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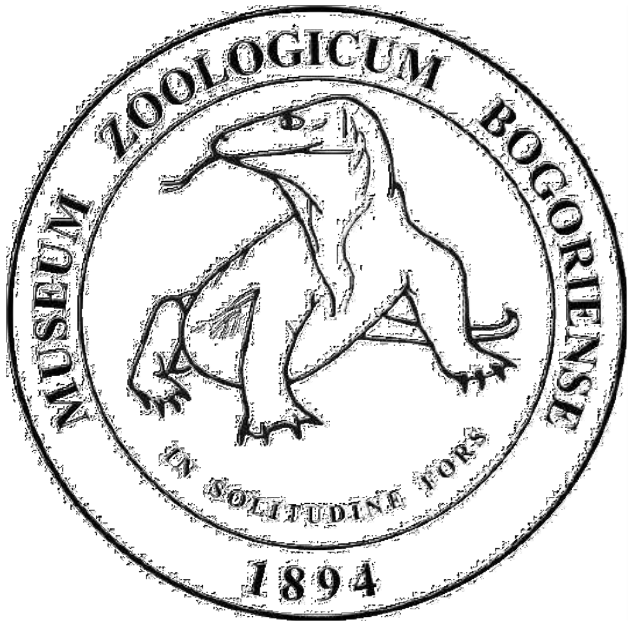

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Yaheita Yokoi

Callidiopini beetles (Coleoptera: Cerambycidae) in the collection of Museum Zoologicum Bogoriense, Indonesia

TREUBIA, December 2019, Vol. 46, pp. 1–20.

Callidiopini species in the collection of Museum Zoologicum Bogoriense, Indonesian Institute of Sciences (LIPI) were examined. Three new species of the genus *Ceresium* Newman, 1842, are described, i.e. *C. clytinioides* sp. nov., *C. sugiartoi* sp. nov., both from Kalimantan, and *C. emarginatum* sp. nov. from Papua. One new species of the genus *Examnes* Pascoe, 1869, from Kalimantan, *E. subvermiculatus* sp. nov. is described.

(Yaheita Yokoi, Hiroshi Makihara and Woro A. Noerdjito)

Keywords: Asia, Kalimantan, longhorn beetle, New Guinea, taxonomy

UDC: 595.78.001.03(594.81)

R.I. Vane-Wright

The identity of *Euploea tulliolus goodenoughi* Carpenter, 1942, a crow butterfly (Lepidoptera: Nymphalidae, Danainae) from Papua New Guinea

TREUBIA, December 2019, Vol. 46, pp. 21–34.

The nominal taxon *Euploea tulliolus goodenoughi* Carpenter, 1942, based on a unique crow butterfly collected on Goodenough Island in 1913, is shown to represent a small, aberrant female of the locally common *Euploea leucostictos eustachius* (Kirby, 1889). This new synonymy invalidates the only previous record of the Purple Crow, *Euploea tulliolus* (Fabricius, 1793), from the islands of Milne Bay Province, Papua New Guinea. However, two female *Euploea tulliolus* collected from islands in the Louisiade Archipelago during 2010 are reported here, constituting the first valid records of the Purple Crow from the Milne Bay islands.

(R.I. Vane-Wright)

Keywords: *tulliolus* species complex, new synonymy, new records, Milne Bay islands, *Euploea leucostictos*

UDC: 595.762(594.31)

Raden Pramesa Narakusumo

Four new species of *Epholcis* Waterhouse (Coleoptera: Scarabaeidae: Melolonthinae: Maechidiini) from the Moluccas, Indonesia

TREUBIA, December 2019, Vol. 46, pp. 35–50.

Here, we provide the first record of the chafer beetle genus *Epholcis* Waterhouse, 1875 from the Moluccas, Indonesia. We describe four new species: *E. acutus* sp. nov., *E. arcuatus* sp. nov., *E. cakalele* sp. nov., and *E. obiensis* sp. nov. A lectotype is designated for *Maechidius moluccanus* Moser, 1920, which is redescribed and transferred to the genus *Epholcis* as *E. moluccanus* (Moser) comb. nov.

(Raden Pramesa Narakusumo and Michael Balke)

Keywords: Coleoptera, *Epholcis*, Maechidiini, Melolonthinae, Moluccas

UDC: 597.82(594.17)

Mediyansyah

A new tree frog of the genus *Kurixalus* Ye, Fei & Dubois, 1999 (Amphibia: Rhacophoridae) from West Kalimantan, Indonesia

TREUBIA, December 2019, Vol. 46, pp. 51–72.

Kurixalus absconditus sp. nov., a new species of tree frog of the genus *Kurixalus,* described from West Kalimantan on the basis of molecular phylogenetic and morphological evidence. The new species can be distinguished from its congeners by a combination of following morphological characters: having smaller body size, more prominent of mandibular symphysis, skin smooth on throat, vomerine odontophores two oblique series touching anterior corner of choanae and widely separated, vomerine teeth thick, buccal cavity narrow and deep, choanae with teardrop shaped, single vocal slit, weakly crenulated dermal fringe on fore- and hindlimbs.

(Mediyansyah, Amir Hamidy, Misbahul Munir and Masafumi Matsui)

Keywords: *Kurixalus absconditus* sp. nov., new species, West Kalimantan

UDC: 594.34.001.03(594.11)

Mulyadi

New records and redescription of *Labidocera rotunda* Mori, 1929 (Copepoda, Calanoida, Pontellidae) from Sebatik Island, North Kalimantan, Indonesia, with notes on its species-group

TREUBIA, December 2019, Vol. 46, pp. 73–84.

During a plankton trip around Sebatik Island, North Kalimantan, a copepod *Labidocera rotunda* Mori, 1929 (Calanoida, Pontellidae) was collected for the first time in Indonesian waters. Both sexes are redescribed and compared to previous descriptions. The geographical distribution of the species confirms that it is of Indo-Pacific origin. There has been a mix-up between *L. rotunda* described by Mori (1929) from Pusan, Korea and *L. bipinnata* from Sagami Bay, described by Tanaka (1936). Fleminger et al. (1982) have argued that the minor difference is based on the presence or absence of cephalic hooks and had synonymized *L. bipinnata* with *L. rotunda*.

(Mulyadi)

Keywords: copepods, Indonesia, *Labidocera rotunda*, new record, Pontellidae

UDC: 595.78:57.01(594.53)

Djunijanti Peggie

Biological aspects of *Papilio peranthus* (Lepidoptera: Papilionidae) as observed at Butterfly Research Facility - LIPI, Cibinong, Indonesia

TREUBIA, December 2019, Vol. 46, pp. 85–102.

Papilio peranthus is endemic to Indonesia, where it occurs on several islands and island groups. This beautiful butterfly is extensively traded, thus efforts to breed this species are very desirable. Captive breeding research was conducted on *P. peranthus* during September 2016 to December 2018. In total, 221 individuals were available for observation. Data on the life cycle of the species, together with observations on females being approached for mating, and female oviposition after mating, are presented. The result demonstrate that *P. peranthus* is not monogamous. Observations on other biological aspects are also reported.

(Djunijanti Peggie)

Keywords: egg-laying, mating, life cycle, *Papilio peranthus*, parent stocks

UDC: 599.41:001.891(594)

Susan M. Tsang

Review - Indonesian flying foxes: research and conservation status update

TREUBIA, December 2019, Vol. 46, pp. 103–113.

Flying foxes are important ecological keystone species on many archipelagoes, and Indonesia is home to over a third of all flying fox species globally. However, the amount of research on this clade belies their importance to natural systems, particularly as they are increasingly threatened by anthropogenic development and hunting. Here, we provide a review of the literature since the publication of the Old World Fruit Bat Action Plan and categorize research priorities as high, medium, or low based on the number of studies conducted. A majority of the research priorities for Indonesian endemics are categorized as medium or high priority. Low priority ratings were in multiple categories for widespread flying fox species found throughout Southeast Asia, though much of the data were from outside of the Indonesian extent of the species range. These research gaps tend to highlight broader patterns of research biases towards western Indonesia, whereas significant research effort is still needed in eastern Indonesia, particularly for vulnerable island taxa.

(Susan M. Tsang and Sigit Wiantoro)

Keywords: bats, conservation, Pteropodidae, *Pteropus*, threats

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http://zoobank.org/urn:lsid:zoobank.org:pub:ID78562F-BB99-4057-A340-14ECBBEE227A

A NEW TREE FROG OF THE GENUS *KURIXALUS* YE, FEI & DUBOIS, 1999 (AMPHIBIA: RHACOPHORIDAE) FROM WEST KALIMANTAN, INDONESIA

Mediyansyah[*1,2], Amir Hamidy[*3], Misbahul Munir[4,5] and Masafumi Matsui[6]

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ABSTRACT

Kurixalus absconditus sp. nov., a new species of tree frog of the genus *Kurixalus,* described from West Kalimantan on the basis of molecular phylogenetic and morphological evidence. The new species can be distinguished from its congeners by a combination of following morphological characters: having smaller body size, more prominent of mandibular symphysis, skin smooth on throat, vomerine odontophores two oblique series touching anterior corner of choanae and widely separated, vomerine teeth thick, buccal cavity narrow and deep, choanae with teardrop shaped, single vocal slit, weakly crenulated dermal fringe on fore- and hindlimbs.

