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Two new *Choerophryne* species from western Papua New Guinea (Amphibia: Anura: Microhylidae)

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Abstract. We describe two new species of the microhylid frog genus *Choerophryne* Van Kampen, 1914 from the mountains of Papua New Guinea. The first is a scansorial species known only from foothill forest at altitudes of 440–950 m a.s.l. on the northern slopes of Papua New Guinea's Central Cordillera. It is a moderately large member of the genus (males 16.8–20.6 mm snout–urostyle length) that utters long series of short whistling calls each lasting 77–125 ms. The second species is arboreal and known only from a small area of montane forest at altitudes of 2060–2300 m a.s.l. on the southern edge of the Central Cordillera. It is also moderately large for the genus (three males with snout–urostyle lengths of 19.3–20.6 mm) and produces long series of short buzzing calls, each lasting 124–173 ms. Descriptions of these two species bring the number of recognised *Choerophryne* to 39, and at least 18 additional species in the genus await formal description.

Key words. Advertisement calls, bioacoustics, Central Cordillera, frogs, morphology, new species, taxonomy.

Introduction

The asterophryine microhylid genus *Choerophryne* is a moderately diverse lineage of 37 recognised species of tiny to small frogs (adult body length ~ 11–25 mm) confined to mainland New Guinea and at least one adjacent land-bridge island (Yapen) (Günther 2008, Frost 2024). Based on sequence data from the 12S and 16S mitochondrial genes, Oliver et al. (2017) found *Choerophryne* to comprise a monophyletic lineage with two speciose clades, one containing species without elongated snouts (previously *Albericus* Burton & Zweifel, 2005), and the other containing species with greatly elongated snouts. They also recovered a lineage of *Choerophryne* containing two species, *C. exclamitans* (Kraus & Allison, 2005) and *C. crucifer* Günther & Richards, 2017 (as *C.* sp. C1) that would render the genus paraphyletic. However, Oliver et al. (2017) considered that this non-monophyly may have been an artefact of rapid diversification and/or the short rapidly saturating loci used, and Hill et al. (2022) subsequently found that *C. exclamitans* is closely related to other short-snouted species (*C. crucifer* was not included in their study), confirming the monophyly of the genus. Their study found that *C. bryonopsis* Kraus, 2013, a species with morphological traits intermediate between short-nosed and long-nosed *Choerophryne* (Kraus 2013) was nested within the diverse lineage of short-nosed species.

Choerophryne reaches its greatest diversity on New Guinea's Central Cordillera, where the regions' complex orogeny has promoted diversification in novel habitats generated in part by mountain uplift through the late Miocene and Pliocene (Oliver et al. 2017). This diversity remains incompletely documented, and numerous *Choerophryne* species have been described from the cordillera in recent years (Kraus 2010, 2013, Günther & Richards 2011, 2017, 2018, Ianella et al. 2014, 2015). Here we describe a new species of the genus *Choerophryne* from the northern slopes of the Central Cordillera, and another from the southern edge of this range, both in western Papua New Guinea. Both species lack a prominent, elongated rostrum and their relationships presumably lie with other short-nosed *Choerophryne*. However, relationships among the increasingly diverse known *Choerophryne* fauna requires a comprehensive genetic assessment incorporating broader taxon sampling than has previously been possible.

Material and methods

Male frogs were located at night by their advertisement calls. The only female was found coincidentally at night. Vouchers were anaesthetised in an aqueous chlorobutanol solution and subsequently fixed in 10% formalin. Liver samples were taken from some individuals to permit fu-

ture genetic analyses. All specimens were transferred to 70% ethanol within two days of fixation. The following measurements were taken with a digital calliper (> 10 mm) or with a binocular dissecting microscope fitted with an ocular micrometer (< 10 mm) to the nearest 0.1 mm from preserved specimens: SUL – snout–urostyle length from tip of snout to posterior tip of urostyle bone; SUL is generally slightly shorter than snout–vent length (SVL). As the measurement error is higher in the latter, we prefer to use the former. Both measurements are sufficiently similar that, where relevant, we compare our SUL measurements with SVLs presented for members of the genus in some papers; TL – tibia length: external distance between knee and tibio–tarsal articulation; TaL – length of tarsus: external distance between tibio–tarsal and tarsal–metatarsal joints held at right angles; FtL – length of foot: from tip of 4th toe to proximal edge of sole; T4D – transversal diameter of disc of 4th toe; T1D – transversal diameter of disc of first toe; HdL – length of hand; from tip of 3rd finger to proximal edge of palm; F3D – transversal diameter of disc of 3rd finger; F1D– transversal diameter of disc of first finger; HL – head length, from tip of snout to posterior margin of tympanum; HW – head width, taken in the region of the tympana; SL – snout length, from an imaginary line connecting the centres of the eyes to tip of the snout; END – eye–naris distance, from anterior corner of orbital opening to centre of naris; IND – internarial distance between centres of nares; ED – eye diameter, from anterior to posterior corner of orbital opening; TyD – horizontal diameter of tympanum. EST – distance from anterior corner of orbital opening to tip of snout. Measurements are presented as mean ± standard deviation.

Advertisement calls were recorded under natural conditions with a Sony Pro-Walkman tape recorder or a Marantz PMD-660 digital recorder, both with a Sennheiser ME66 Microphone with K6 power module and analysed with Avisoft-SAS Lab Pro version 5.2 software. Terminology and acoustic analysis procedures follow Köhler et al. (2017). Photographs of the whole bodies and/or body parts of some preserved frogs were taken with a Sony a7r III equipped with a Canon MP-E 65 mm f/2.8 lens.

Sex was determined by observations of calling, presence of vocal slits and/or testes (males), or absence of vocal slits and presence of eggs (in the female). Colour of the holotypes and some paratypes in life was described from digital photographs, and of preserved specimens from photographs and direct observations. Most colours were determined according to a colour matching system created and administrated by the German RAL GmbH; (https://en.wikipedia.org/wiki/RAL_colour_standard). When it was not possible to find an exact match between observed colours and RAL colour numbers, the most similar RAL number was chosen.

Specimens are deposited in the collections of the South Australian Museum, Adelaide, Australia (SAMA), the Museum für Naturkunde, Berlin (ZMB) and the Papua New Guinea National Museum (PNGNM). SJR is the field number of Stephen Richards. Coordinates of collection localities were obtained using the GPS datum WGS84. Data for species' altitudinal ranges was extracted from the IUCN Red List of Threatened species, accessed on 27 January 2024.

Material of *Choerophryne* species examined for this study, including species previously included in *Albericus*, is listed in Günther (2000), Günther & Richards (2011, 2017, 2018) and in Ianella et al. (2014, 2015). Additional comparisons with other "short-nosed" *Choerophryne* relied on the papers by Richards et al. (1992), Burton & Zweifel (1995), Menzies (1999, 2006), Kraus & Allison (2005a, b, 2009) and Kraus (2010, 2013).

Nomenclatural acts

The electronic edition of this article conforms to the requirements of the amended International Code of Zoological Nomenclature, and hence the new names contained herein are available under that Code from the electronic edition of this article. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The LSID (Life Science Identifier) for this publication is: urn:lsid:zoobank.org:pub:774D9BCE-0961-447C-BBD8-0AFF815829FC.

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Choerophryne frieda sp. n.

(Figs 1–5)

ZooBank LSID: urn:lsid:zoobank.org:act:B65B0105-AD4F-4B7A-996C-89CA3740EA2E

Holotype: SAMA R72171 (SJR 12978), adult male, calling when collected, from Horsevaal Pit Camp, Sepik River headwaters, West Sepik Province, Papua New Guinea (4.6964° S, 141.7534° E; 825 m a.s.l.), collected on 15 February 2010 by S. J. Richards.

Paratypes: Adult males, except ZMB 93579 (SJR12842) adult female. SAMA R72170 (SJR12977), ZMB 93576 (SJR12979), same collection data as holotype; ZMB 93577 (SJR12844), from Nena Limestone Camp, Sepik River headwaters, West Sepik Province, Papua New Guinea (4.6439° S, 141.6791° E; 950 m a.s.l.), collected on 11 December 2009 by S. J. Richards; ZMB 93578 (SJR12965), from Koki Camp, Sepik River headwaters, West Sepik Province, Papua New Guinea (4.6800° S, 141.7698° E; 560 m a.s.l.), collected on 10 February 2010 by S. J. Richards; SAMA R72166 (SJR12662), R72167 (SJR12683), R72168 (SJR12719), R72169 (SJR12843), ZMB 93579 (SJR12842), PNGNM (SJR12752, 12759), from Nena Camp, Sepik River headwaters, West Sepik Province, Papua New Guinea (4.6530° S, 141.7241° E; 835 m a.s.l.), collected between 29 November and 12 December 2009 by S. J. Richards.

