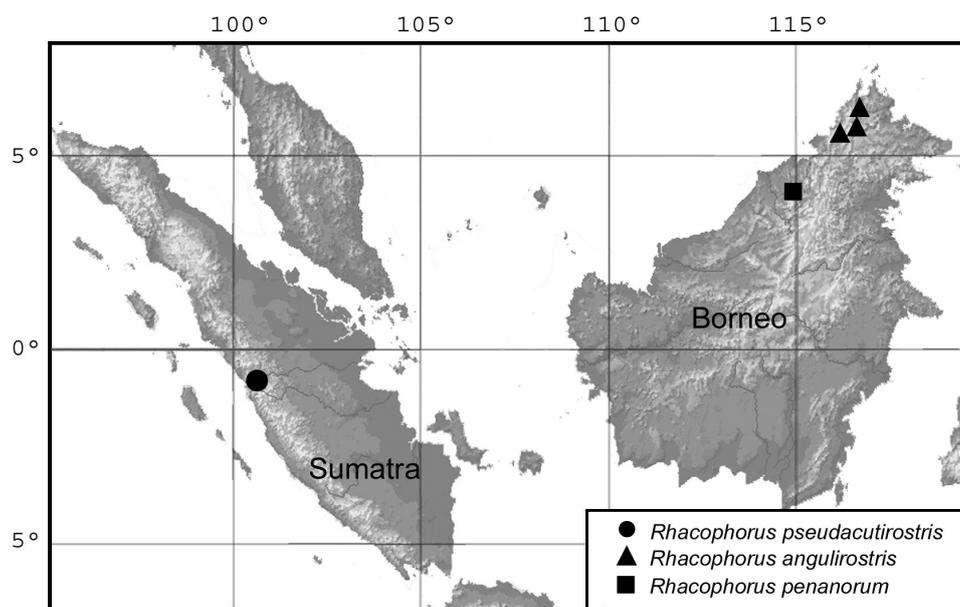


Figure 5. Point locality distribution map of *Rhacophorus pseudacutirostris* sp. n., *R. angulirostris*, and *R. penanorum*.

Asian members of the genus. Therefore, it seems justified to regard the population from Padang as a distinct evolutionary lineage, now named *Rhacophorus pseudacutirostris*.

**Key to the Sumatran species of *Rhacophorus***

- 1 Fingers II–IV and all toes webbed to the base of the disc ..... **2**
- 1\* Fingers II–IV and toes not or not entirely webbed to the disc ..... **5**
- 2 Finger I webbed to the disc, webbing black proximally, yellow distally ..... ***R. nigropalmatus***
- 2\* Finger I not webbed to disc, colour of webbing different ..... **3**
- 3 Dorsum green, webbing black with blue markings ..... **4**
- 3\* Dorsum brown, grey, or reddish, never green, webbing red ..... ***R. pardalis***
- 4 Dorsum with small, black spots; lateral faces of thigh and tibia yellow ..... ***R. reinwardtii***
- 4\* Dorsum without black spots; lateral faces of thigh and tibia black with blue markings ..... ***R. norhayatae***
- 5 Dermal flaps along the postaxial edges of forearm and tarsus ..... **6**
- 5\* Dermal flaps absent ..... **12**
- 6 Dorsum green in life; webbing between Toes III–V red ..... **7**
- 6\* Dorsum not green; webbing between Toes III–V not red ..... **8**
- 7 Toes fully webbed; SVL of males > 50 mm; snout pointed ..... ***R. prominanus***
- 7\* Toes not fully webbed; SVL of males 40–47 mm; snout acuminate ..... ***R. achantharrhena***
- 8 SVL of adult males < 38 mm ..... **9**
- 8\* SVL of adult males > 40 mm ..... **10**
- 9 Dorsum tuberculate; broad, wavy skin flaps along forearm; webbing reaching to distal subarticular tubercles on Finger IV and Toe IV ..... ***R. appendiculatus***
- 9\* Dorsum shagreened; skin flap along forearm weakly expressed or reduced to a line of tubercles; webbing not reaching distal subarticular tubercles ..... ***R. catamitus*** (partim)
- 10 Snout sharply pointed ..... ***R. barisani***
- 10\* Snout rounded or acuminate ..... **11**
- 11 Tibio-tarsal articulation extending beyond tip of snout when the leg is adpressed forward ..... ***R. margaritifera***
- 11\* Tibio-tarsal articulation reaching a point between eye and tip of snout when the leg is adpressed forward ..... ***R. bifasciatus***