Keywords: *Kurixalus absconditus* sp. nov.*,* new species, West Kalimantan

ABSTRAK

Kurixalus absconditus sp. nov., spesies baru katak pohon dari genus *Kurixalus*, dideskripsikan dari Kalimantan Barat berdasarkan hasil analisis filogeni molekuler dan karakter morfologi. Spesies baru ini dapat dibedakan dari anggota genus yang sama dengan kombinasi karakter morfologi sebagai berikut: memiliki ukuran tubuh lebih kecil, pada bagian simfisis mandibula lebih menonjol, kulit pada bagian bawah leher halus, jarak antar sepasang gigi vomer lebar dengan posisi miring menempel pada sudut bagian depan dari koana, gigi vomer tebal, rongga bukal sempit dan dalam, koana berbentuk seperti bulir air mata, celah vokal tunggal, renda kulit pada bagian kaki depan dan belakang tidak terlalu bergerigi.

Kata kunci: *Kurixalus absconditus* sp. nov.*,* spesies baru, Kalimantan Barat

INTRODUCTION

Kurixalus appendiculatus (Günther, 1858) was originally described as the genus *Polypedates* (Günther, 1858), and later placed in the genus *Rhacophorus* by Boulenger (1882). Yei, Fei and Dubois *in* Fei (1999) then elevated to a new genus, *Kurixalus* that contains 17 species (Frost, 2019). *Kurixalus appendiculatus* originally described from the Philippines (Günther, 1858; Taylor, 1920; Inger, 1954), but the distribution widely ranged from India (Das & Dutta, 1998), Myanmar (Boulenger, 1893, 1894; Wolf 1936; Inger, 1954, Inger et al., 1999), Vietnam (Orlov et al., 2002), Thailand (Chan-ard, 2003), Peninsular Malaysia (Smith, 1930; Berry, 1975), Sumatra (van Kampen, 1923; Smith, 1930), and Borneo

(Smith, 1924; Inger, 1954, 1966). However, the population outside of Sundaland and the Philippines is suspected a misidentification (Nguyen et al., 2014b; Matsui et al., 2018).

Recent evaluation of *K. appendiculatus* by Matsui et al. (2018) shows significant genetic differentiation between Malay Peninsula, Borneo and the Philippines population. Thus they revalidated Malay Peninsula and Bornean population to *Kurixalus chaseni* (Smith) from its synonymy of *K. appendiculatus*, where it had placed by Smith (1930). Matsui et al. (2018) also considered *K. appendiculatus* is restricted to the Philippines, which also reported as cryptic species and possibility contains of several species (Gonzales et al., 2014).

During the field work in Kapuas Hulu District, West Kalimantan, the senior author collected a small tree frog, morphologically is almost similar to *K. chaseni*. Further investigation using molecular and morphological examination revealed the significant differences between this West Kalimantan population compared to all known *Kurixalus* species. Herein we describe this population as a new species.

MATERIALS AND METHODS

Field survey was undertaken in 2012 in Kapuas Hulu District, West Kalimantan by senior author (Fig. 1). Upon collection of specimens, tissue samples were taken before fixing vouchers in 10% formalin. The voucher specimens were later stored in 70% ethanol and stored at the Museum Zoologicum Bogoriense (MZB), Research Center for Biology, Indonesian Institute of Sciences. For morphological comparisons, we examined specimens of *Kurixalus* that are deposited at MZB (Appendix 1). We measured 24 external body characters following Matsui (1984) and Matsui et al. (2013): (1) snout-vent length (SVL); (2) head length (HL), measured from the tip of snout to jaw angel; (3) head width (HW), measured ventrally at the angles of jaws; (4) internarial distance, distance between centers of external nares (IND); (5) interorbital distance (IOD), the minimum distance between the paired of upper eyelids, measured perpendicular to the body axis; (6) upper eyelid width (UEW), the greatest width of the upper eyelids, measured perpendicular to the eyelid axis; (7) snout length (SL), measured from center of an external naris to the tip of snout; (8) eye length (EL), the greatest diameter of eye, including uper eyelid; (9) tympanum diameter (TD), the greatest diameter of tympanum, measured vertically; (10) tympanum-eye length (T–EL), minimum distance from the posterior corner upper eyelid to the anterior border of tympanum; (11) forelimb length (FLL), distance from the axilla to the tip of the longest finger (the 3rd finger), measured with the forelimb stretched perpendicular to the body axis; (12) hand length (HAL), longest length from inner metacarpal tubercle to the tip of finger; (13) lower arm and hand length (LAL), distance from the elbow joint to the tip of the longest finger (the third finger), measured with forearm stretched straight and flexed perpendicular to the upper arm; (14) first finger length (1FL), measured from the distal edge of inner palmar tubercle to the tip of first

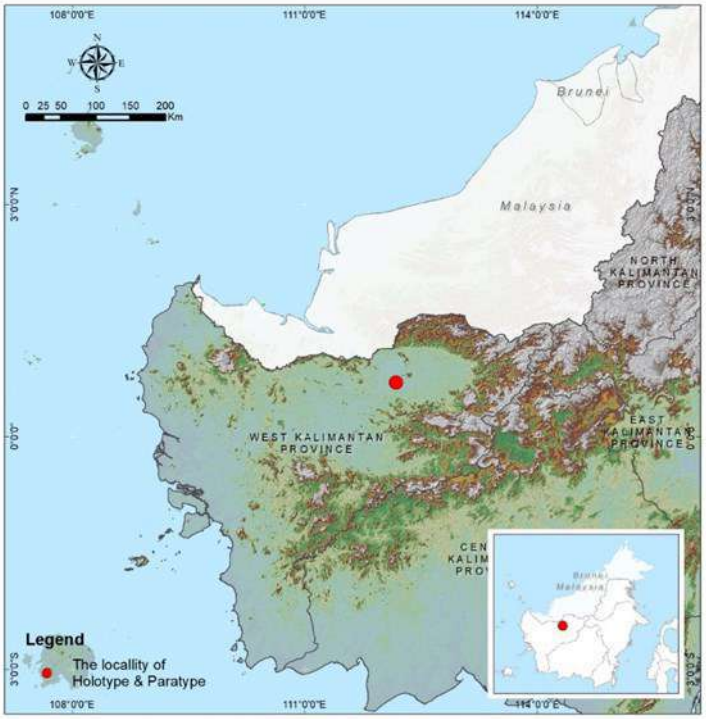


Figure 1. Map of the Kalimantan, Indonesian Borneo showed the type locality of *Kurixalus absconditus* sp. nov. (red circle).

finger; (15) inner palmar tubercle length (IPTL), the maximum length of inner palmar tubercle; (16) thigh length (THIGHL), measured from the center of anus to the tip of knee with the hind limb positioned in a Z pattern; (17) tibia length (TL), the greatest length of tibia, measured with the hind limb positioned in a Z pattern; (18) foot length (FL), distance from the proximal end of the inner metatarsal tubercle to the tip of the longest finger (fourth) toe; (19) hind limb length (HLL), distance from the center of anus to the tip of the longest (fourth) toe, measured dorsally with hind limb fully stretched perpendicular to the body axis; (20) inner metatarsal tubercle length (IMTL), the greatest length of the inner metatarsal tubercle, measured parallel to its long axis; (21) first toe length (1TOEL), measured from the distal edge of inner metatarsal tubercle to the tip of first toe; (22) width of third finger disk (3FDW), the greatest length of third finger disk, measured horizontally; (23) width of fourth finger disk (4FDW), the greatest length of four finger disk, measured horizontally; (24) width of fourth toe disk (4TDW), the greatest length of four toe disk, measured horizontally. All measurements were made to the nearest 0.1 mm with dial calipers under a binocular dissecting microscope, when necessary. Webbing formula was determined following Savage & Heyer (1997). We also examined the characters related to the roof of the buccal cavity, presence of vomerine odontophores, shape, position, the shape of choanae, and interchoanal distance. The absence or presence of vomerine odontophores and its shape, position, and interchoanal distance are also considered of taxonomic importance in some genera (Kok &

Table 1. Factor loading for variables along the first of two principal components of morphometric characteristics

Characters	PC 1	PC 2
Eigenvalue	12.513	4.618
% variation	60.761	22.425
SVL	0.346	-0.344
HL	0.048	0.055
HW	0.092	-0.102
IND	0.038	-0.007
IOD	0.018	-0.041
UEW	0.022	-0.003
SL	0.036	-0.005
EL	0.029	0.018
TD	-0.020	-0.022
T-EL	0.010	0.017
FLL	0.050	-0.015
HAL	0.136	-0.050
LAL	-0.259	0.764
1FL	0.058	-0.041
IPTL	-0.008	-0.005
THIGHL	0.261	-0.079
TL	0.276	-0.053
FL	0.159	-0.102
HLL	0.770	0.505
IMTL	-0.009	0.017
1TOEL	0.109	-0.034
3FDW	-0.011	-0.003
4FDW	0.004	0.024
4TDW	0.012	-0.013

Kalamandeen, 2008). In addition, statistical analysis of the morphometric data was performed on size adjusted measurements by taking all measurements as a percent of SVL to remove the bias due to body size variation. A multivariate principal component analysis (PCA) based on the correlation matrix of size standardized measurements on morphometric data was performed using PAST 3.23 (Hammer et al., 2001).

