

Two new *Oreophryne* species from the Fakfak Mountains, West Papua Province of Indonesia (Anura, Microhylidae)

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Accepted 19.x.2015.

Published online at www.senckenberg.de/vertebrate-zoology on 13.xi.2015.

Abstract

On the basis of material collected in the year 2008 in the Fakfak Mountains, Bomberai Peninsula, West Papua Province of Indonesia, two new microhylid frogs in the genus *Oreophryne* are described. Both new species are small (males 23.9–24.1 mm snout-vent length and 16.2–17.8 mm SVL) and belong to those *Oreophryne* that have a ligamentous connection between the procoracoid and the scapula, and by rattling or chirping advertisement calls. The larger species is further characterized by a mostly uniform dark grey-brown or black dorsal colouration with numerous small white flecks and yellow blotches on the hind limbs. The smaller species is characterized by a very small body size, and by a chirping call, this of great similarity to the call of the allopatric *Choerophryne arndtorum*.

Kurzfassung

Auf der Basis von Material, das im Jahr 2008 in den Fakfak Bergen, Bomberai Halbinsel, West Papua Provinz von Indonesien, gesammelt wurde, werden zwei neue Arten der Microhylidengattung *Oreophryne* beschrieben. Beide neue Arten gehören zu den kleinwüchsigen Formen (Männchen haben 23,9–24,1 mm bzw. 16,2–17,8 mm Kopf-Rumpf-Länge) der Gattung, und beide haben eine ligamentöse Verbindung zwischen Procoracoid und Scapula. Im Gegensatz zu den vielen Arten mit piependen oder pfeifenden Paarungsrufen klingen ihre Rufe knatternd (größere Art) bzw. zirpend (kleinere Art). Die größere Art kann von allen übrigen Vertretern der Gattung durch die einförmig dunkel graubraune bis schwarze Oberseite, die mit unzähligen winzigen weißen Flecken und Punkten bedeckt ist, sowie die großen gelbe Flecken an den Hinterextremitäten, abgegrenzt werden. Von den wenigen Arten im gleichen Größenrahmen und einer ligamentösen Verbindung zwischen Procoracoid und Scapula kann die kleinere Spezies durch ihre charakteristisch zirpenden Paarungsrufe, die denen von der auf Yapen Island heimischen Art *Choerophryne arndtorum* täuschend ähneln, unterschieden werden.

Key words

Anura, Microhylidae, new species, western New Guinea.

Introduction

Frogs of the Australasian microhylid genus *Oreophryne* are found from the Philippines in the west to New Britain Island (Papua New Guinea) in the east and reach their greatest diversity on the island of New Guinea (FROST 2015) where numerous new species have been discovered and described since the year 2000 (GÜNTHER 2003a,b; GÜNTHER & RICHARDS 2011; GÜNTHER *et al.* 2001, 2009, 2012, 2014; KRAUS 2011, 2013; KRAUS &

ALLISON 2009; RICHARDS & ISKANDAR 2000; ZWEIFEL 2003; ZWEIFEL *et al.* 2003, 2005). In September 2008 the author, together with Papuan colleagues, studied frogs in the Fakfak Mountains, on the Bomberai Peninsula, in the West Papua Province of Indonesia, island of New Guinea. Among those frogs are two species of the genus *Oreophryne* that are here described as new to science.

Material and methods

Frogs were collected at night after they were located by their advertisement calls. All specimens were photographed in life the next day, anaesthetised with chlorobutanol, and subsequently fixed in 2 % formalin. Tissue probes from thigh muscle were taken from some specimens and probes stored in 96 % ethanol to enable later DNA sequencing, before the animal was fixed in formalin. All specimens were later transferred to 75 % ethanol in the Berlin museum. One specimen of each species was cleared and stained as an osteological preparation according to a method modified from DINGERKUS & UHLER (1977).