Diagnosis: Included within *Choerophryne* based on the combination of jaws eleutherognathine; procoracoids, clavicles and omosternum absent; musculus depressor mandibulae arising mostly from the otic ramus of the squamosal bone; fifth toe longer than third; and forearms relatively long.

The new species lacks an elongated snout and can be distinguished from other short-snouted congeners by the following unique combination of characters: (1) moderate size (SUL in males (n = 11) 16.8–20.6 mm (mean 19.0 ± 1.35) and in one female 21.1 mm); (2) finger discs wider than toe discs (T4D/F3D 0.69–0.93); (3) shanks short (TL/SUL 0.40–0.45); (4) eyes moderately small (ED/SUL 0.94–0.116); (5) eye–naris distance distinctly greater than internarial distance (END/IND 1.19–1.43); (6) dorsal surfaces with many conspicuous tubercles of different sizes; (7) dorsal tubercles in life deep orange (RAL 2011) with pearl white (RAL 1013) tips; (8) conspicuous pearl white spot extends from posterior lower margin of eye to corner of mouth; (9) broad pearl white (often with yellow tinge) band present on proximal thigh and on distal shank; (10) advertisement call a single very short, finely pulsed but melodious note sounding like 'meep', uttered in series with call duration 77–125 ms, pulse repetition rate 311–495 pulses/s, and dominant frequency 2.9 kHz.

Description of the holotype (Figs 1a–e): Adult male with SUL of 20.3 mm; measurements and ratios are listed in Table 1. Head slightly broader than long (HL/HW 0.88); snout shape in dorsal view subelliptical, snout protruding in profile; nostrils near tip of snout, directed laterally, not visible from above, distance between nares much less than distance between eye and naris (END/IND 1.43); canthus rostralis rounded; loreal region sloped; tongue medium sized, posterior half free, without posterior indentation; anterior prepharyngeal ridge with central lobe, posterior prepharyngeal ridge not serrated; vocal slits long, on both sides of mouth floor; tympanum including anulus clearly visible in preserved specimen, more weakly expressed but detectable in life. Shanks short (TL/SUL 0.40). Fingers unwebbed with broad, grooved terminal discs, their relative lengths 3 > 4 > 2 > 1; disc of third finger more than twice width of penultimate phalanx, two metacarpal tubercles and all subarticular tubercles weakly developed.

All toes with wide, grooved terminal discs, those of fourth toe narrower than those of third finger (T4D/F3D 0.86); toes unwebbed, inner metatarsal tubercle and distal subarticular tubercles weakly developed; relative lengths of toes 4 > 5 > 3 > 2 > 1. All dorsal surfaces with tubercles visible in life and in preservative. Ventral surfaces granular.

Colour of lateral surfaces of body in life predominantly beige (RAL 1001) with some pearl white (RAL 1013) spots; pearl white spots also on hind legs; tubercles on lateral surfaces whitish-crème or orange brown (RAL 8023); dorsal surfaces of limbs beige with orange brown and whitish-crème tubercles; conspicuous tubercles above insertion of upper arm orange brown; dorsal surfaces of body and head darker than lateral surfaces, with numerous orange brown tubercles and wrinkles, black spots across entire dorsum, two on anterior of back particularly prominent. Iris ivory (RAL 1014) with orange brown inner margin and darker zones above, below, and anterior and posterior of pupil (Fig. 1a).

Colour of all dorsal and lateral surfaces in preservative predominantly green beige (RAL 1000); middle of back and limbs with black flecks of varying size, but darker flecks absent from lateral surfaces. Ivory white (RAL 1015) lumbar ocelli present (Fig. 1b). Base colour of ventral surfaces green beige with dense fawn brown (RAL 8007) reticulation on belly and hind legs; throat densely reticulated with quartz grey (RAL 7039), chest less mottled (Fig. 1c). Colour of ventral surfaces of hands and feet is illustrated in Figures 1d–e.

Variation: Measurements and body ratios of the type series fall within narrow limits (Table 1). Eleven males have SULs between 16.8 and 20.6 mm (mean 18.97 ± 1.35) and one female measures 21.1 mm. There is some variation in number and size of tubercles on the dorsum, but colour of the type specimens in life varies considerably (Figs 2a–f). SAMA R72167 (Figs 2a–b) is ivory (RAL 1014) laterally with dorsal surfaces of head, body and extremities ochre yellow (RAL 1024); tubercles on head, back and extremities deep orange (RAL 2011); ivory white postocular spot extends from posterior edge of lower eye margin to corner of mouth, further ivory white spots are on anterior and posterior body sides and on proximal thighs and distal shanks. SAMA R72166 (Fig. 2c) is beige (RAL 1001) laterally with dorsal surfaces of head and back orange brown (RAL 8023), dorsal surface of foreleg saffron yellow (RAL 1017), of hind leg saffron yellow mixed with grey; most tubercles on dorsal surfaces deep orange with white tips; a few sepia brown (RAL 8014) spots on dorsal surface; pale postocular spot interspersed with grey. SAMA R72169 (Fig. 2d) has particularly conspicuous tubercles on dorsal surfaces otherwise it closely resembles the preceding specimen. ZMB 93578 (Fig. 2e) differs from the others mainly by its much darker colouration with dorsal and lateral surfaces including tubercles predominantly terra brown (RAL 8028); dorsal surface of head and middle and posterior of back orange brown (RAL 8023). ZMB 93576 (Fig. 2f) is brightest among specimens for which illustrations in life are available. Base colour of dorsal and lateral surfaces is green beige (RAL 1000); ivory white spots between eye and angle of mouth, on anterior back, on upper flanks, on proximal thighs, and on distal shanks; some large dorsal tubercles deep orange (RAL 2011), most other tubercles same basic green beige colour.

In preservative, about half of specimens with predominantly green beige dorsal surfaces and irregular blackish and/or brownish spots and areas and the other half with predominantly brown beige (RAL 1011) dorsal surfaces with some irregular brighter spots. Most specimens show two dark brown spots bordered ventrally by a lighter spot on anterior back and a light band on distal shank; some specimens show further light bands or spots on hind