For molecular analyses, we extracted total DNA by using Phenol-Cloroform methods as shown by Matsui et al. (2010). We examined the 12S rRNA, tRNAval, 16SrRNA genes from single specimen of *Kurixalus* from West Kalimantan. In addition, we also sequenced a short 16S rRNA of *Kurixalus* species from lowland forest of Jambi, Sumatra. Those additional samples were deposited at MZB. Comparable sequences of *Kurixalus* species were downloaded from NCBI (National Center for Biotechnology Information; Table 2). We constructed the mithochondrial genealogies based Bayesian Inference (BI) using Mr. Bayes 3.2.6 (Ronquist & Huelsenbeck, 2003). We ran BI based on the Akaike Information Criterion (AIC) under the optimum substitution model GTR+Gamma, which was selected before using Kakusan 3 (Tanabe, 2007). We ran an analysis for ten million generations with parameter and topology sampling every 1.000 generations and MCMC diagnosis frequency of 100.000 and discarded the first 25% of analyses as burn-in. We estimated the genetic distance (p–uncorrected distance) from 16S rRNA gene using MEGA 6.06 (Tamura et al., 2013) with complete deletion for treating the gaps.

RESULTS

The differentiation in morphometric parameters based on Principal Component Analysis (PCA) result of the *Kurixalus* morphometric characters shows an important information, which component analysis extracted 13 factors out of which first two principal components explained 83.19% of the total variance in the data, where loading for PC 1 explained 60.77% of the total variance and loading for PC 2 explained 22.43% of the total variance. Component analysis loadings of morphometric characters in the first two principal components are shown in Table 1 and Fig. 2.

In general, the measured of morphometric characters clearly separated West Kalimantan *Kurixalus* sp. from *K. chaseni.* The West Kalimantan specimens differ from *K. chaseni* by several characters associated with the head and limbs such as narrower HW, smaller IND, smaller IOD, smaller UEW, shorter SL, shorter FLL, shorter HAL, shorter 1FL, shorter THIGHL, shorter TL, shorter FL, shorter HLL, shorter 1TOEL, and narrower 4TDW. Furthermore, the smaller body size (SVL) also distinguished the West Kalimantan specimen from *K. chaseni.*

The Sundaland and Philippines *K. appendiculatus* group clearly formed a monophyletic group with well-supported node (Fig. 3). In this clade, three lineages were recognized: Lineage I: *K. chaseni* from Borneo and Malay Peninsula; Lineage II: *Kurixalus* sp. from West Kalimantan of Borneo; and Lineage III: *K. appendiculatus* from the Philippines. *Kurixalus* sp. from West Kalimantan is nested as a sister taxon of *K. appendiculatus* from the Philippines. The genetic distances of 16S rRNA gene within the two lineages of *Kurixalus* from Borneo were high (9.4–9.9%). Within the lineage I (*K. chaseni*), the distance between populations were low: 0.9–1.7% between Borneo and Malay Peninsula, 2.1–2.6% between Borneo and Sumatra, 1.2–1.4% between Malay Peninsula and Sumatra, and 0.0–1.9% within Borneo. Unfortunately the 16S rRNA gene of *K. appendiculatus* from the Philippines are not available on NCBI database, so we cannot compared it with the new species (Table 3). Based on the combination of morphological and molecular results, we herein describe *Kurixalus* sp. from West Kalimantan as a new species.

Systematics

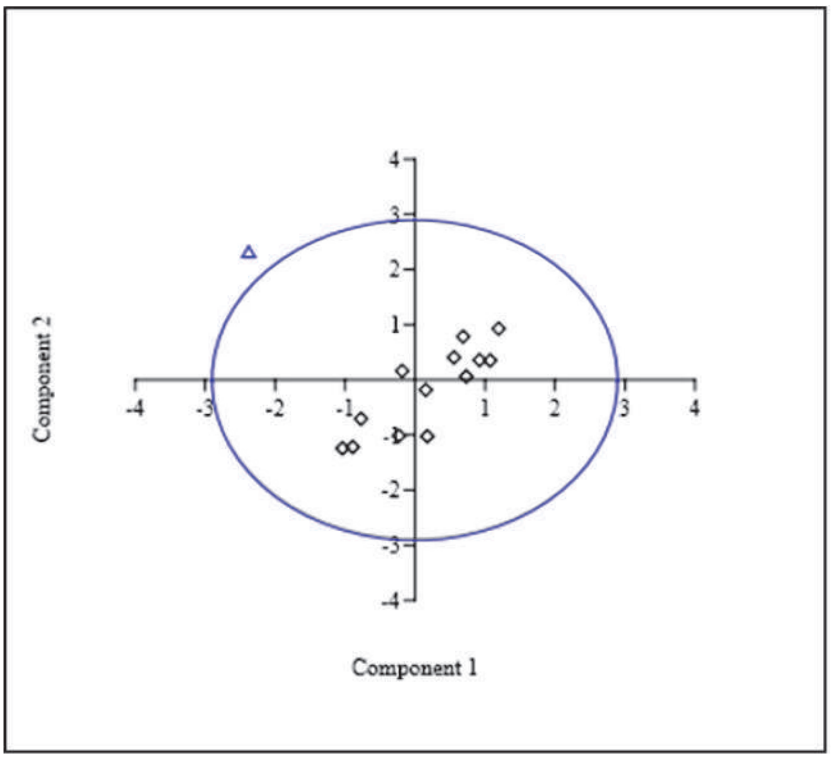
***Kurixalus absconditus* sp. nov.**

(Figs. 4, 5, 6A, 7A, 8A)

Holotype. MZB Amph 21862 (Field number PIK 003), an adult male from village forest area of Piasak Village, Kapuas Hulu District, West Kalimantan Province, Indonesia (0° 41’46.49” N, 112°10’50.74”E, 50 m. a.s.l) collected on 17 February 2012 at 19:27 h by Mediyansyah.

Table 2. In-group samples of *Kurixalus* and related taxa used for mtDNA analysis in this study together with species information, specimen voucher number, locality, GenBank accession, and references. ACD: Arvin C. Diesmos field number; BORN: Institute for Tropical Biology and Conservation, University Malaysia Sabah (BORNEENSIS); CAS: California Academy of Science; FMNH: Field Museum of Natural History; KUHE: Kyoto University, Graduate School of Human and Environmental Studies; MZB: Museum Zoologicum Bogoriense; RMB: Rafe M. Brown field number; RMBR: Raffles Museum of Biodiversity Research, reference collection field number; ROM: Royal Ontario Museum; VNMN: Vietnam National Museum of Nature.