- 12 Snout pointed ..... **13**
- 12\* Snout rounded or subacuminate ..... **14**
- 13 Webbing on Finger III does not reach distal subarticular tubercle; dermal projection present at tibio-tarsal articulation; SVL of females > 50 mm ..... ***R. pseudacutirostris***
- 13\* Finger III webbed beyond distal subarticular tubercle; dermal projection at tibio-tarsal articulation absent; SVL of females < 45 mm ..... ***R. cyanopunctatus***
- 14 SVL of adult males > 40 mm ..... **15**
- 14\* SVL of adult males < 38 mm ..... ***R. catamitus*** (partim)
- 15 Toes fully webbed; dermal calcar at tibio-tarsal articulation present ..... ***R. poecilnotus***
- 15\* Toes not fully webbed; dermal calcar absent ..... ***R. modestus***

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**References**

- AHL, E. (1927): Zur Systematik der asiatischen Arten der Froschgattung *Rhacophorus*. – Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin, **1927**: 35–47.
- BOETTGER, O. (1893): Neue Reptilien und Batrachier aus West-Java. – Zoologischer Anzeiger, **16**(427): 334–340.
- BOULENGER, G. A. (1882): Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum. Second Edition. – Taylor and Francis, London. xvi + 503 pp., 30 plates.
- BOULENGER, G. A. (1920): Reptiles and batrachians collected in Korinchi, West Sumatra, by Messrs. H. C. Robinson and C. Boden Kloss. – Journal of the Federated Malay States Museums, **8**: 285–296.
- CHAN K. O. & L. L. GRISMER (2010): Re-assessment of the Reinwardt’s Gliding Frog, *Rhacophorus reinwardtii* (Schlegel 1840) (Anura: Rhacophoridae) in southern Thailand and Peninsular Malaysia and its re-description as a new species. – Zootaxa, **2505**: 40–50.