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 only:

- SUL snout-urostyle length from tip of snout to distal tip of urostyle bone; SUL is about one to two mm shorter than the snout-vent length (SVL). As the measurement error is higher in the latter, I prefer to use the former. In general, both measurements are more or less identical and are used interchangeably in this paper;
- TL tibia length: external distance between knee and ankle;
- TaL length of tarsus: external distance, tarsal and ankle joints held at right angles;
- T4L length of 4th toe: from tip of toe to proximal end of inner metatarsal tubercle;
- T4D transverse diameter of disc of 4th toe;
- T1D transverse diameter of disc of first toe;
- F3L length of 3rd finger;
- F3D transverse diameter of disc of 3rd finger;
- F1D transverse 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 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.

Advertisement calls were recorded under natural conditions with a Sony Digital Audio Tape (DAT) Walkman TCD-D 100 and a Sennheiser microphone MKE 300 and analysed with Avisoft-SAS Lab Pro software. All specimens are currently housed in the Museum für Naturkunde Berlin (ZMB) and bear registration numbers of this institution. Part of the type series will be transferred to the Museum Zoologicum Bogoriense (MZB), Cibinong, West Java, Indonesia, after completion of my studies.

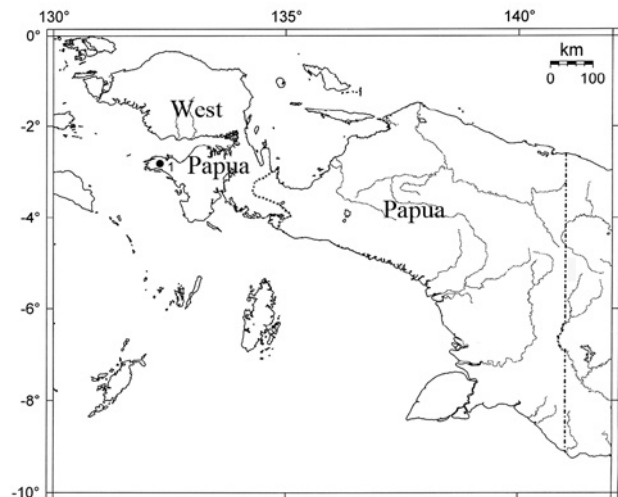


Fig. 1. Map of western New Guinea Island indicating West Papua Province and Papua Province of Indonesia and approximate collection site (closed circle 1) of both new species.

Material compared

Oreophryne albomaculata South Australian Museum Adelaide (SAMA) and Museum für Naturkunde, Berlin (ZMB), type series; *O. albopunctata*, Zoologisch Museum Amsterdam (ZMA) 5821, 5822, syntypes; *O. anthonyi*, The Natural History Museum, London (BMNH) 1947.2.12.34–40, syntypes; *O. asplenicola*, ZMB, type series; *O. atrigularis*, ZMB type series; *O. biroi* (*Mehelyia affinis*), Naturhistorisches Museum Wien (NHMW) 19826, fide ZWEIFEL *et al.* (2003); *O. brevicrus*, American Museum of Natural History, New York (AMNH) 43694, 43697, 43700–02, paratypes; *O. brevisrostris*, ZMB, type series; *O. clamata*, ZMB, type series; *O. crucifer*, ZMA 5819, syntype; *O. curator*, SAMA and ZMB, type series; *O. flava*, ZMA 5823, holotype, AMNH 58152–53, 58155–57; *O. frontifasciata*, National Museum of Natural History, Naturalis, Leiden (RMNH) 1807, lectotype; *O. furu* Museum Zoologicum Bogoriense, Cibinong (MZB Amp.), SAMA and ZMB, type series; *O. geislerorum*, Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt/Main (SMF) 4197, holotype; NHMW 19825: 1–4, fide ZWEIFEL *et al.* (2003); *O. graminis*, University of Papua New Guinea, Port Moresby (UPNG), SAMA and ZMB, type series; *O. habbemensis*, ZMB, type series; *O. idenburgensis*, RMNH 10473 and AMNH A49665–6, A49668, paratypes; *O. inornata*, AMNH 56731, 56903–04, 56984, 57259, paratypes; *O. insulana*, AMNH 56732, 57265, 57266, paratypes; *O. kampeni*, BMNH 1947.2.1214, holotype; *O. kapisa*, ZMB, type series; *O. loriae*, BMNH 1947.2.12.41–42, syntypes; *O. moluccensis*, SMF 4203, lectotype; *O. notata* (AMNH A–81196–97 and A–81199) paratypes; *O. oviprotector*, SAMA and ZMB, type series; *O. parkeri*, Museum of Comparative Zoology, Cambridge (MCZ) 12964, holotype; *O. pseudasplenicola*, ZMB, type series; *O. sibilans*, ZMB, type series; *O. streiffeleri*, SAMA, UPNG and ZMB, type series; *O. unicolor*, ZMB, type series; *O. wapoga*, ZMB, type series; *O. wolterstorffi*, ZMB 16853, holotype. Moreover, I referred to most of the original species descriptions and recompiled treatises to make my comparisons.