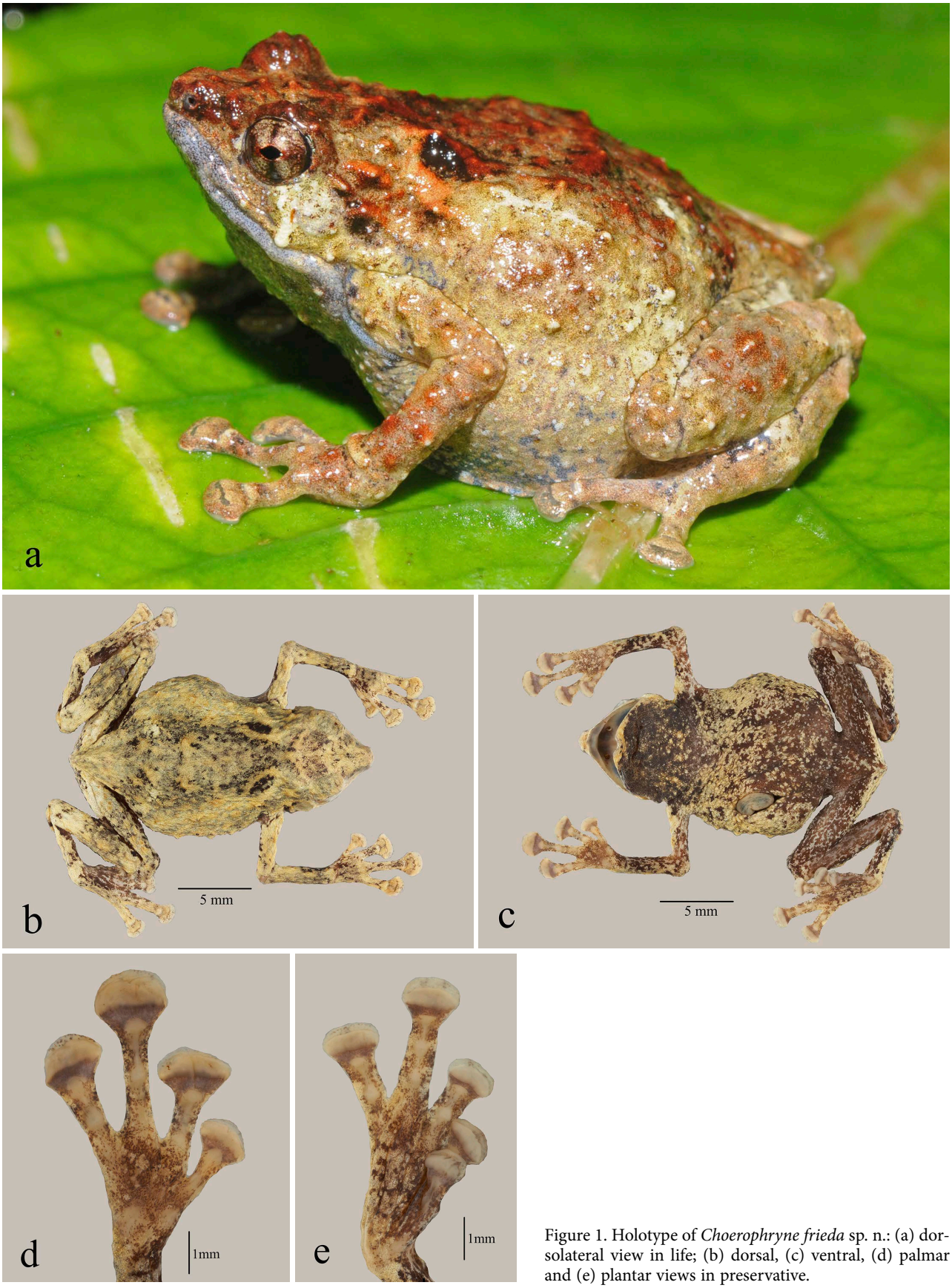

Figure 1. Holotype of *Choerophryne frieda* sp. n.: (a) dorsolateral view in life; (b) dorsal, (c) ventral, (d) palmar and (e) plantar views in preservative.

Table 1. Body measurements and body ratios of the type series of *Choerophryne frieda* sp. n. SAMA R72171 is the male holotype. All measurements in mm; M = male, F = female; for explanation of abbreviations see "Material and methods".

Reg.-No.	SAMA R72166	SAMA R72167	SAMA R72168	SAMA R72169	SAMA R72170	SAMA R72171	PNGNM 12752	PNGNM 12759	ZMB 93576	ZMB 93577	ZMB 93578	ZMB 93579	Mean±SD
Sex	M	M	M	M	M	M	M	M	M (?)	M	M	F	
SUL	20.2	17.2	18.0	20.3	19.9	20.3	20.6	18.4	16.8	18.2	18.8	21.1	
TL	8.6	7.4	7.8	8.4	8.3	8.1	8.8	8.0	7.4	7.7	8.5	8.8	
TaL	5.4	4.8	5.3	5.5	5.8	6.0	6.0	5.5	5.0	5.6	5.4	6.0	
FtL	7.2	7.0	7.4	7.9	7.8	7.5	7.5	7.3	6.2	7.1	7.0	7.8	
T4D	1.1	1.1	1.3	1.1	1.4	1.3	1.3	1.2	1.1	1.2	1.3	1.3	
T1D	0.9	0.8	1.1	1.0	1.0	1.0	1.1	1.0	0.8	0.9	1.1	1.0	
HdL	6.0	5.3	6.1	5.7	6.2	5.7	6.4	5.4	5.2	5.6	5.5	6.1	
F3D	1.4	1.5	1.6	1.6	1.5	1.4	1.5	1.4	1.4	1.6	1.5	1.7	
F1D	1.0	0.8	1.1	1.0	1.0	1.1	1.1	1.0	0.9	1.1	1.0	1.2	
HL	5.8	5.1	5.8	6.0	5.6	6.1	6.0	5.6	5.2	5.7	5.8	6.2	
HW	7.4	6.4	6.6	7.0	6.9	6.9	7.0	6.8	5.9	6.1	6.7	7.0	
END	1.9	1.8	1.8	1.8	2.0	2.0	1.8	1.7	1.7	1.9	1.8	1.9	
IND	1.5	1.4	1.4	1.5	1.5	1.4	1.5	1.3	1.2	1.4	1.3	1.6	
SL	3.0	2.8	2.7	3.1	3.2	3.1	3.0	2.5	2.8	3.0	3.0	3.3	
EST	2.5	2.2	2.3	2.3	2.6	2.7	2.5	2.4	2.4	2.6	2.6	2.7	
ED	2.1	2.0	2.0	2.1	2.1	1.9	2.1	1.9	1.9	1.8	2.1	2.2	
TyD	1.0	0.7	0.8	0.8	0.9	1.2	1.1	0.9	1.0	1.0	0.9	1.2	
TL/SUL	0.43	0.43	0.43	0.41	0.42	0.40	0.43	0.43	0.44	0.42	0.45	0.42	0.43±0.013
TaL/SUL	0.27	0.28	0.29	0.27	0.29	0.30	0.29	0.30	0.30	0.31	0.29	0.28	0.29±0.012
FtL/SUL	0.36	0.41	0.41	0.39	0.39	0.37	0.36	0.40	0.37	0.39	0.37	0.37	0.38±0.018
T4D/SUL	0.054	0.064	0.072	0.054	0.070	0.064	0.063	0.065	0.065	0.066	0.069	0.062	0.064±0.006
T1D/SUL	0.045	0.047	0.061	0.049	0.050	0.049	0.053	0.054	0.048	0.049	0.059	0.047	0.051±0.005
HdL/SUL	0.30	0.31	0.34	0.28	0.31	0.28	0.31	0.29	0.31	0.31	0.29	0.29	0.30±0.017
F3D/SUL	0.069	0.087	0.089	0.079	0.075	0.069	0.073	0.076	0.083	0.088	0.080	0.081	0.079±0.008
F1D/SUL	0.050	0.047	0.061	0.049	0.050	0.054	0.053	0.054	0.054	0.060	0.053	0.057	0.053±0.005
T4D/F3D	0.77	0.73	0.81	0.69	0.93	0.86	0.87	0.86	0.79	0.75	0.87	0.76	0.81±0.071
T1D/F1D	0.90	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.89	0.82	1.10	0.83	0.95±0.083
HL/SUL	0.25	0.30	0.32	0.30	0.28	0.30	0.29	0.30	0.31	0.31	0.31	0.29	0.30±0.018
HW/SUL	0.37	0.37	0.37	0.34	0.35	0.34	0.34	0.37	0.35	0.34	0.36	0.33	0.35±0.015
HL/HW	0.78	0.78	0.88	0.86	0.81	0.88	0.86	0.82	0.88	0.93	0.87	0.89	0.85±0.046
END/SUL	0.094	0.105	0.100	0.089	0.101	0.099	0.087	0.092	0.101	0.105	0.096	0.090	0.097±0.006
IND/SUL	0.074	0.081	0.078	0.074	0.075	0.069	0.073	0.071	0.071	0.076	0.069	0.076	0.074±0.004
END/IND	1.27	1.29	1.29	1.20	1.33	1.43	1.20	1.31	1.42	1.36	1.38	1.19	1.31±0.083
ED/SUL	0.104	0.116	0.111	0.103	0.106	0.094	0.102	0.103	0.113	0.099	0.112	0.104	0.106±0.006
TyD/SUL	0.050	0.041	0.044	0.039	0.045	0.059	0.053	0.049	0.060	0.055	0.048	0.057	0.050±0.007
TyD/ED	0.48	0.35	0.40	0.38	0.43	0.63	0.52	0.47	0.53	0.56	0.43	0.55	0.48±0.084
SL/SUL	0.149	0.163	0.150	0.153	0.161	0.153	0.146	0.136	0.167	0.165	0.160	0.156	0.155±0.009
EST/SUL	0.124	0.128	0.128	0.113	0.131	0.133	0.121	0.130	0.143	0.143	0.138	0.128	0.130±0.009

limbs and on urostyle region. Lumbar ocelli are more or less pronounced, and are lacking in some specimens completely. A light postocular spot that includes parts of or the entire tympanum occurs in almost all specimens. Most specimens exhibit a pair of longitudinal curved skin ridges on anterior back and more or less developed tubercles on dorsal surfaces. Colour pattern of ventral surfaces in most specimens is similar to that of the holotype except SAMA R72166, ZMB 93576, ZMB 93577 and ZMB 93579 which have a much lighter throat and also more sparsely pigmented remaining ventral surfaces. All ventral surfaces are smooth or finely grained.