Species	Voucher	Locality	Genbank	Reference
Kurixalus viridescens	VNMN:KHA003	Vietnam, Khanh Hoa	AB933285	Nguyen et al., 2014b
Kurixalus baliogaster	VNMN 201293	Vietnam, Gia Lai	AB933298	Nguyen et al., 2014b
Kurixalus banaensis	VNMN JJ07	Vietnam , Lam Dong	AB933304	Nguyen et al., 2014b
Kurixalus eiffingeri	KUHE 12910	Japan, Iriomote Island	AB933305	Nguyen et al., 2014b
Kurixalus idiootocus	KUHE 12979	Taiwan, Jiayi	AB933306	Nguyen et al., 2014b
Kurixalus bisacculus	200602010	China, Wenshan, Yunnan	KC465801	Li et al., 2013
Kurixalus hainanus	ROM 36827	Vietnam, Hia Duong, Chi Linh Vicinity	KC465813	Li et al., 2013
Kurixalus odontotarsus	FMNH 271334	Lao PDR, Luang Namtha Province	KC465815	Li et al., 2013
Kurixalus verrucosus	RAO 6305	China, Motuo, Xizang	KC465825	Li et al., 2013
Kurixalus appendiculatus	RMB 8020	Philippines, Camiguin Province, Camiguin Sur Island	KF933208	Gonzales et al., 2014
Kurixalus appendiculatus	ACD 6322	Philippines, Surigao Island	KF933239	Gonzales et al., 2014
Kurixalus appendiculatus	ACD 7563	Philippines, Leyte Island	KF933215	Gonzales et al., 2014
Kurixalus appendiculatus	ACD 926	Philippines, Luzon Island	KF933216	Gonzales et al., 2014
Kurixalus appendiculatus	RMB 11970	Philippines, Luzon Island	KF933218	Gonzales et al., 2014
Kurixalus appendiculatus	ACD 4914	Philippines, Luzon Island	KF933222	Gonzales et al., 2014
Kurixalus appendiculatus	RMB 9294	Philippines, Mindanao Island	KF933232	Gonzales et al., 2014
Kurixalus appendiculatus	RMB 9352	Philippines, Mindanao Island	KF933233	Gonzales et al., 2014
Kurixalus appendiculatus	RMB 11750	Philippines, Mindanao Island	KF933238	Gonzales et al., 2014
Kurixalus motokawai	VNMN 03457	Vietnam, Kon Tum	LC002887	Nguyen et al., 2014a
Kurixalus chaseni	RMBR 01064	Indonesia, Borneo, Kalimantan,	KF933207	Gonzales et al., 2014
Kurixalus chaseni	KUHE 52145	Malaysia, Peninsular Malaysia, Johar	LC369640	Matsui et al., 2018
Kurixalus chaseni	KUHE 52468	Malaysia, Peninsular Malaysia, Pahang	LC369648	Matsui et al., 2018
Kurixalus chaseni	BORN 22043	Malaysia, Borneo, Sabah	LC369655	Matsui et al., 2018
Kurixalus chaseni	KUHE 42610	Malaysia, Borneo, Sarawak	LC369658	Matsui et al., 2018
Kurixalus chaseni	KUHE 53032	Malaysia, Borneo, Sarawak	LC369661	Matsui et al., 2018
Kurixalus chaseni	MZB Amph 16357	Indonesia, Borneo, East Kalimantan	LC369666	Matsui et al., 2018
Kurixalus chaseni	MZB Amph 30584	Indonesia, Sumatera, Jambi, Harapan Rain Forest	MN727053	This study
Kurixalus absconditus sp. nov.	MZB Amph 21862	Indonesia, Borneo, West Kalimantan.	MN727052	This study



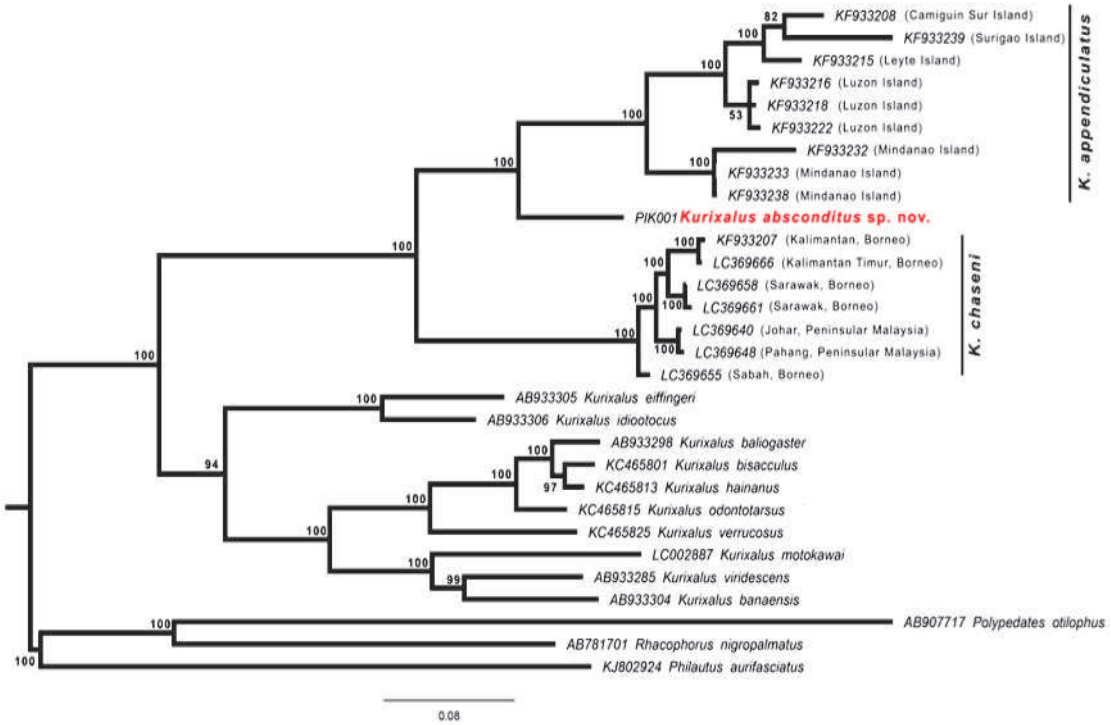


Figure 3. The Bayesian Inference phylogeny tree based on the 715–1914 bp sequence of mitochondrial 12S and 16S rRNA and tRNA Val genes, numbers upper/below branches represent Bayesian Posterior Probability.

Table 3. Genetic distance within *Kurixalus* spp. based on the 430 bp of 16S rRNA mtDNA

No	Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	AB933285 *Kurixalus viridescens*	–																	
2	AB933298 *Kurixalus baliogaster*	9.7																	
3	AB933304 *Kurixalus banaensis*	7.3	9.0																
4	AB933305 *Kurixalus eiffingeri*	12.3	9.7	10.8															
5	AB933306 *Kurixalus idiootocus*	12.0	10.1	11.8	5.2														
6	KC465801 *Kurixalus bisacculus*	10.1	2.8	10.1	10.6	10.6													
7	KC465813 *Kurixalus hainanus*	10.4	3.1	10.4	11.3	10.8	0.7												
8	KC465815 *Kurixalus odontotarsus*	9.9	4.0	9.2	9.9	9.7	2.8	3.1											
9	KC465825 *Kurixalus verrucosus*	9.2	6.1	8.5	9.0	8.3	6.6	6.8	6.6										
10	LC002887 *Kurixalus motokawai*	10.6	8.7	8.7	11.6	10.6	9.9	9.4	9.4	9.7									
11	LC369640 *Kurixalus chaseni* (Peninsular Malaysia)	17.5	17.2	15.3	15.1	15.6	17.5	17.9	17.2	15.3	15.8								
12	LC369648 *Kurixalus chaseni* (Peninsular Malaysia)	17.5	17.2	15.3	15.1	15.6	17.5	17.9	17.2	15.3	15.8	0.2							
13	LC369655 *Kurixalus chaseni* (Borneo)	18.2	17.2	15.6	15.6	15.1	17.0	17.5	16.7	15.3	16.0	1.4	1.2						
14	LC369658 *Kurixalus chaseni* (Borneo)	17.9	17.7	15.8	16.0	15.6	17.5	17.9	17.2	15.3	16.3	1.2	0.9	0.7					
15	LC369661 *Kurixalus chaseni* (Borneo)	17.9	17.7	15.8	16.0	15.6	17.5	17.9	17.2	15.3	16.3	1.2	0.9	0.7	0.0				
16	LC369666 *Kurixalus chaseni* (Borneo)	17.2	17.0	15.6	15.3	15.6	17.2	17.7	16.5	15.6	16.0	1.7	1.4	1.9	1.2	1.2			
17	MN727053*Kurixalus chaseni* (Sumatra)	18.6	18.2	16.5	16.3	16.7	18.4	18.9	18.2	16.5	16.5	1.4	1.2	2.4	2.1	2.1	2.6		
18	MN727052 *Kurixalus absconditus* sp. nov.	13.9	12.5	12.7	12.5	12.5	13.0	13.2	12.5	12.5	13.0	9.7	9.4	9.7	9.4	9.4	9.9	10.6	

Paratypes. Two specimens (juveniles), MZB Amph 21860–21861 (Field number PIK 001 & PIK 002), locality, collection time, and collector are same as the holotype.

Etymology. The specific epithet *"absconditus"* is derived from a Latin word, "disguised, concealed or hidden". The name is an adjective in concordance with the previous undetected status of this species within *K. appendiculatus* group.

Suggested English common name. Piasak-frilled Swamp Treefrogs.

Suggested Indonesia common name. Katak-renda piasak.