Oreophryne roedeli sp. nov.

Holotype. ZMB 83016 (Field number: FN 7917), adult male, about 6 km direct line N of Fakfak Town, near the road Fakfak Town–Kokas Village, Bomberai Peninsula, West Papua Province,

Indonesia, 2°52'37.56" S and 132°18'15.03" E (Fig.1), elevation 500 m above sea level (a.s.l.), collected by R. GÜNTHER and A. PIHAR on 11 September 2008.

Paratypes. ZMB 83017 (FN 7918) and ZMB 83018 (FN 7919), both adult males, collection data the same as for the holotype. ZMB 83017 is now an osteological preparation.

Diagnosis. A small species of the genus *Oreophryne* with a snout–urostyle length in males (n=3) from 23.9–24.1 mm. Connection between procoracoid and scapula ligamentous. No webs between fingers, but basal webs between toes; fifth toe somewhat longer than third; finger discs wider than toe discs (ratio T4D/F3D 0.79–0.89); tibiae of middle size (TL/SUL 0.43–0.47). Eyes middle-sized (ED/SUL 0.112–0.117), eye-naris distance greater than internarial distance (END/IND 1.17–1.29). Dorsal and lateral body surfaces in life dark grey-brown or black with numerous tiny white flecks. A large irregular yellow blotch on anterior thigh extends to inferior thigh and a blotch of same colour on inferior shank may extend to tarsus and foot. In preservative, lateral and dorsal body surfaces dark brown with less contrasting tiny light flecks; yellow blotches on hind limbs now off-white. Advertisement call a loud rattle of 1.6–2.8 seconds (s), notes strongly pulsed and last on average 59 milliseconds (ms), repetition rate 6.7–7.8 notes/s. Dominant frequency at 2.75 kHz.

Description of the holotype (Figs. 2–4). Adult male with a SUL of 23.9 mm. Additional measurements and ratios are listed in Table 1. Head clearly broader than long (HL/HW 0.73), tip of snout rounded in dorsal view (Fig. 2a) and somewhat protruding in lateral view (Fig. 2b); nostrils directed anterolaterally and not visible from above, distance between nares less than distance between eye and naris (END/IND 1.29); canthus rostralis straight; loreal region slightly skewed and its upper margin rounded; tongue long and slender, free posteriorly and without posterior indentation; denticles on prepharyngeal ridge scarcely visible; long vocal slits on both sides of mouth floor; tympanum small (about one-third of eye diameter), near to eye, and hardly visible; no prominent supratympanic fold. Forelegs and hind legs moderately long; fingers unwebbed and with broad and grooved terminal discs (disc of third finger twice width of penultimate phalange), their relative lengths 3>2~4>1 (Fig. 2c); no prominent metacarpal or subarticular tubercles. All toes with wide and grooved terminal discs, discs of toes less than twice as wide as penultimate phalanges; basal webs between all toes, least pronounced between toes 1 and 2; no prominent metatarsal or subarticular tubercles; relative lengths of toes 4>5>3>2>1 (Fig. 2d). A few inconspicuous tubercles on all dorsal and lateral surfaces,)(-shaped glandular folds in the scapular region, lower surfaces smooth except for a semicircular gular fold that indicates the posterior end of the (empty) vocal sac.

Colour in preservative. Dorsal surfaces of body and limbs dark brown with some irregular vague blackish

Table 1. Body measurements and body ratios of the type series of *Oreophryne roedeli* sp. nov. ZMB 83016 is the holotype, all types are adult males, all measurements in mm. Inv.-No.=registration number; explanation of measurements in “Material and methods”.