Distribution and ecological notes: *Choerophryne frieda* sp. n. is known from four locations between 560–950 m a.s.l. All locations are within an approximately 10 km radius, in the extensively forested northern foothills of the Central Cordillera in far western Papua New Guinea (Fig. 7). Males normally call at night from leaves on low vegetation between 1.0–1.5 m above the ground in wet hill forest (Fig. 3). One male was calling from a hidden position within a crevice in a tree trunk at a similar height. Like other asterophryine microhylid frogs they presumably breed by direct development (Günther 2006, Anstis et al. 2011) so calling males were not closely associated with streams.

Figure 2. *Choerophryne frieda* sp. n. in life showing variation in dorsal colouration: (a–b) SAMA R72167, (c) SAMA R72166, (d) SAMA R72169, (e) ZMB 93578, (f) ZMB 93576.

Vocalisation: The advertisement call of the new species consists of a single, finely pulsed note sounding like a short 'meep', uttered in short (< 30 seconds) or long (several minutes) sequences (Fig. 4). Calls have a musical quality which, combined with the very finely pulsed structure, produces a sound that is intermediate between the unpulsed call of *C. murrita* (Kraus & Allison, 2009) and the harsher buzzing calls of many other species (Günther & Richards 2018). We analysed a series of 65 calls produced by the holotype (SAMA R72171) at 23.0 °C, of 25 calls produced by SAMA R72167 at 23.5 °C and of 46 calls of SAMA R72170 at 23.0 °C. Although most call features including length and intercall interval vary only slightly among these specimens the number of pulses per call as well as pulse repetition rate vary significantly so we present results for each frog separately. The series of 65 calls produced by the holotype lasted 2.14 minutes. Mean duration of 48 randomly selected calls was 96 ± 4.26 ms, range 85–105; mean duration of 48 intercall intervals 2.07 ± 0.39 s, range 1.6–3.7; mean number of pulses per call 43.5 ± 2.21, range 37–48; mean number of pulses/s 454 ± 11.9, range 430–495. The 25 calls from SAMA R72167 had a mean call length of 115 ± 2.8 ms, range 108–119; mean inter-call interval length 1.7 ± 0.27 s, range 1.30–2.35, mean number of pulses per call 52.2 ± 1.71, range 49–55; mean number of pulses/s 456 ± 16.1, range 415–478. The 46 calls from SAMA R72170 had a mean call length of 102 ± 9.6 ms, range 77–125; mean inter-call interval length 2.2 ± 0.46 s, range 1.6–3.6; mean number of pulses per call 36.6 ± 2.91, range 32–43; mean number of pulses/s 360 ± 22.6,

Figure 3. Upper hill forest habitat of *Choerophryne frieda* sp. n. on the northern slopes of Papua New Guinea's Central Cordillera.

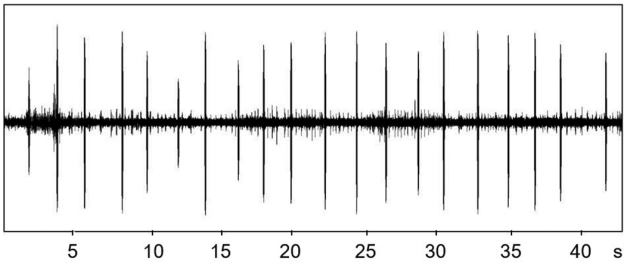

Figure 4. Wave form of 20 consecutive calls from a longer series produced by the holotype of *Choerophryne frieda* sp. n. (SAMA R72171) showing relative uniformity of inter-call intervals.

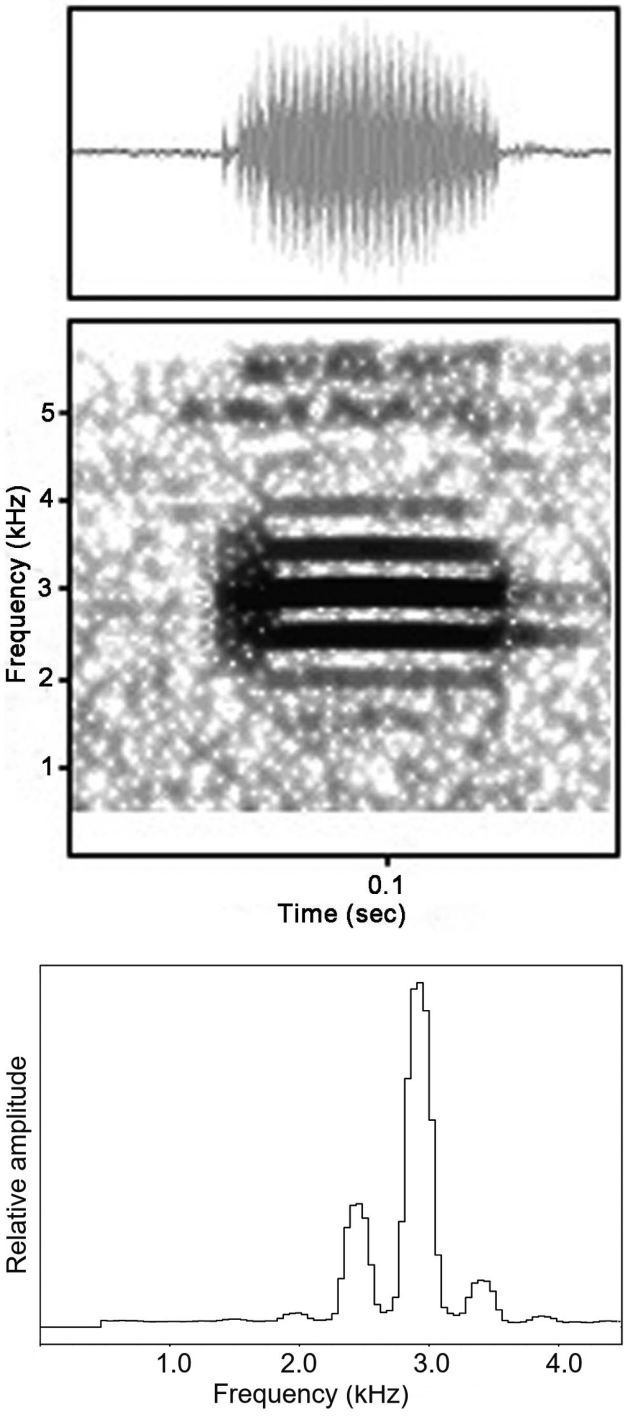

Figure 5. Wave form (above), spectrogram (middle) and amplitude spectrum (below) of a single call of *Choerophryne frieda* sp. n. from the series illustrated in Figure 4. Parameters: FFT-length 256; Frame size 100%; Window FlatTop; Bandwidth 176 Hz; Resolution 47 Hz; Overlap 93.75 %; sampling rate conversion 48 kHz to 12 kHz, sample units 16.

range 311–393. Most of the harmonically structured calls start with a few pulses of low intensity that are produced at a slower rate than later pulses. Amplitude of pulses rises gradually at the beginning of the note and decreases gradually at the end of the note (Fig. 5 above). Frequencies scatter mostly between 2.0 and 4.0 kHz; dominant frequency is at 3.0 kHz (Fig. 5 middle and below).

Etymology: The specific epithet "*frieda*" is a proper noun in nominative singular and refers to the Frieda River in northwestern Papua New Guinea in the vicinity of which the new species was discovered.