- DEHLING, J. M. (2008): A new treefrog (Anura: Rhacophoridae: *Rhacophorus*) from Gunung Mulu, Borneo. – *Salamandra*, **44**: 193–205.
- DEHLING, J. M. & T. U. GRAFE (2008): A new treefrog of the genus *Rhacophorus* (Anura: Rhacophoridae) from Brunei Darussalam (Borneo). – *Salamandra*, **44**: 101–112.
- DEHLING, J. M., P. YAMBUN & M. B. LAKIM (2010): Advertisement calls of *Rhacophorus angulirostris* Ahl, 1927 and *Rhacophorus everetti macroscelis* Boulenger, 1896 from Gunung Kinabalu, Sabah, East Malaysia (Borneo). – *Herpetozoa*, **23**: 51–57.
- FROST, D. R. (2011): Amphibian species of the world: an online reference. Version 5.5 (31 January 2011). – American Museum of Natural History, New York, USA. Electronic database accessible at <http://research.amnh.org/herpetology/amphibia/index.php> (01.03.2011).
- HARVEY, M. B., A. J. PEMBERTON & E. N. SMITH (2002): New and poorly known parachuting frogs (Rhacophoridae: *Rhacophorus*) from Sumatra and Java. – *Herpetological Monographs*, **16**: 46–92.
- INGER, R. F. (1966): The systematics and zoogeography of the Amphibia of Borneo. – *Fieldiana: Zoology*, **52**: 1–402.
- INGER, R. F. & D. T. ISKANDAR (2005): A collection of amphibians from West Sumatra, with description of a new species of *Megophrys* (Amphibia: Anura). – *The Raffles Bulletin of Zoology*, **53**: 133–142.
- INGER, R. F., N. ORLOV & I. DAREVSKY (1999): Frogs of Vietnam: a report on new collections. – *Fieldiana: Zoology, New Series*, **92**: iii–iv + 1–46.
- MALKMUS, R., U. MANTHEY, G. VOGEL, P. HOFFMANN & J. KOSUCH (2002): Amphibians & Reptiles of Mount Kinabalu (North Borneo). – Koeltz Scientific Books, Königstein, 424 pp.
- MANTHEY, U. & W. GROSSMANN (1997): Amphibien & Reptilien Südostasiens. – Natur und Tier - Verlag, Münster, 512 pp.
- MATSUI, M. & S. PANHA (2006): A new species of *Rhacophorus* from eastern Thailand (Anura: Rhacophoridae). – *Zoological Science*, **23**: 477–481.
- MOCQUARD, M. F. (1890): Recherches sur la faune herpétologique des îles de Bornéo et de Palawan. – *Nouvelles archives du Muséum d'Histoire Naturelle, Série 3*, **2**: 115–168.
- MYERS, C. W. & W. E. DUELLMAN (1982): A new species of *Hyla* from Cerro Colorado, and other treefrog records and geographical notes from western Panama. – *American Museum Novitates*, **2752**: 1–32.
- OHLER, A. (2009): *Rhacophorus burmanus* (Andersson, 1939) – the valid nomen for *Rhacophorus taronensis* Smith, 1940 and *Rhacophorus gongshanensis* Yang & Su, 1984. – *Herpetozoa*, **21**: 179–182.
- OHLER, A., O. MARQUIS, S. SWAN & S. GROSJEAN (2000): Amphibian biodiversity of Hoang Lien Nature Reserve (Lao Cai Province, northern Vietnam) with description of two new species. – *Herpetozoa*, **13**: 71–87.
- ORLOV, N. L. (2008): Description of a new species of *Rhacophorus* genus (Amphibia: Anura: Rhacophoridae) from Kon Cha Rang Area (Gia Lai Province, Vietnam). – *Russian Journal of Herpetology*, **15**: 133–140.
- ORLOV, N. L., S. GNOPHAXAY, T. PHIMMINITH & K. PHOMPHOU- MY (2010 “2009”): A new species of *Rhacophorus* genus (Amphibia: Anura: Rhacophoridae: Rhacophorinae) from Khammouan Province, Lao PDR. – *Russian Journal of Herpetology*, **16**: 295–303.
- ORLOV, N. L., A. LATHROP, R. W. MURPHY & HO T. C. (2001): Frogs of the family Rhacophoridae (Anura: Amphibia) in the northern Hoang Lien Mountains (Mount Fan Si Pan, Sa Pa District, Lao Cai Province), Vietnam. – *Russian Journal of Herpetology*, **8**: 17–44.
- ORLOV, N. L., N. S. NGUYEN & HO T. C. (2008): Description of a new species and new records of *Rhacophorus* genus (Amphibia: Anura: Rhacophoridae) with the review of amphibians and reptiles diversity of Ghu Yang Sin National Park (Dac Lac Province, Vietnam). – *Russian Journal of Herpetology*, **15**: 67–84.
- PETERS, W. (1867): Herpetologische Notizen. – Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin. Aus dem Jahre 1867: 13–37.
- TEYNIÉ, A., P. DAVID & A. OHLER (2010): Note on a collection of amphibians and reptiles from western Sumatra (Indonesia), with the description of a new species of the genus *Bufo*. – *Zootaxa*, **2416**: 1–43.
- VAN KAMPEN, P. N. (1923): The Amphibia of the Indo-Australian Archipelago. – E. J. Brill Ltd., Leiden, xii + 304 pp.
- WERNER, F. (1900): Reptilien und Batrachier aus Sumatra, gesammelt von Herrn Gustav Schneider jr. im Jahre 1897–98. – *Zoologische Jahrbücher. Abteilung für Systematik, Geographie und Biologie der Tiere*, **13**: 479–508, plates 31–35.
- WOLF, S. (1936) Revision der Untergattung *Rhacophorus* (ausschließlich der Madagaskar-Formen). – *The Bulletin of the Raffles Museum*, **12**: 137–217.
- WILKINSON, J. A., T. THIN, K. S. LWIN & A. K. SHEIN (2005): A new species of *Rhacophorus* (Anura: Rhacophoridae) from Myanmar (Burma). – *Proceedings of the California Academy of Science*, **56**: 42–52.