Inv.-No.	ZMB 83016	ZMB 83017	ZMB 83018	Mean
SUL	23.9	24.0	24.1	24.0
TL	10.8	11.3	10.4	
TaL	6.9	7.1	6.7	
L4T	10.9	11.0	10.3	
T4D	1.7	1.5	1.5	
L3F	7.3	7.8	6.9	
F3D	1.9	1.8	1.9	
F1D	1.3	1.2	1.2	
T1D	1.0	1.0	1.0	
HL	6.3	6.0	6.0	
HW	8.6	8.5	8.4	
SL	3.2	3.1	3.2	
END	2.2	2.1	2.0	
IND	1.7	1.8	1.7	
ED	2.7	2.8	2.7	
TyD	0.8	1.0	0.9	
TL/SUL	0.45	0.47	0.43	0.45
TaL/SUL	0.29	0.30	0.28	0.29
T1D/SUL	0.042	0.042	0.041	0.042
T4D/SUL	0.071	0.063	0.062	0.065
T4L/SUL	0.46	0.46	0.43	0.45
F3D/SUL	0.079	0.075	0.079	0.078
F1D/SUL	0.054	0.050	0.050	0.051
T4D/F3D	0.89	0.79	0.79	0.082
T1D/F1D	0.77	0.83	0.83	0.81
HL/SUL	0.26	0.25	0.25	0.25
HW/SUL	0.36	0.35	0.35	0.35
HL/HW	0.73	0.71	0.71	0.72
SL/SUL	0.134	0.129	0.133	0.132
END/IND	1.29	1.17	1.18	1.20
ED/SUL	0.113	0.117	0.112	0.114
TyD/ED	0.88	0.88	0.67	0.81

flecks and with numerous tiny light flecks. Two irregular whitish blotches in inguinal region. Throat, chest, abdomen, and inferior sides of limbs off-white with dense brown reticulum. Conspicuous, large off-white blotch on anterior thigh that extends to inferior thigh, and a blotch of same colour on inferior shank.

Colour in life. Dorsal and lateral surfaces of body and limbs black with numerous and conspicuous tiny white flecks often arranged in shorter or longer straight or curved rows (Fig. 3). Ventral surfaces of head, trunk, and extremities with a dense pattern of irregular whitish and dark-brown flecks and few more prominent and smaller blotches (Fig. 4) in which the dark brown colour dominates anteriorly and the white posteriorly. The forked off-white inguinal blotch is more pronounced than in the preserved specimen. Large lemon-yellow blotches on anterior and inferior portions of hind legs. Iris rounded in day and horizontally oval at night, brown with relatively