Diagnosis. The new species is assigned to the genus *Kurixalus* based on molecular analysis, and following morphological characters: a small-sized rhacophorid (SVL<50 mm); tips of fingers dilated into round disks having circummarginal grooves; snout tip pointed; finger webbing poorly developed; toe webbing moderately developed; dermal fringes present on forearm and tarsus; narrow flap on heel and crenulate dermal projection on vent; dorsum brown with saddle-shaped or X-shaped marking (Nguyen et al., 2014a; Yu et al., 2017b, 2018). *Kurixalus absconditus* sp. nov. can be distinguished from all known congeners by a combination of following morphological characters: (1) smaller body size of an adult male; (2) more prominent mandibular symphysis; (3) skin smooth on throat; (4) vomerine odontophores two oblique series touching anterior corner of choanae and widely separated; (5) vomerine teeth thick, short with oval-shaped; (6) narrow and deep buccal cavity; (7) choanae teardropshaped; (8) weakly crenulated dermal fringe on outer edges of fore- and hindlimb; (9) hindlimb slightly short, tibio-tarsal articulation of adpressed limb reaches center of the eye.

Description of holotype (measurements in mm). Adult male; body moderately robust with SVL 27.3; head longer (HL 12.6; 46.2% of SVL) than wide (HW 10.7; 39.1% of SVL); snout pointed in dorsal view, rounded in lateral view, tip with a small conical projection, canthus rostralis gently rounded, lore region oblique, and slightly concave; snout (SL 5.0; 18.4% of SVL) slightly longer than eye (EL 4.0; 14.6% of SVL); nostril slightly protuberant, closer to tip of snout (NS 1.0; 3.6% of SVL) than to eye (EN 2.7; 10% of SVL). Internarial distance (IND 1.8; 6.6% of SVL) much smaller than interorbital distance (IOD 3.2; 11.6% of SVL); interorbital distance wider than upper eyelid (UEW 2.5; 9.3% of SVL); eye large (EL 4.0; 14.6% of SVL), protuberant, pupil horizontally elliptical; the tympanum is externally distinct, small, rounded, curved from posterior edge of eye to axilla, diameter (TD 2.1; 7.8% of SVL) approximately half eye diameter and separated from eye (T–EL 0.6; 2.1% of SVL) less than half of tympanum diameter; supratympanic fold distinct from the posterior of eye to the insertion of arm (axilla); buccal cavity narrow and deep, vomerine teeth thick and short, choanae with teardropshaped, and there is a single vocal slit near the base of tongue.

Forelimbs slender and slightly shorter (FLL 5.8; 21.3% of SVL), about half of hindlimbs (FLL 5.8; 12.9% of HLL); finger length formula **I<II<IV<III**; length of first finger (1FL 3.5; 12.7% of SVL) shorter than length of eye (4.0; 14.6% of SVL); tips of

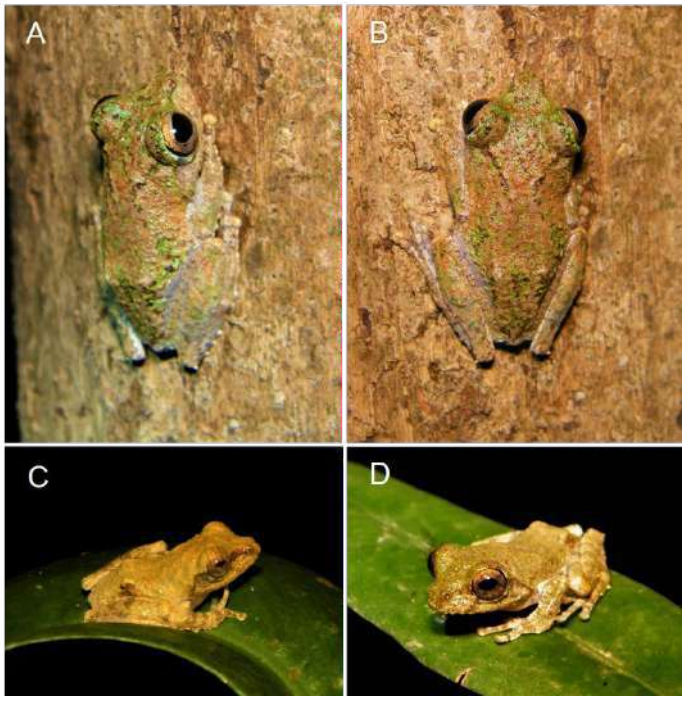


Figure 4. (A&B) Adult male holotype of *K. absconditus* sp. nov. (MZB Amph 21862) in life; (C&D) juvenile paratype MZB Amph 21860–21861. Not to scale. (Photographs by Mediyansyah).

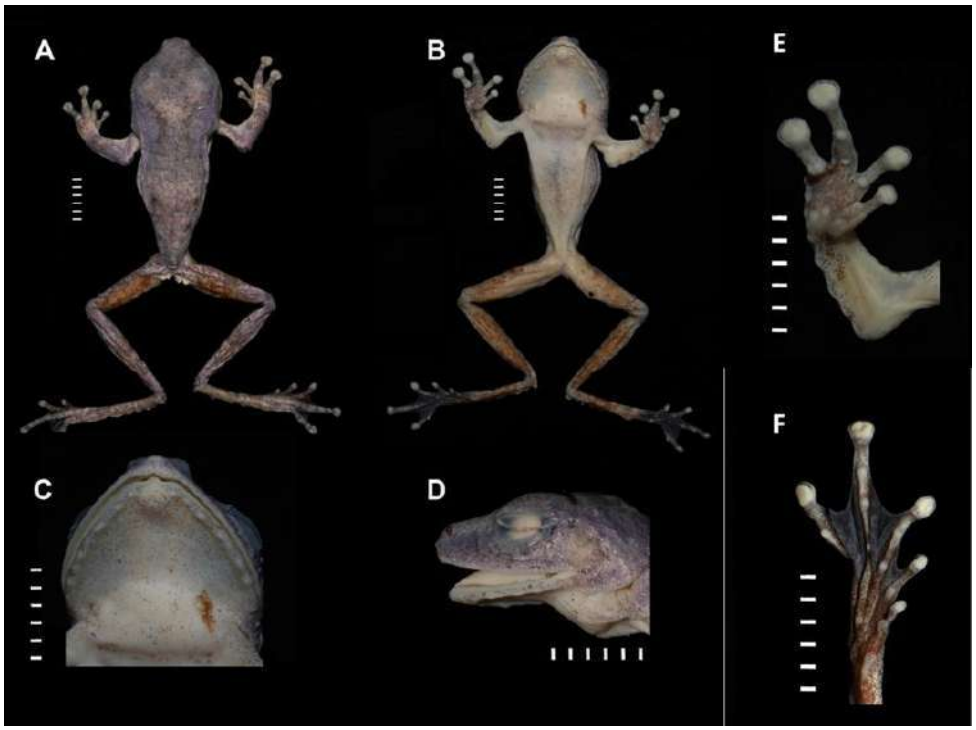


Figure 5. (A) Dorsal and (B) ventral body views, (C) ventral and (D) left aspects of head, (E) Hand and (F) foot ventral view of male holotype *Kurixalus absconditus* sp. nov. (MZB Amph 21862). Scale bar is 5 mm (Photographs by M. Munir).

fingers expanded, broadened into round disks with circummarginal groove; disk of third finger (3FDW 1.1; 4.2% of SVL) narrower than tympanum (4.0; 14.6% of SVL); hand length (HAL 7.3; 26.7% of SVL) shorter than lower arm length (LAL 12.8; 47.0% of SVL); fingers poorly webbed; web between third and fourth fingers reaching beyond proximal of outer subarticular tubercle; fringe a half of first phalange on outer side of third finger; weakly crenulated dermal fringe on outer edge of forearm; there is one distal subarticular tubercle on fourth finger, tubercle divided into two lobes (bifid); no supernumerary metacarpal tubercles; nuptial pad absent; oval inner palmar tubercle (IPTL 0.7; 2.5% of SVL); subarticular tubercle rounded, prominent with formula: **I** (1), **II** (1), **III** (2), **IV** (1).

Hindlimbs slender, length (HLL 43.1; 164.7% of SVL), about three times length of forelimbs; thigh (THIGHL 12.9; 47.3% of SVL) shorter than tibia (TL 14.1; 51.5% of SVL); tibio–tarsal articulation of adpressed limb reaching center of eye; foot (FL 11.3; 41.3% of SVL) shorter than tibia; toe length formula **I<II<III<V<IV**; supernumerary tubercles absent; tips of toes expanded, with disks smaller than those of outer fingers (4TDW 0.6; 2.3% of SVL versus 4FDW 1.1; 4.1% of SVL); weakly crenulated dermal fringe on outer edge of hindlimb; toe webbing not well developed with formula **I** (0)–(1) **II** (½)–(0) **III** (1)–(½) **IV** (1)–(0) **V**; number of subarticular tubercles formula: **I** (1), **II** (1), **III** (2), **IV** (3), **V** (2); elongated, low inner metatarsal tubercle, length (IMTL 0.7; 2.6% of SVL) approximately a fourth of the length of first toe (1TOEL 2.9; 10.6% of SVL) and no outer metatarsal tubercle.