## Appendix

### Comparative material examined

*Rhacophorus angulirostris* – MALAYSIA: Sabah: Gunung Trusmadi (SP 2859, 2869, 2884, 2896, 2904, 2913); Sungai Silau-Silau, Headquarters, Kinabalu National Park (ZMB 49022, 61674, 70073).

*Rhacophorus appendiculatus* – INDONESIA: Indragiri, Sumatra (NHMB 1187 [holotype of *Rhacophorus phyllopygus* Werner, 1900]). MALAYSIA: Sabah: Taman Bukit Tawau, Tawau District (SP 1098–1101, 2355, 26064); Linumunsut Lake, Maliau, (SP 2817); Lower Segama, Lahad Datu District (SP 20370–20372, 20374, 20375). Sarawak: Gunung Mulu National Park, Miri Division (NMBE 1056474–1056479). PHILLIPINES: Culion, Calamian Group (SMF 6984); Northeast Mindanao (SMF 6985, 6986); no locality (ZMB 5464, 70071).

*Rhacophorus baluensis* – MALAYSIA: Sabah: Headquarters, Taman Kinabalu, Ranau District (SP 24, 1291); Restaurant Bayu, near Kinabalu Park, Ranau District (SP 2802).

*Rhacophorus belalongensis* – BRUNEI DARUSSALAM: Kuala Belalong Field Studies Centre, Temburong District (ZMB 70377 [holotype], 70378, 70379 [paratypes]; UBD GK 06-22, 06-23, 06-24, 06-25, 06-26, 06-57, G07-1, 07-2, 07-3, 07-4, 07-5, 07-6, 07-7, 07-8, 07-9 [paratypes]).

*Rhacophorus* cf. *bipunctatus* – INDIA: “Travancore”, Kerala State (ZMB 10131). MYANMAR: “Birma” (ZMB 11575, 70072).

*Rhacophorus bimaculatus* – PHILLIPINES: Agusan River, Mindanao (ZMB 5681 [syntype]); Dapitan, Mindanao (SMF 7053).

*Rhacophorus cyanopunctatus* – BRUNEI DARUSSALAM: Kuala Belalong Field Studies Centre, Temburong District (UBD GK06-13). MALAYSIA: Sabah: East Coast Residency, Kinabatangan District (FMNH 77158); Sungai Tawau, Tawau Hills Park, Tawau District (FMNH 250942). Sarawak: Gunung Mulu National Park, Miri Division (NMBE 1056480; ZMB 70707–70709); Nanga Tekalit Camp, Kapit Division (FMNH 136316, 137990–137992, 139347, 146199, 221749, 221750); Labang camp on Sungei Seran, Bintulu Division (FMNH 147892, 147898); Tubau camp on Sungei Pesu, Bintulu Division (FMNH 157308, 157309, 157312, 157313, 157319, 157321–157323). SINGAPORE: no locality (FMNH 100964). THAILAND: Khao Sok National Park, Surat Thani (ZMB 57895 [holotype]).

*Rhacophorus dennysi* – CHINA: Northern Guangdong Province (ZMB 27715); “Gao-fung Provinz”, Kuangtung [= Guangdong Province] (ZMB 39303); “Pingshiang”, Jiangxi Province (ZMB 28683); no locality (ZMB 24117, 54915, 66196–66202).

“*Rhacophorus depressus* – INDONESIA: West Java (ZMB 11535 [holotype]).

*Rhacophorus dugritei* – CHINA: Batang, Sichuan Province (ZMB 27878, 27879, 54916–54928 [syntypes of *Rhacophorus pleurostictus batangensis* Vogt, 1924]).