Comparisons with other species: With its short snout *C. frieda* differs from all 14 *Choerophryne* with an elongated snout and would have previously been placed in the synonymous genus *Albericus*. According to Frost (2024) 23 species of short-snouted *Choerophryne* are recognized at present. The advertisement call of most short-snouted species is described as a buzz, squeak, peep, click(s) (Menzies 1999) or a rattle (Günther & Richards 2017), often produced in long series, although these categories are not clearly defined. The new species has a single note call that is intermediate between a buzz and a peep (Menzies 1999) and we focus our comparisons on species that utter similar calls. *Choerophryne alainduboisi* Günther & Richards, 2018 is morphologically similar to *C. frieda* and these species exhibit considerable overlaps in all morphometric characters. They are best distinguished by their advertisement calls (as is the case in many *Choerophryne* species). Calls of the former are much longer than in the latter (303–373 ms [n = 30] vs. 77–125 ms [n = 119]), have a harsh nasal tone (vs. distinctly musical), mean intercall interval is about 4 s between calls in the former and about 2 s in the latter, and mean dominant frequency is at 3.25 kHz in the former and 2.90 kHz in the latter. The distributions of the two species are separated by more than 200 km and by New Guinea's Central Cordillera. *Choerophryne brevicrus* (Günther & Richards, 2012) has shorter shanks (TL/SUL 0.30–0.35 vs. 0.40–0.45), smaller finger discs and toe discs (T4D/SUL 0.030–0.045 vs. > 0.050), a lower END/IND ratio (0.80–1.00 vs. > 1.19) and longer call notes with a lower pulse repetition rate (489–641 ms with 146–197 pulses/s vs. 77–125 ms with 311–495 pulses/s) than *C. frieda* (Günther & Richards 2012). *Choerophryne brunhildae* (Menzies, 1999) has narrower finger discs (F3D/SVL 0.059–0.063 vs. 0.064–0.089) than *C. frieda*. Moreover, call note length in *C. brunhildae* is 435–570 ms, vs. 77–125 ms in the new species, and pulse repetition rate is more than 500 pulses/s in *C. brunhildae* but less than 500 pulses/s in *C. frieda* (Menzies 1999). *Choerophryne darlingtoni* (Loveridge, 1948) is larger than the new species (mean SUL of six male and three female paratypes 23.0 ± 1.55 mm and 23.5–25.9 mm respectively) and has shorter shanks (TL/SUL 0.34–0.37 vs. 0.38–0.42 and narrower finger discs (F3D/SVL 0.054–0.070 vs. 0.064–0.089) than *C. frieda*. Call duration in *C. darlingtoni* is 160–320 ms, with pulse repetition rate of 180–260 pulses/s (vs. 77–125 ms with > 300 pulses/s in *C. frieda*) (Menzies 1999). *Choerophryne fafniri* (Menzies, 1999) is larger (21.0–23.1 mm SVL) than the new species and has a lower END/IND ratio (0.86–1.00 vs. 1.19–1.43). Duration of its calls is more than 500 ms, vs. less than 150 ms in *C. frieda*, and pulse rate is lower (< 220 pulses/s vs. > 300 pulses/s in *C. frieda*) (Menzies 1999). *Choerophryne laurini* (Günther, 2000) is smaller than *C. frieda* (SUL of six males and one female 15.9–17.1 mm and 19.0 mm, respectively). These species also differ in the END/SUL ratio (> 0.110 in *C. laurini* vs. < 0.105 in *C. frieda*) and in their advertisement calls. Those of *C. laurini* last 157–204 ms while those of *C. frieda* last 77–125 ms and dominant frequency of *laurini* calls is at 4.5 kHz, while that of *frieda* calls is at 2.90 kHz (Günther 2000). *Choerophryne murrita* overlaps extensively with *C. frieda* in body size but differs in the ratios IND/SVL (0.081–0.096 vs. 0.069–0.081) and END/IND (1.06–1.23 vs. 1.19–1.43). Calls are unpulsed in *C. murrita* vs. clearly pulsed in the new species (Kraus & Allison 2009). *Choerophryne pandanicola* (Günther & Richards, 2012) has shorter shanks (TL/SUL 0.34–0.38 vs. 0.40–0.45) and a lower END/IND ratio (0.88–1.06 vs. 1.19–1.43) than *C. frieda*. Calls of *C. pandanicola* are longer (229–275 ms vs. 77–125 ms in *C. frieda*) and pulse repetition rate is < 300 pulses/s (vs. > 300 pulses/s in *C. frieda*) (Günther & Richards 2012). *Choerophryne pipiens* Günther, Richards & Tjaturadi, 2018 is morphologically similar to the new species but has a different call; that of *C. pipiens* is unpulsed or at most very finely pulsed (vs. distinctly pulsed in *C. frieda*), is much longer (285–374 ms [n = 44] vs. 77–125 ms in *C. frieda*), and dominant frequency is around 3.25 kHz (vs. 2.90 kHz in *C. frieda*) (Günther et al. 2018). *Choerophryne rhenaurum* (Menzies, 1999) is smaller than *C. frieda* (14.9–15.8 mm vs. 16.8–21.1 mm SVL) and has a higher IND/SVL ratio (0.083–0.089 vs. 0.069–0.081). Calls of *C. rhenaurum* are longer (470–510 ms vs. 77–125 ms) with a slower pulse repetition rate of about 50 pulses/s (vs. > 300 pulses/s) in *C. frieda* (Menzies 1999). *Choerophryne siegfriedi* (Menzies, 1999) has a higher IND/SVL ratio (0.082–0.094 vs. 0.069–0.081), narrower finger discs (F3D/SVL 0.059–0.063 vs. 0.064–0.089) and narrower toe discs (T4D/SVL 0.050–0.054 vs. 0.054–0.072) than the new species. Call duration in *C. siegfriedi* is 160–210 ms (vs. 77–125 ms in *C. frieda*) and pulse repetition rate is 500–600 pulses/s (vs. 300–500 pulses/s in the new species) (Menzies 1999). *Choerophryne tubercula* (Richards, Johnston & Burton, 1992) has a longer head (HL/SVL 0.32–0.34 vs. 0.25–0.32) and a wider internarial distance (IND/SVL 0.079–0.094 vs. 0.069–0.081). Based on 13 calls produced by two males of *C. tubercula* at the type locality, calls are longer (196–217 ms vs. 77–125 ms) and have a slower pulse repetition rate (181–191 pulses/s vs. 300–500 pulses/s in *C. frieda*). *Choerophryne variegata* (Van Kampen, 1923) is known from a single specimen, and its advertisement call is unknown. According to measurements by Menzies (1999) the holotype of this species differs from *C. frieda* by the ratios TL/SVL (0.47 vs. 0.40–0.45), T4D/SVL (0.053 vs. 0.054–0.072), ED/SVL (0.133 vs. 0.094–0.116) and moreover, toes 4 and 5 are connected by webbing in *C. variegata* and not so in *C. frieda*.

***Choerophryne hageni* sp. n.**
(Figs 6, 8, 9)

ZooBank LSID: urn:lsid:zoobank.org:act:8A21EDFC-3454-464E-8506-750ED3926A60

Holotype: SAMA R72039 (FN SJR 10549), adult male, calling when collected, from unnamed camp in upper Kikori River basin, Hela Province, Papua New Guinea (6.0967° S, 143.1045° E; 2060 m a.s.l.), collected on 4 April 2008 by S. J. Richards.

Paratypes: SAMA R72036 (SJR 10537), same details as holotype but collected on 3 April 2008; SAMA R72178 (SJR 9091), adult male, calling when collected, from Gigira Ridge, upper Kikori River basin, Hela Province, Papua New Guinea (5.9477° S, 142.7451° E; 2250 m a.s.l.), collected on 28 April 2005 by S. J. Richards.

Diagnosis: Included within *Choerophryne* based on the combination of jaws eleutherognathine; procoracoids, clavicles and omosternum absent; Musculus depressor mandibulae arising mostly from the otic ramus of the squamosal bone; fifth toe longer than third; and relatively long forearms.