Skin. Upper eyelid with a series of rounded small tubercles, consisting five or six tubercles on first row near the lateral margin and three or four small tubercles on the second row; supratympanic fold distinct from posterior of eye to axilla; dorsum, snout, surface of limbs with small irregular bumps and tend to be larger and slightly elongated on flank; skin on throat smooth, chest finely granulated, and belly coarsely granulated; distinct of dermal appendages on lower jaw.

Coloration in life. Dorsum brown with green speckles on the dorsal, thigh, and shank surface. A sparse and disjointed of dark brown saddle-shaped mark on dorsum. Flank brown with few green speckles, groin whitish. Iris bright gold with distinct black reticulation and black scleral ring around iris. Hindlimb less of distinctly dark crossbars.

Coloration in preservative. Inner tarsus and foot dirty white. Brown and green speckles entire dorsum fades to pale violet and contrast on lateral side of head and dorsum. Ventral surface whitish with small dark speckles scattered on lower jaw and brown splotches scattered on belly. Limbs dorsally pale violet, ventrally dirty white with brown color scattered on thigh, and concentrated on shank.

Variation. Morphometric data of the *K. absconditus* sp. nov. and *K. chaseni* are summarized in Table 4. Because the holotype of the new species is only an adult male and

Table 4. Measurements of morphological characters of *K. absconditus* sp. nov. and *K. chaseni*

Characters	*Kurixalus absconditus* sp. nov.			*Kurixalus chaseni*			
	MZB Amph 21862	MZB Amph 21860	MZB Amph 21861	Male (N=13)		Female (N=10)	
				Mean±SD	Range	Mean±SD	Range
SVL	27.3	20.4	17.3	31.6±1.2	30.1-33.4	34.1±3.8	30.6-44.3
HL	12.6	8.5	7.8	12.5±0.5	11.6-13.1	13.3±1.4	12.4-17.1
HW	10.7	7.5	6.4	11.8±0.5	11.1-12.9	12.7±1.6	11.5- 17.0
SL	5.0	2.7	2.6	5.3±0.3	4.8-5.9	5.8±0.7	5.0-7.5
T–EL	0.6	0.4	0.4	0.6±0.2	0.32-1.0	0.6±0.2	0.5-0.9
TD	2.1	0.9	0.7	1.9±0.5	0.7-2.4	2.1±0.4	1.7-3.1
IND	1.8	1.5	1.2	2.2±0.2	1.8-2.5	2.1±0.2	1.7-2.7
EL	4.0	3.0	2.2	4.2±0.3	3.7-4.7	4.1±0.3	3.6-4.5
IOD	3.2	2.7	1.6	3.6±0.4	3.0-4.0	3.7±0.3	3.3-4.1
UEW	2.5	1.6	1.4	3.0±0.3	2.3-3.3	2.9±0.3	2.5-3.3
HAL	7.3	5.3	3.3	8.6±0.5	7.7-9.4	9.1±1.2	7.9-12.1
FLL	5.8	4.2	3.4	6.4±0.3	5.9-7.0	6.9±0.8	6.0-8.3
LAL	12.8	3.5	3.5	5.7±0.7	4.5-6.8	5.9±1.2	4.6-8.6
HLL	44.9	30.6	26.5	49.5±2.8	45.0-53.3	54.6±7.0	45.0-71.4
THIGHL	12.9	10.5	8.5	15.5±0.8	14.2-16.9	16.7±2.2	14.7-22.6
TL	14.1	10.5	8.8	16.7±0.8	15.3-18.0	18.0±2.1	15.4-23.4
FL	11.3	7.4	4.5	13.0±0.6	11.7-13.8	14.0±1.8	11.9-18.5
1FL	3.5	2.2	2.0	4.2±0.3	3.5-4.8	4.7±0.7	3.8-6.1
3FDW	1.1	0.7	0.4	1.0±0.2	0.8-1.3	1.3±0.3	0.9-2.1
4FDW	1.1	0.8	0.5	1.0±0.2	0.7-1.3	1.2±0.2	0.9-1.6
1TOEL	2.9	1.9	1.7	4.1±0.4	3.5-5.0	4.6±0.6	3.9-6.1
4TDW	0.6	0.5	0.2	0.8±0.1	0.5-1.0	0.9±0.2	0.7-1.4
IMTL	0.7	0.6	0.1	0.6±0.3	0.2-1.1	0.5±0.2	0.3-0.9
IPTL	0.7	0.6	0.2	0.7±0.3	0.3-1.1	0.7±0.2	0.5-1.1

paratypes are juvenile, sexual dimorphism could not be determined. There was variation only in the tibio-tarsal articulation, which reaches the center of the eye in holotype MZB Amph 21862 and paratype MZB Amph 21860, but reaches the front of eye in paratype MZB Amph 21861.

Comparisons. The new species, *K. absconditus* sp. nov. is morphologically similar to *K. chaseni* from Kalimantan (Borneo) and Sumatra, but they can be distinguished from each other in some morphological characteristics: smaller body size, SVL 27.3 mm in adult male (versus > 30 mm in adult male of *K. chaseni*). An adult male of *K. absconditus* sp. nov. has smooth throat (versus granular in *K. chaseni;* Fig 6). *K. absconditus* sp. nov. has a narrow and deep buccal cavity (versus broad and shallow buccal cavity in *K. chaseni;* Fig 7). Vomerine teeth thick, short, oval-shaped in *K. absconditus* sp. nov. (versus vomerine teeth thin, elongated, in *K. chaseni*). *K. absconditus* has a choanae with teardrop shaped (versus elongated shape in *K. chaseni*). Dermal fringe on limbs weakly crenulated in *K. absconditus* sp. nov. (versus stronger, narrow wavy-edge fringe in *K. chaseni*). Flap at heel slightly short and blunt in *K. absconditus* sp. nov. (versus slightly long and tapered of flap at heel in *K. chaseni*). The hindlimb being carried forwards along the body, the tibio-tarsal articulation reached the center of eye in *K. absconditus* sp. nov. (versus reached the tip of the snout in *K. chaseni*). Toe webbing formula in *K. absconditus* sp. nov. **I** (0)–(1) **II** (½)–

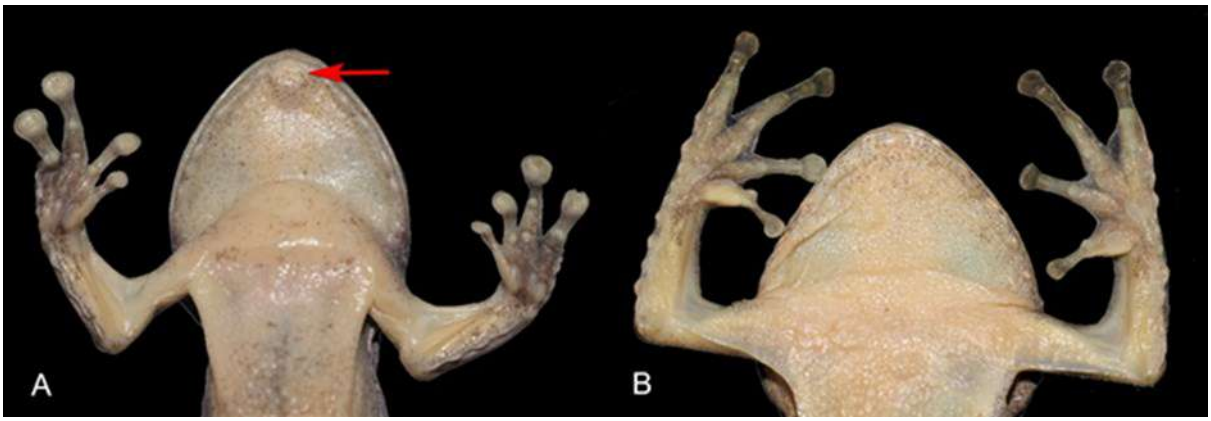


Figure 6. Comparison of skin on gular region of (A) male holotype of *K. absconditus* sp. nov. (MZB Amph 21862) and (B) male of *K. chaseni* (MZB Amph 16357) from Sungai Wain, East Kalimantan. Red arrow added to show the prominent of mandibular symphysis. Not to scale. (Photographs by Mediyansyah). Not to scale.