*Rhacophorus dulitensis* – BRUNEI DARUSSALAM: Batu Apoi, Temburong District (UBD 550). MALAYSIA: Sabah: Marak Parak, Kota Merudu District (SP 634–636, 842–844); Hutan Simpan, Mandamui, Pitas Kudat (SP 1165–1168, 20377); Taman Bukit-bukit Tawau, Tawau District (SP 637, 1264). Sarawak: Gunung Mulu National Park, Miri Division (NMBE 1056481–1056485).

*Rhacophorus edentulus* – INDONESIA: Northern Sulawesi (ZMB 34323).

*Rhacophorus everetti* – MALAYSIA: Sabah: Marai Parai (SP 362, 1123); Sayap, Kota Belud District (SP 1202, 1203, 1773, 1865, 2185); Headquarters, Kinabalu Park, Ranau District (SP 2700, 2701, 20020, 20322, 20325, 20327, 20362, 21412, 21451, 21452); Trusmadi (SP 2891, 2901). Sarawak: Gunung Mulu National Park, Miri Division (NMBE 1056486–1056491).

*Rhacophorus fasciatus* – MALAYSIA: Sarawak: Akar River (BMNH 95.7.2.22–23 = 1947.2.8.92–93 [syntypes]); Gunung Mulu National Park, Miri Division (NMBE 1056492, 1056525; ZMB 70710); Mount Penrissen (BMNH 99.12.8.9 = 1947.2.8.90 [holotype of *Rhacophorus shelfordi* Boulenger, 1900]).

*Rhacophorus gadingensis* – MALAYSIA: Sarawak: Gunung Gading National Park, Lundu Division (JMD 494); Kubah National Park (JMD 342–348).

*Rhacophorus gauni* – MALAYSIA: Sabah: Sungai Kilampun, Purulon Camp, Crocker Range National Park (FMNH 239235; SP 2172, 2176); Mendolong Camp, Sipitang District (FMNH 235045, 239236, 239240, 242922, 242923, 242941, 242926; SP 2178, 2179); Poring Station, Mt. Kinabalu Park, Ranau District (FMNH 248308; SP 1257, 1805); Tawau Hills Park, Tawau District (FMNH 248924, 248925, 249833–249836; SP 645, 646, 1072); Marak Parak, Kota

Marudu District (FMNH 235747); Rangkam Kimanis, Pantod Besar, Tambunan District (FMNH 239233); Danum Valley Field Centre, Lahad Datu District (FMNH 231062, 231069, 231071, 231073, 231075, 234990, 234994, 241081, 241083, 241085, 241086, 241090, 245890, 245892, 245894, 245904, 245905, 245909, 245910, 245913, 245915, 245920); Sungai Agathis, Maliau Basin (SP 20244). Sarawak: Mengiong River, Nanga Tekalit, Kapit Division (FMNH 137981, 137983, 137985, 139343, 139344, 139346 [paratypes], FMNH 145542, 145545, 146269, 195359, 195445–195449, 221743, 221744, 221746–221748); Gunung Mulu National Park, Miri Division (ZMB 70711–70717, NMBE 1056493–1056496).

*Rhacophorus georgii* – INDONESIA: Tanke Solokko, Mekongga Mountains, Southeast Sulawesi (ZMB 34322).

*Rhacophorus harrissoni* – BRUNEI DARUSSALAM: Batu Apoi, Temburong District (UBD 214). MALAYSIA: Sabah: Lower Segama, Lahad Datu District (SP 20392–20394); Maliau Basin (SP 20279–20281). Sarawak: Gunung Mulu National Park, Miri Division (NMBE 1056497–1056499).

*Rhacophorus kajau* – MALAYSIA: Sarawak: Camp I, 150 m, Gunung Mulu National Park, Miri Division (BMNH 1978.1757 [holotype], 1978.1757–1763 [paratypes]; NMBE 1056500–1056502); Kubah National Park (JMD 393).