This new species lacks an elongated snout and can be distinguished from other short-snouted congeners by the following unique combination of characters: (1) moderate body size (snout–urostyle length in males (n = 3) 19.3–20.6 mm); (2) fingers and toes without webbing; (3) finger discs wider than toe discs (T4D/F3D 0.79–0.93); (4) shanks fairly short (TL/SUL 0.40–0.42); (5) head moderately wide (HW/SUL 0.38–0.40); (6) eye–naris distance about the same as internarial distance (END/IND 0.94–1.18); (7) some tubercles on dorsal and lateral surfaces; (8) bright Y-shaped mark extending from dorsoposterior eye margin to anterior back; and (9) advertisement call a short, distinctly pulsed buzz uttered in long series with call duration 124–173 ms, pulse repetition rate 145–200 pulses/s, and dominant frequency 2.6–2.9 kHz.

Description of the holotype (Figs 6a–f): Adult male with SUL of 19.3 mm; measurements and ratios are listed in Table 2. Head broader than long (HL/HW 0.74); snout truncate in dorsal view, slightly protruding in profile; nostrils near tip of snout, directed laterally, not visible from above, distance between nares about same as distance between eye and naris (END/IND 0.94); canthus rostralis rounded, loreal region sloped; tongue medium sized, posterior half free with weak indentation; anterior prepharyngeal ridge trilobed, posterior prepharyngeal ridge serrated; vocal slits located posteriorly on both sides of mouth floor; tympanum including annulus clearly expressed in preserved specimen, less conspicuous in life. Fingers unwebbed with broad, grooved terminal discs, their relative lengths 3 > 4 > 2 > 1; disc of third finger more than twice width of penultimate phalanx; metacarpal and subarticular tubercles barely detectable. Shanks short (TL/SUL 0.40); all toes with wide, grooved terminal discs, those of fourth toe narrower than those of third finger (T4D/F3D 0.79); no webbing between toes; no metatarsal tubercles, but some weakly developed subarticular tubercles and skin ridges on soles; relative lengths of toes 4 > 5 > 3 > 2 > 1. All dorsal and lateral surfaces with tubercles, more strongly pronounced

Table 2. Body measurements and body ratios of the holotype (SAMA R72039) and two paratypes (SAMA R72036 and R72178) of *Choerophryne hageni* sp. n. All are males. All measurements in mm; for explanation of abbreviations see "Material and methods".

Reg.-No.	SAMA R72036	SAMA R72039	SAMA R72178	Mean±SD
Sex	M	M	M	
SUL	20.2	19.3	20.6	
TL	8.9	7.8	8.3	
TaL	5.8	5.9	6.1	
FtL	7.7	7.2	8.1	
T4D	1.2	1.1	1.3	
T1D	0.8	1.0	0.9	
HdL	6.0	5.8	6.3	
F3D	1.3	1.4	1.4	
F1D	1.0	1.0	0.9	
HL	6.0	5.8	6.8	
HW	7.6	7.8	8.0	
END	1.7	1.6	2.0	
IND	1.6	1.7	1.7	
SL	3.3	3.1	3.5	
EST	2.3	2.2	2.6	
ED	2.4	2.5	2.5	
TyD	1.1	1.0	1.2	
TL/SUL	0.42	0.40	0.40	0.41±0.012
TaL/SUL	0.29	0.31	0.30	0.30±0.010
FtL/SUL	0.38	0.37	0.39	0.38±0.010
T4D/SUL	0.059	0.057	0.063	0.060±0.003
T1D/SUL	0.040	0.052	0.044	0.045±0.006
HdL/SUL	0.30	0.30	0.31	0.30±0.006
F3D/SUL	0.064	0.073	0.069	0.069±0.005
F1D/SUL	0.050	0.052	0.044	0.049±0.004
T4D/F3D	0.92	0.79	0.87	0.86±0.066
T1D/F1D	0.80	1.00	1.00	0.93±0.115
HL/SUL	0.30	0.30	0.33	0.31±0.017
HW/SUL	0.38	0.40	0.39	0.39±0.010
HL/HW	0.79	0.74	0.85	0.79±0.055
END/SUL	0.084	0.083	0.097	0.088±0.008
IND/SUL	0.079	0.088	0.083	0.083±0.005
END/IND	1.06	0.94	1.18	1.06±0.120
ED/SUL	0.119	0.130	0.121	0.123±0.006
TyD/SUL	0.054	0.052	0.058	0.055±0.003
TyD/ED	0.46	0.40	0.48	0.45±0.042
SL/SUL	0.163	0.161	0.170	0.165±0.005
EST/SUL	0.114	0.114	0.126	0.118±0.007

Figure 6. Holotype of *Choerophryne hageni* sp. n., (SAMA R72039): (a) dorsolateral view and (b) ventral view, in life; (c) dorsal view, (d) ventral view, (e) palmar view and (f) plantar view, in preservative.

in life than in preservative. Ventral surfaces of head, chest and abdomen granular, of limbs smooth.

In life (Fig. 6a), dorsal and lateral surfaces brown-beige (RAL 1011) covered with orange brown (RAL 8023) spots of different size and intensity on mid dorsum, on urostyle region, on head and on limbs; some brown spots on dorsal limbs, above tympanum and on anterior of back. An irregular beige longitudinal stripe present on upper flank and conspicuous Y-shaped light ivory (RAL 1015) mark from dorsal eye margin to scapular region and narrow interocular stripe of same colour. Iris silvery with dense black veining and solid black triangle in middle of dorsal half. Ventral surfaces (Fig. 6b) with stone grey (RAL 7030) areas and larger spots of same colour as well as numerous small white dots.

In preservative (Figs 6c–f) dorsal and lateral surfaces various shades of brown interspersed with light ivory (RAL 1015) areas especially on limbs, urostyle region, middle and anterior of dorsum as well as between eyes. Base colour of ventral surfaces ivory with scattered dark brown (RAL 8003) dots. These dots are equally distributed on throat, and form some inconspicuous flecks on abdomen and more pronounced mottling on ventral surfaces of limbs.

Morphological variation: Measurements and body ratios of the two paratypes are similar to the holotype (Table 2). Colour in life of SAMA R72178 was not recorded. Head sides, flanks and dorsal limbs of the paratype SAMA R72036 in life uniform beige (RAL 1001) with signal-grey (RAL 7004) areas and spots on dorsal limbs, on anterior insertion of front legs and in lumbar region; dorsal surfaces of head, neck and back predominantly grey-beige (RAL 1019); a conspicuous V-shaped spot present in middle of back, its margins beige and its centre orange-brown; orange-brown areas also present on sacrum; postocular stripe grey-brown; characteristic V-shaped mark and interocular stripe beige; conspicuous also are pale areas around tibio–tarsal articulation, on proximal thigh and on urostyle region. Dorsal surfaces of preserved paratype SAMA R72036 dominated by mixture of grey and brown tones. Conspicuous are two light ivory coloured, Y-shaped marks between eyes and anterior of back, the two arms of these marks each enclosing a brown beige spot, a light ivory coloured cross-figure between eyes, and a broad light longitudinal band from middle of back to posterior of body and continuing on to rear of thighs and on tibio–tarsal joint. Inconspicuous light lumbar spots are bordered posteriorly by brown-beige (RAL 1011) spots.

Distribution and ecological notes: *Choerophryne hageni* sp. n. is currently known from two locations 40 km apart in the mountains of Hela Province, Papua New Guinea (Fig. 7). Both are in extremely wet, mossy montane *Nothofagus* for-