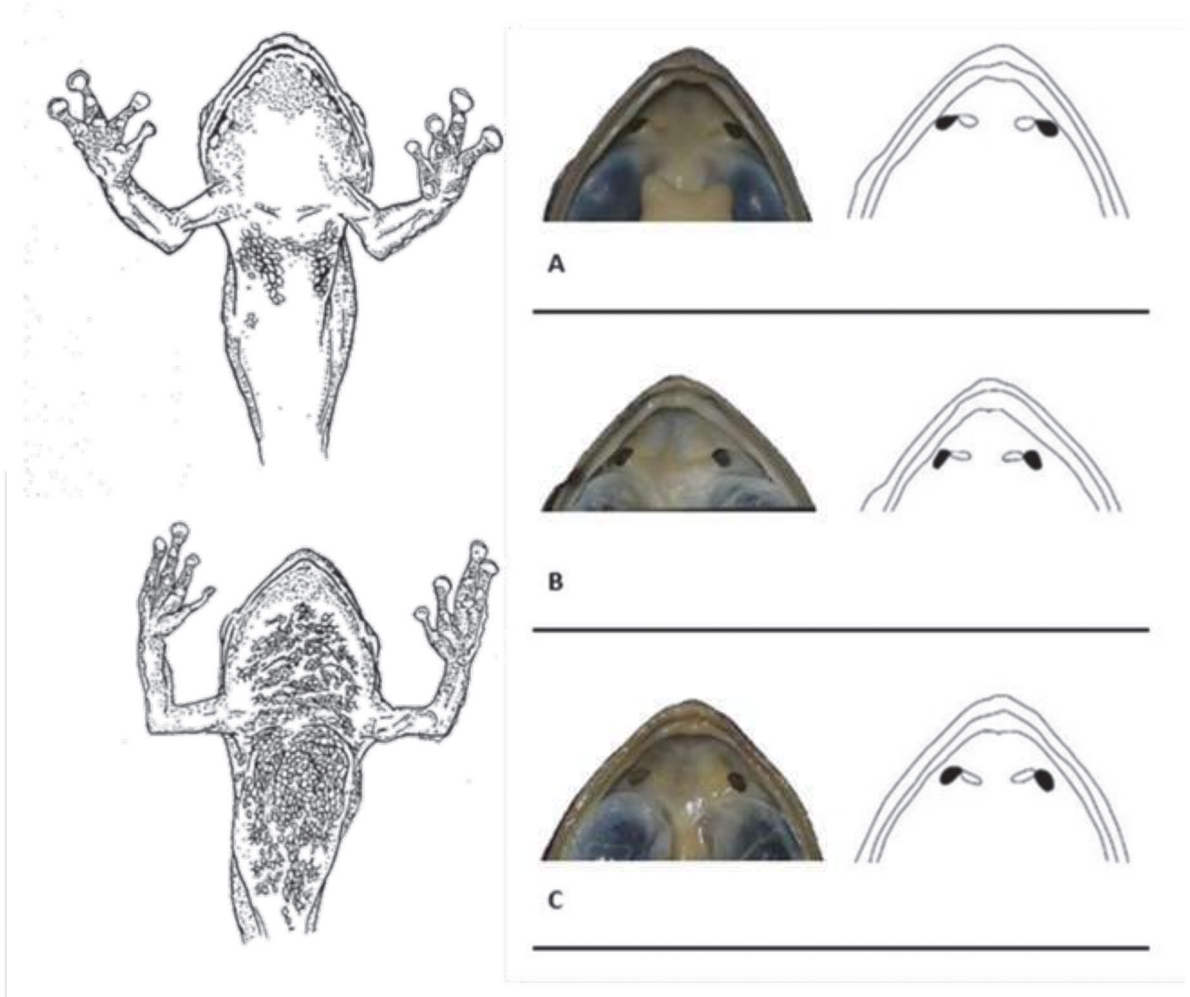


Figure 7. Ventral view of male holotype of *K. absconditus* sp. nov. (above) versus *K. chaseni* MZB Amph 16358 (bellow) and Ventral view of the roof of buccal cavity aspects of the illustrating the choanae and vomerine teeth (right). (A) *K. absconditus* sp. nov. by having narrow and deep buccal cavity, choanae with teardrop shaped, vomerine teeth thick, short, oval; (B) *K. chaseni* from Sumatra and (C) Kalimantan, having shallow and broad buccal cavity, choanae oval, vomerine teeth thin and elongated. Not to scale.

(0) **III** (1)–(½) **IV** (1)–(0) **V** (Fig. 5) versus **I** (0)–(½) **II** (0)–(½) **III** (0)–(0–½) **IV** (0–½)–(0) **V** in *K. chaseni.*

In addition, *K. absconditus* sp. nov. is differentiated from all known congeners by the following characters: The new species differs from the Philippines *K. appendiculatus* by having a web as narrow fringe reaching on half of first phalange (above distal subarticular tubercle) on exterior side of third finger (versus narrow fringe reaching distal subarticular tubercle), has crenulated edges of the fringes (versus smooth). From *K. yangi* by absence of supernumerary tubercles and outer metacarpal tubercle (versus presence of supernumerary tubercles and outer metacarpal tubercle). *K. absconditus* sp. nov. can be distinguished from *K. baliogaster* by having crenulated dermal fringe on limbs (versus without crenulated dermal fringe on limbs). From *K. eiffingeri* and *K. odontotarsus*, by having smaller body size of an adult male, SVL 27.3 mm (versus SVL ≥ 30 mm). *K. absconditus* sp. nov. differs from *K. bisacculus*, *K. hainanus,* and *K. lenquanensis* by having smooth throat in an adult male (versus granular throat). From *K. banaensis, K. motokawai,* and *K. verrucosus* by presence of vomerine teeth (versus absence of vomerine teeth). *K. absconditus* sp. nov. can be distinguished from *K. idiootocus* by having single vocal slit (versus two vocal slits). From *K. berylliniris* and *K. wangi* by gently rounded canthus rostralis (versus curved canthus rostralis). From *K. naso* by less developed toe webbing (versus well-developed). Finally, *K. absconditus* sp. nov. can be differentiated from *K. viridescens* by having dermal appendage around cloaca (versus absence of dermal appendage), and brown dorsum with green speckles (versus solid green dorsum without any markings).

Distribution and Natural history. *Kurixalus absconditus* sp. nov. currently is known only from the type locality. The holotype and juvenile paratypes were collected in the shrub swamp habitat close to secondary swamp forest (Fig. 9). The holotype was found clinging to the trunk of a tree 70 cm above the ground and the juvenile paratypes were found perched on leave 100–190 cm above the ground. The tadpoles, eggs, and female individual were not found. The advertisement call of this species is unknown. Associated frog species observed in the collection site were *Amnirana nicobariensis* (Stoliczka), *Chalcorana raniceps* (Peters), *Hylarana erythraea* (Schlegel), *Polypedates colletti* (Boulenger), *Pulchrana baramica* (Boettger), and *Limnonectes paramacrodon* (Inger).

Table 5. Comparison of selected characters of *Kurixalus* spp.

Species	SVL of an adult male	Vomerine teeth	Skin of gular region	Toe webbing formula	references
Kurixalus absconditus sp. nov.	27.3 mm	Present	Smooth	I (0)–(1) II (½)–(0) III (1)–(½) IV (1)–(0) V	This study
Kurixalus appendiculatus	29.3 mm–35.4 mm	Present	Smooth	–	Brown & Alcala, 1994
Kurixalus baliogaster	≥ 30 mm	Present	Smooth	–	Inger et al. 1999
Kurixalus banaensis	–	Absent	Smooth	–	Bourret, 1939; Bossuyt & Dubois, 2001; Yu et al. 2018
Kurixalus berylliniris	29.0–42.4 mm	Present only on left side	Smooth	I (½)–(1) II (½)–(1½) III (1)–(2) IV (1)–(½) V	Wu et al. 2016
Kurixalus bisacculus	≥ 30 mm	Present	Finely granulated	–	Taylor, 1962
Kurixalus chaseni	≥ 30 mm	Present	Granular	I (0)–(½) II (0)–(½) III (0)–(0–½) IV (0–½)–(0) V	Malkmus et al. 2002; Mediyansyah pers.obs.
Kurixalus eiffingeri	≥ 30 mm	Present	–	–	Stejneger, 1907
Kurixalus hainanus	≥ 30 mm	–	Granular	–	Yu et al. 2017b; Zao et al. 2005
Kurixalus idiootocus	24.9 mm	Present	Finely granulated	I (2)–(2) II (1)–(2½–2⅓) III (0)–(3) IV (2)–(0) V	Kuramoto & Wang, 1987
Kurixalus lenquanensis	27 mm	Present	Finely granulated	I (2)–(2½) II (1½)–(3) III (1½)–(3) IV (2¾)–(1½) V	Yu et al. 2017b.
Kurixalus motokawai	23.2–28.4 mm	Absent	Granular?	I (2)–(2) II (⅓)–(2) III (1)–(2½) IV (2½)–(1½) V	Nguyen et al. 2014a
Kurixalus naso	> 30 mm	Present	Coarsely granulated	–	Annandale, 1912
Kurixalus odontotarsus	≥ 30 mm	Present	Smooth	–	Nguyen et al. 2014a; Yu et al. 2010
Kurixalus verrucosus	≥ 30 mm	Absent	Smooth	–	Boulenger, 1893
Kurixalus viridescens	–	Absent	Granular?	I (2)–(2¾) II (1½)–(2¾) III (1½)–(3) IV (2½)–(1¾) V	Nguyen et al. 2014b
Kurixalus wangi	28.6–31.6 mm	Present	Slightly granular	I (1)–(trace) II (½)–(1½) III (1)–(2) IV (1)–(⅓) V	Wu et al. 2016
Kurixalus yangi	≥ 30 mm	Present	Finely granulated	I (½)–(2) II (1)–(2) III (1)–(2) IV (2)–(1) V	Yu et al. 2018