*Rhacophorus margaritifer* – INDONESIA: Penglengan, West-Java (SMF 6983); West Java (ZMB 11535 [holotype of *Rhacophorus barbouri* Ahl, 1923]); Vulkan Tjisurupan, West-Java (SMF 6982 [holotype of *Rhacophorus javanus* Boettger, 1893]).

*Rhacophorus maximus* – INDIA: “Khasija” [= Khasi Hills, Assam] (ZMB 8498); North India (ZMB 10129).

*Rhacophorus monticola* – INDONESIA: Southern Sulawesi (SMF 6829).

*Rhacophorus nigropalmatus* – BRUNEI DARUSSALAM: Batu Apoi, Temburong District (UBD 366). INDONESIA: Palembang, Sumatra (NMBE 1018981–1018989). MALAYSIA: Sabah: Sungai Stuebing, Trusmadi, Tambunan District (SP 223); Tawau Hills Park, Tawau District (SP 1286); “primary forest” (SP 20696).

*Rhacophorus orlovi* – VIETNAM: Ky Anh-Ke Go, Ha Tinh Province (ZMB 63294, 63295 [paratypes]); Kannack Town, Buon Luoi village, Ankhe District, Gia-Lai Province (FMNH 253156).

*Rhacophorus pardalis* – BRUNEI DARUSSALAM: Kuala Belalong Field Studies Centre, Temburong District (UBD GK06-07); without locality (UBD 17). INDONESIA: Djapura, Indragiri, Sumatra (NHMB 1186 [holotype of *Rhacophorus pulchellus* Werner, 1900]). MALAYSIA: Sabah: Taman Bukit Tawau, Tawau District (SP 2723, 26060); Danum Valley Field Centre, Lahad Datu District (SP 2082); Pulau Tiga National Park (SP 640–642, 644, 2778–2781); Kg. Tipasu, Napong 1, Ranau District (SP 2033); Mongkopo, Ranau District (SP 21986); Sungai Kokoguan, Marak Parak, Kota Marudu District (SP 353, 2083); Mendulong, Sipitang District (SP 1917–1919, 2084); Maliau Basin (SP 20255–20257); Sungai Rompon, Trusmadi (SP 671); Pulau Jembongan (SP 2190); Lower Segama, Lahad Datu District (SP 20378, 20381, 20382, 20384, 20389); Hutan Simpan, Mendamai,

Pitas Kudat (SP 1169–1180); no locality (SP 1688, 1694, 1696); PDC Lembak Inbak, Telupid (SP 2660–2661); Malangkap Tomis, Kinabalu Park, Kota Belud District (SP 20768–20771); Sg. Kimanis, Kg. Kindosodon, Tambunan District (SP 21634). Sarawak: Bako National Park, Kuching Division (NMBE 1056564, 1056570); Batang Ai National Park, Sri Aman Division (NMBE 1056512–1056514); Gunung Mulu National Park, Miri Division (NMBE 1056515); Kubah National Park, Kuching Division (NMBE 1056579). PHILLIPINES: Palawan (SMF 6994); Claveria, Northern Luzon (SMF 6995).

*Rhacophorus penanorum* – MALAYSIA: Sarawak: Gunung Mulu National Park, Miri Division (ZMB 70718 [holotype], 70719, 70720 [paratopotypes]).

*Rhacophorus prominanus* – MALAYSIA: Pahang: Gunung Brinchang, Cameron Highlands (ZMB 47984); Bukit Fraser (ZMB 52067, 52331).

*Rhacophorus reinwardtii* – INDONESIA: Java (NMBE 1018979, 1018980). MALAYSIA: Sarawak: Batang Ai National Park, Sri Aman Division (NMBE 1056516–1056518). “Borneo” (SMF 76372 [two specimens]).

*Rhacophorus rufipes* – BRUNEI DARUSALAM: Kuala Belalong Field Studies Centre, Temburong District (UBD GK06-08). MALAYSIA: Sarawak: Gunung Mulu National Park, Miri Division (NMBE 1056519–1056524).