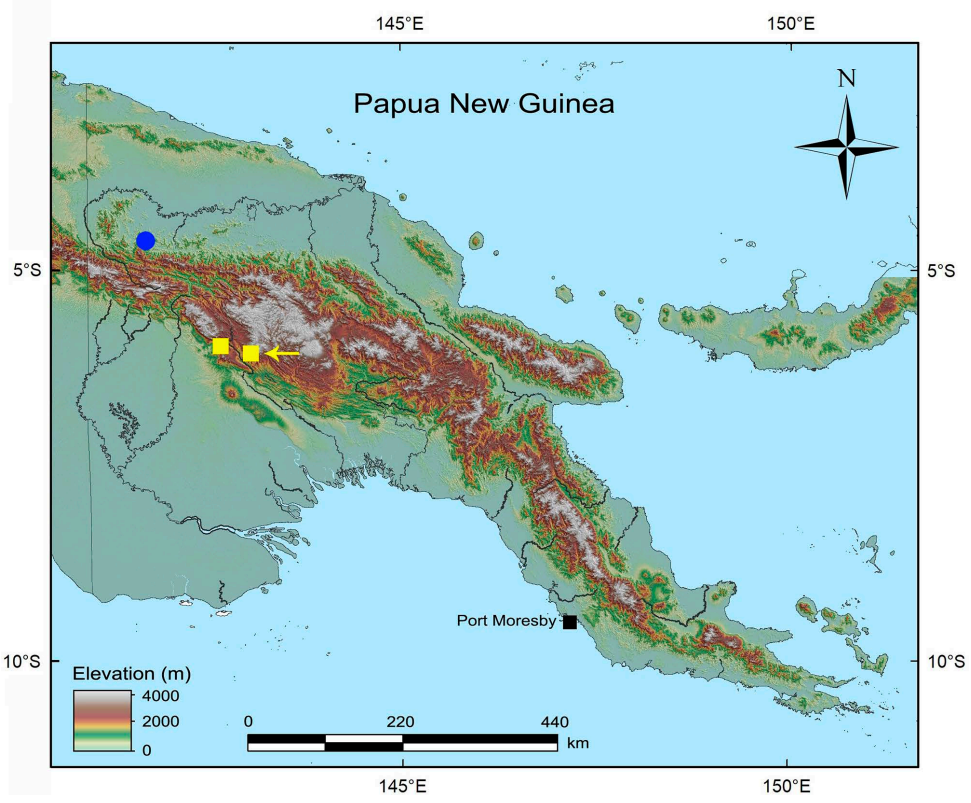

Figure 7. Map of Papua New Guinea showing the known localities of *Choerophryne frieda* sp. n. (blue dot) and *C. hageni* sp. n. (yellow squares). The symbol for *C. frieda* covers four closely separated sites including the type locality. The arrow indicates the type locality for *C. hageni* sp. n.

est (2060 and 2250 m a.s.l.). *Choerophryne hageni* sp. n. is an arboreal species; at the type locality males were calling from heights of about 4 m above the ground while on Gigira Ridge males normally called from heights of more than 10 m above the forest floor in trees, including *Pandanus*, on steep, rugged karst terrain (Fig. 8). Like other asterophryine microhylid frogs they presumably breed by direct development (Anstis et al. 2011), so calling males were not closely associated with streams.

Vocalisation: The advertisement call of *C. hageni* sp. n. consists of a single, distinctly pulsed note sounding like a sharp buzz. Calls are uttered in long series that can last several minutes, although shorter series of less than a dozen calls may also be produced. We recorded advertisement calls of all three type specimens; calls of the three individuals are similar in most features but differ in some parameters so we present results for each frog separately and then a summary of means and ranges for all three specimens. Eleven consecutive calls from the holotype (SAMA R72039) recorded at an air temperature of 15.8 °C have a mean length of 146 ± 9.25 ms, range 134–165; mean length of call intervals 3.25 ± 1.23 s, range 2.2–6.5; mean number of pulses per call 22.3 ± 1.35, range 20–25; mean number of pulses per second 153 ± 6.6, range 145–165, mean dominant frequency 2.79 ± 0.054 kHz, range 2.7–2.9. Five consecutive calls from the paratype SAMA R72178 recorded at an air temperature of 15.0 °C have a mean length of 169 ± 3.08 ms, range 165–173; mean length of call intervals 3.7 ± 1.76 s, range 2.4–6.3; mean number of pulses per call 32.0 ± 1.0, range 31–33; mean number of pulses per second 189 ± 8.14, range 181–

Figure 8. Habitat of *Choerophryne hageni* sp. n. on Gigira Ridge. The species called from high in the trees illustrated here.

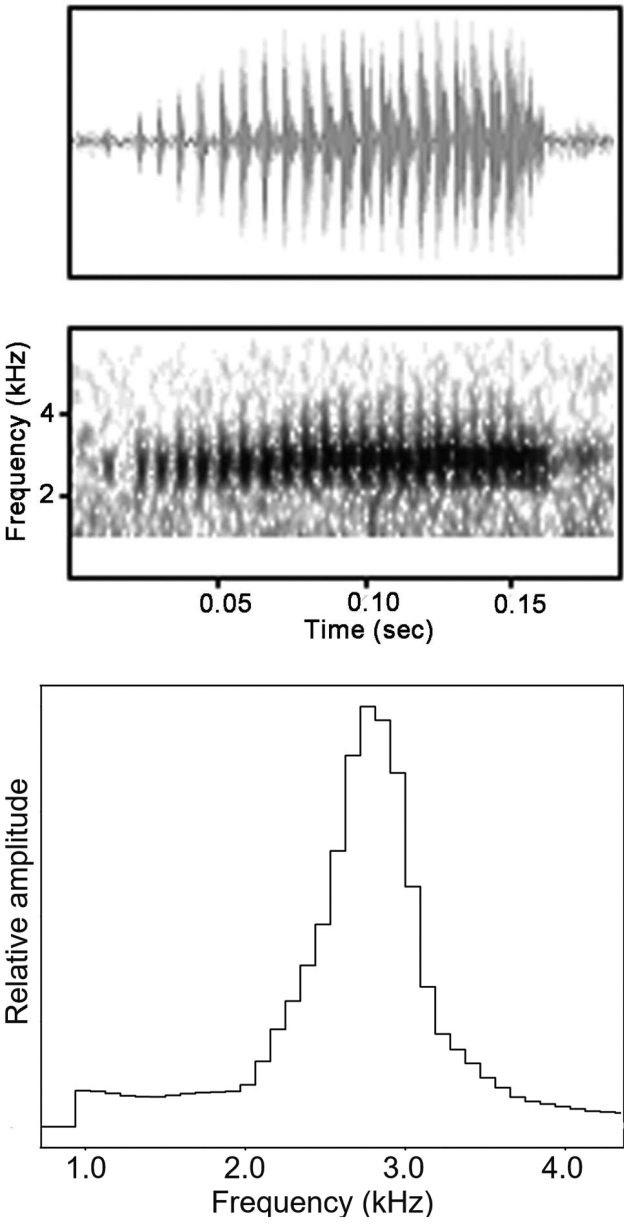

Figure 9. Wave form (above), spectrogram (middle) and amplitude spectrum (below) of a single call from the holotype of *Choerophryne hageni* sp. n. (SAMA R72039). Parameters: FFT-length 128; Frame size 100%; Window FlatTop; Bandwidth 353 Hz; Resolution 94 Hz; Overlap 87.5 %; sampling rate conversion 48 kHz to 12 kHz, sample units 16.

200; mean dominant frequency 2.90 ± 0.042 kHz, range 2.85–2.95. Eleven consecutive calls from SAMA R72036 recorded at an air temperature of 17.6 °C have a mean length of 132 ± 4.67 ms, range 124–139; mean length of call intervals 2.55 ± 0.31 s, range 2.2–3.2; mean number of pulses per call 25.5 ± 1.04, range 24–27; mean number of pulses per second 193 ± 3.94, range 186–198; mean dominant frequency 2.64 ± 0.050 kHz, range 2.60–2.70. Mean of means and range of means of the parameters for all three specimens: mean call length 149 ms, range 132–169; mean intercall interval 3.17 s, range 2.55–3.70, mean number of pulses per call 26.6, range 22.3–32.0; mean number of pulses per second 178.3, range 153–193; mean dominant frequency 2.78 kHz, range 2.64–2.90.

Calls lack a harmonic structure. They start with one or a few pulses of very low intensity that are produced at a slower rate than later pulses. Amplitude of pulses then rises gradually and reaches maximum about halfway through the call, before decreasing rapidly at the end of the call. A single call is illustrated in Figure 9.

Etymology: The specific epithet "hageni" is a latinized proper noun in apposition and genitive and refers to Hagen of Tronje, another figure from the medieval Nibelung Saga. With this name we continue a tradition initiated by Burton & Zweifel (1995) and continued by Menzies (1999) to name *Choerophryne* species after persons in the Nibelung Saga.

Comparisons with other species: With its short snout *C. hageni* differs from all 14 *Choerophryne* with an elongated snout and would have previously been placed in the genus *Albericus*. According to Frost (2024), 23 species of short-snouted *Choerophryne* are recognized at present. The advertisement call of most short-snouted species is described as a buzz, squeak, peep, click or rattle, often produced in long series. The new species has a single note call that is best described as a short buzz and we focus our comparisons on species that utter similar calls.