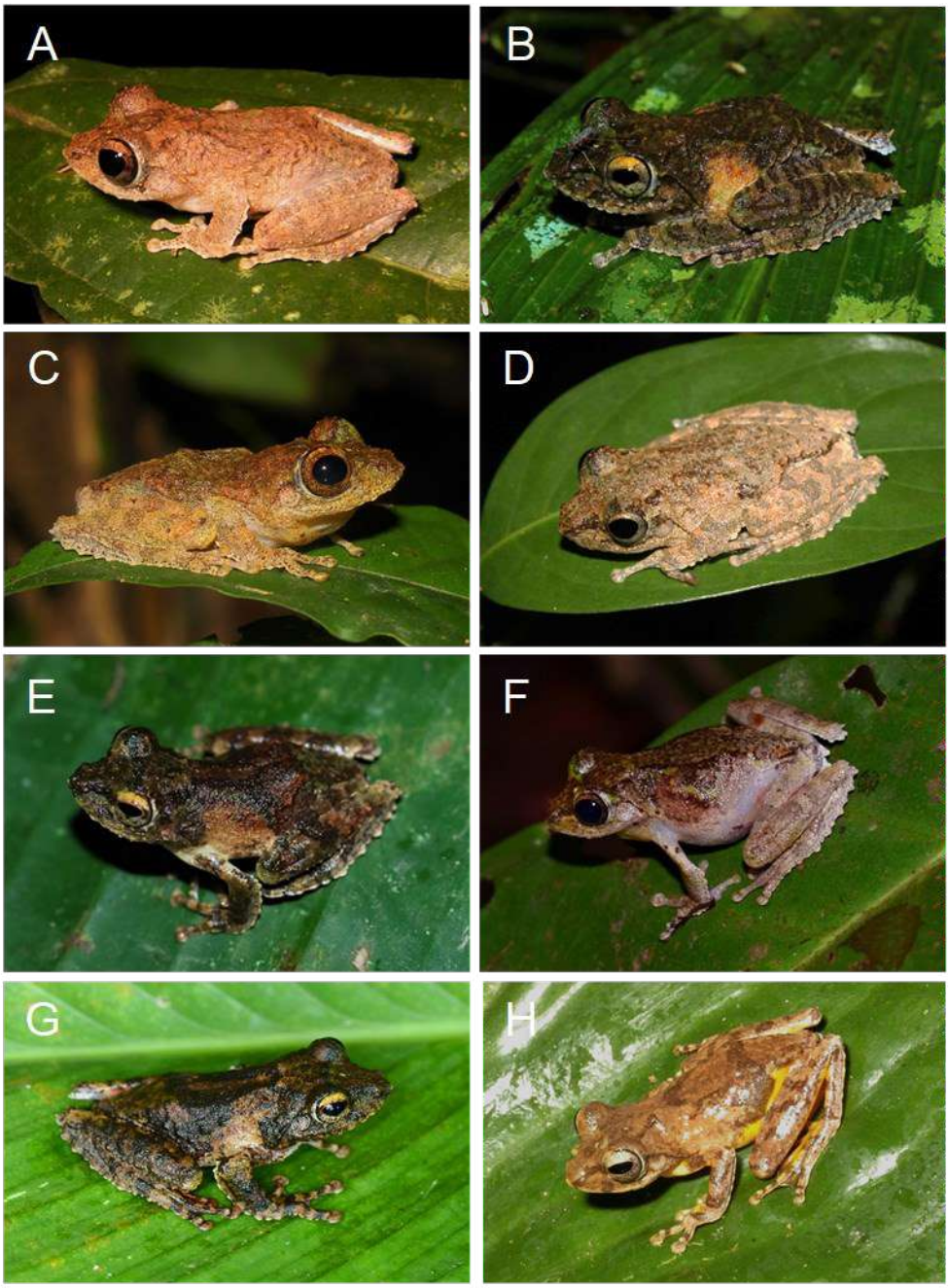


Figure 8. (A) Non–vouchered adult male of *K. absconditus* sp. nov.; (B) adult male of *K. chaseni* from Bukit Batikap, Central Kalimantan Province; (C) adult male of *K. chaseni* from Lahat, South Sumatra Province; (D) adult male of *K. chaseni* from Ketapang, West Kalimantan Province; (E) adult male of *K. chaseni* from Sungai Wain, East Kalimantan Province; (F) adult male of *K. chaseni* from Grand Forest Park (TAHURA) Sultan Adam, South Kalimantan Province; (G) adult male of *K. chaseni* from Terengganu, Peninsular Malaysia; (H) adult male of *K. appendiculatus* from the Philippines. Not to scale. Photographs by Mediyansyah (A, B, C, D); Amir Hamidy (E); Zainudin. B. Akar (F); Evan Quah (G); Arvin C. Diesmos (H).

Figure 9. Habitat condition of *Kurixalus absconditus* sp. nov. at the type locality. Photograph by Mediyansyah.

DISCUSSION

As one of the biodiversity hotspot, Borneo has rich frog species, more than 180 species occur in the island (Inger et al., 2017). That species number is increasing, many groups remain unknown and appears underestimated (Waser et al., 2016; Matsui et al., 2017; Eto et al., 2018; Munir et al., 2019). The discovery of *K. absconditus* sp. nov. indicates that the Kalimantan (Indonesia Borneo) species is also interesting aside from the highland part of the Island on Sabah and Sarawak, where the most of Bornean species described. This finding contributes to the increasing number of new species in Borneo and become the second species of *Kurixalus* known to occur in Borneo.

In this study, we also confirmed that Sumatran population is conspecific with *K. chaseni* sensu Matsui et al. (2018). We included a sequence sample of *K. chaseni* from Harapan Rainforest of southern Sumatera, which showed a quite low genetic variation, only 1.2–1.4% from Malay Peninsula and 2.1–2.6% from Borneo (Table 3). An old name Sumatran population, a *Rhacophorus phyllopygus* was described from Indragiri, Riau Province of Sumatra (Werner, 1900). This population was synonymized with *R. appendiculatus* by Roux (1918), van Kampen (1923), Smith (1930), Wolf (1936), and Inger (1954). However, the complex geological history of Sumatra affected unique speciation in this Island. As the result, several cryptic species occur in Sumatra such as the *L. borbonica* group (Hamidy et al., 2018), *Megophrys* (Munir et al., 2018), *Rhacophorus* (Hamidy and Kurniati, 2015), and *Leptobrachium* (Matsui et al., 2010; Hamidy et al., 2012). Further studies by examining type series and involving the topotypic population from Indragiri are needed to prove whether Sumatran population consist of single or multiple lineages.

Kurixalus absconditus sp. nov. was disguised within the *K. chaseni* populations due to the superficial similarity in morphological characters. In general, the taxonomy and systematics of *Kurixalus* are still confused (Nguyen et al., 2014; Yu et al. 2017b, 2018), and genetic relationships among Bornean populations are little understood (Matsui et al., 2018). Reviving the name of *K. chaseni* to separate the Bornean populations from the Philippines *K. appendiculatus* at least resolved the taxonomic problem in this species (Matsui et al., 2018). Further genetic studies by involving large scale of samples are needed to reveal more undescribed lineage of *Kurixalus* from Borneo.

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APPENDIX 1. Material examined.

Kurixalus chaseni formerly *Kurixalus appendiculatus* (N = 24)-Indonesia: South Kalimantan Province, HPH PT ATI, MZB Amph 5984 (female); Lampung, Bukit Barisan Selatan National Park, Pemerian, MZB Amph 3455 (male); East Kalimantan Province, Kutai Timur District, Muara Ancalong Sub-district, Anak Sungai Lompong, Desa Senyiur, MZB Amph 22073-22078 (female); East Kalimantan Province, Balikpapan, Sungai Wain, MZB Amph 16356-16361 (male); East Kalimantan Province, Tau Lumbis Sub-district, Desa Tau Lumbis, MZB Amph 25070-25074 (female); East Kalimantan Province, Kutai Kartanegara District, Bukit Layang Sub-district, Desa Bukit Layang, Transect 1 Plasma Bukit Layang, MZB Amph 24775-24776 (male); Sumatra, Jambi, Harapan Rain Forest, MZB Amph 30584.

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