Choerophryne alainduboisi is smaller than *C. hageni* (males 16.5–18.1 mm vs. 19.3–20.6 mm), with a shorter head (HL/SUL 0.27–0.31 vs. 0.30–0.33), wider finger discs (F3D/SUL 0.072–0.076 vs. 0.064–0.073), a smaller internarial distance (IND/SUL 0.066–0.072 vs. 0.079–0.088) and longer calls (303–373 ms vs. 124–173 ms) (Günther & Richards 2018). *Choerophryne brevicrus* is smaller than the new species (SUL of males 13.4–18.2 mm vs. 19.3–20.6 mm, has shorter shanks (TL/SUL 0.30–0.35 vs. 0.40–0.42), and longer calls (489–641 ms vs. 124–173 ms) (Günther & Richards 2012). *Choerophryne brunhildae* has narrower toe discs (T4D/SVL 0.050–0.054 vs. 0.057–0.063) than *C. hageni*, and call length in *C. brunhildae* is longer (435–570 ms, vs. 124–173 ms in the new species), with pulse repetition rate > 500 pulses/s in *C. brunhildae* vs. 145–200 pulses/s in *C. hageni* (Menzies 1999). *Choerophryne darlingtoni* is larger than the new species (mean SUL of six male paratypes 23.0 ± 1.55 mm vs. 20.0 ± 0.67 mm in three males of the new species), with shorter shanks (TL/SUL of nine paratypes 0.34–0.37 vs. 0.40–0.42 in three types of *C. hageni*), narrower discs on the first finger (F1D/SUL 0.028–0.040 vs. 0.040–0.052) and calls are harmonic (Menzies 2006, p. 288) (vs. inharmonic). *Choerophryne fafniri* is larger (21.0–23.1 mm SVL) than the new species, has narrower toe discs (T4D/SVL 0.043–0.055 vs. 0.057–0.063), and longer calls (> 500 ms, vs. < 200 ms) (Menzies 1999). *Choerophryne frieda* has a narrower head (HW/SUL 0.33–0.37 vs. 0.38–0.40) and shorter calls (< 125 ms vs. > 140 ms) with a much faster pulse repetition rate (311–495 pulses/s vs. 145–200 pulses/s in *C. hageni*). *Choerophryne laurini* is smaller than *C. hageni* (SUL 15.9–17.1 mm [n = 6] vs. 19.3–20.6 mm in *C. hageni*) with a higher END/SUL ratio (> 0.110 in *C. laurini* vs. < 0.097 in *C. hageni*) and calls have a much higher dominant frequency (4.5 kHz vs. 2.6–2.9 kHz in *C. hageni*) (Günther 2000). *Choerophryne murrita* is smaller (male SVL 14.6–18.3 mm [n = 17] vs. 19.3–20.6 mm in three *C. hageni*-males) and has unpulsed, harmonically structured calls with a dominant frequency of 3.5 kHz (vs. clearly pulsed, inharmonic structure with dominant frequency between 2.6 and 2.9 kHz in the new species) (Kraus & Allison 2009). *Choerophryne pandanicola* has shorter shanks (TL/SUL 0.34–0.38 vs. 0.40–0.42) and longer calls (229–275 ms vs. 124–173 ms) with more pulses (46–63 vs. 20–33) than the new species) (Günther & Richards 2012). *Choerophryne pipiens* is smaller (SUL 15.9–18.5 [n = 7] vs. 19.3–20.6 mm) and has a much longer call (285–374 ms [n = 44] vs. 132–169 ms) (Günther et al. 2018). *Choerophryne rhenaurum* is smaller than *C. hageni* (SVL 14.9–15.8 mm vs. 19.3–20.6 mm) with longer calls (470–510 ms vs. 124–173 ms) having a much slower pulse repetition rate (50 pulses/s vs. 145–200 pulses/s in *C. hageni*) (Menzies 1999). *Choerophryne siegfriedi* has a larger head than *C. hageni* (HL/SVL 0.35–0.38 vs. 0.30–0.33 and HW/SVL 0.40–0.44 vs. 0.38–0.40), narrower toe discs (T4D/SVL 0.050–0.054 vs. 0.057–0.063) and calls with a much faster pulse repetition rate (500–600 pulses/s vs. 145–200 pulses/s in *C. hageni*) (Menzies 1999). *Choerophryne tubercula* is smaller than *C. hageni* (SVL 14.4–17.1 mm vs. 19.3–20.6 mm) and has longer calls (196–217 ms vs. 124–173 ms). *Choerophryne variegata* is known from a single specimen, and its advertisement call is unknown. According to measurements presented by Menzies (1999) the holotype of this species differs from *C. hageni* by its smaller size (SVL 17.4 mm vs. 19.3–20.6 mm), longer legs (TL/SVL (0.47 vs. 0.40–0.42), and the following ratios: IND/SVL (0.074 vs. 0.079–0.088), HL/SVL (0.27 vs. 0.30–0.33) and HW/SVL (0.36 vs. 0.38–0.40). Moreover, toes 4 and 5 are connected by webbing in *C. variegata* and not so in *C. hageni*.

Discussion

Melanesia supports the highest insular anuran diversity globally, most of which occurs on the large island of New Guinea (Oliver et al. 2022). The factors generating this extraordinary diversity are complex but are linked closely to the island's complex orogeny (Roycroft et al. (2022), and

Oliver et al. (2017) concluded that mountain uplift was a major driver of diversification in 'short-snouted' *Choerophryne*. Members of this clade occur from sea level to more than 3000 m a.s.l. but they are a predominantly mid-montane group with only four of 24 species occurring below 500 m a.s.l. (one additional species, *C. variegata*, probably occurs in the lowlands but its distribution remains uncertain). Species richness in this clade peaks between 1000 and 2500 m a.s.l. (Kraus 2010, Günther & Richards 2011, 2017, 2018, Oliver et al. 2017) with 11 of the 25 known species occurring above 2500 m a.s.l. In contrast the clade of 'long-snouted' *Choerophryne* comprises predominantly lowland and foothill species, with only two of 14 species known to occur at altitudes above 1500 m a.s.l. (*C. allisoni* Richards & Burton, 2003 and *C. burtoni* Richards, Dahl and Hiaso, 2007).

Choerophryne is currently the third-most diverse genus of microhylid frogs in Melanesia, with 39 recognized species (including the two species described herein) (Frost 2024). Only *Oreophryne* (with 64 currently recognized Melanesian species) and *Cophixalus* (47 Melanesian species) are more species rich. However, Oliver et al. (2022) reported 18 known candidate species (known to researchers in the region but undescribed) of *Choerophryne* and only nine candidate species of *Cophixalus*, so the total known diversity of these two genera is approximately equivalent (57 and 56 species respectively). *Oreophryne* remains by far the most diverse genus in the region (65 named species plus 28 candidate species), although Hill et al. (2022) argued that *Oreophryne* comprises two distinct lineages warranting recognition as different genera.

In their examination of the structure of microhylid communities in northern and eastern New Guinea, Hill et al. (2022) noted that *Choerophryne* is one of the genera most likely to contribute multiple species to assemblages at individual sites. This pattern is evident on Gigira Ridge (but not at the type locality of *C. frieda* sp. n.), where three species of *Choerophryne* occur in sympatry: *C. hageni* sp. n., *C. brevicrus*, and a miniaturized *Choerophryne* species that remains undescribed. Unpublished genetic data indicate that a fourth species may also occur in sympatry with them on Gigira Ridge. The three confirmed species occupy different niches, with *C. hageni* sp. n. being arboreal, *C. brevicrus* scansorial (calling from low shrubs) and the undescribed species occupying litter on the forest floor (Günther & Richards 2011, S. Richards, personal observations). However, niche differentiation is not always evident where multiple species of *Choerophryne* have been confirmed in sympatry in the mountains of southern New Guinea. For example, three species of similar-sized, scansorial, short nosed *Choerophryne* are known to occur at several sites on Iagifu Ridge in Papua New Guinea's Southern Highlands Province: *C. alainduboisi*, *C. multisyllaba* Günther & Richards, 2017 and *C. murrita* (Richards et al. 2021). They are frequently found calling from low foliage within meters of each other, and the factors that permit extensive niche overlap of such morphologically, ecologically and phylogenetically similar species warrants investigation.

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