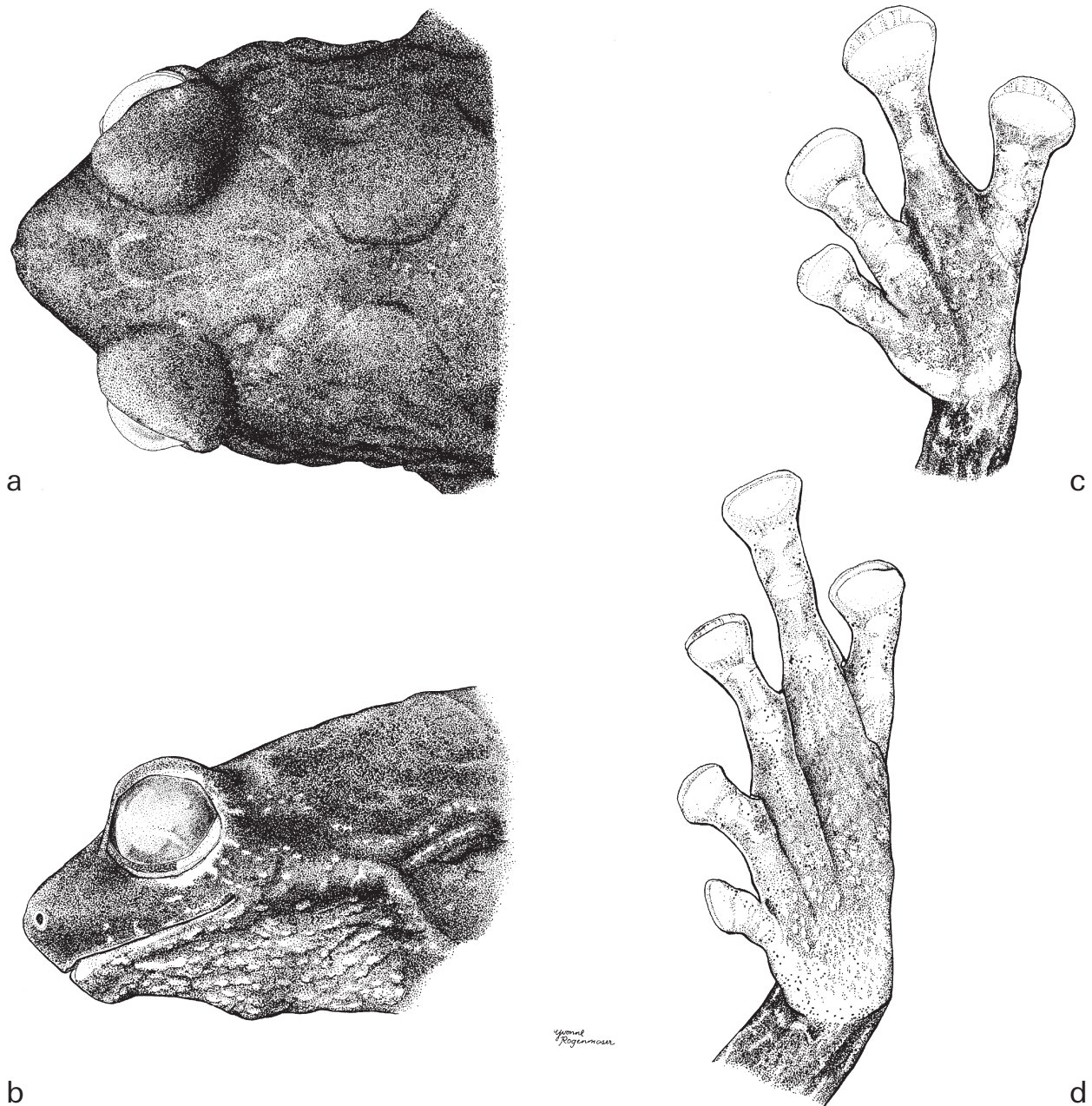


Fig. 2. Preserved holotype of *Oreophryne roedeli* sp. nov. (a) head in dorsal view, (b) head in profile, (c) palmar view of left hand, (d) plantar view of left foot.

few silvery speckles; annulus pericornealis bluish (at least in its upper half).

Morphological characters of the types. For body measurements and ratios of all types see Table 1. All three types are of very similar size (23.9–24.1 mm SUL) and have very similar body ratios. Ground colour of dorsal surfaces varies in life from dark grey-brown (Fig. 5) to blackish and the tiny white flecks may be more or less numerous. In preservative, the dorsal ground colour varies from middle grey-brown to dark grey-brown and the tiny white flecks are scarcely visible. Shape of light inguinal blotch is more (ZMB 83017 and ZMB 83018) or less (ZMB 83016) semicircular. Dimensions of yellow

blotches on hind legs also vary: for example, the blotch on inferior tibia extends onto tarsus and foot in the two paratypes (Fig. 6), but not so in the holotype.

Distribution and ecological notes. We heard and found the new species at only about 500 m a.s.l. near the road from Fakfak Town to Kokas Village. This region was once almost certainly completely covered by primary rain forest, but today vegetation along this road is mostly secondary (Fig. 7). All three collected specimens of *O. roedeli* sp. nov. are males and all three called from holes in bamboo with stems of about 6 cm in diameter. Calling sites were 1.50–3.50 m above the ground and at least 10 m from each other. One specimen was found in a bamboo stem



Fig. 3. Dorsolateral view of the holotype of *Oreophryne roedeli* sp. nov. in life.



Fig. 4. Ventral view of the holotype of *Oreophryne roedeli* sp. nov. in life.



Fig. 5. Dorsolateral view of the paratype ZMB 83017 of *Oreophryne roedeli* sp. nov. in life.



Fig 6. Ventral view of the paratype ZMB 83018, in which yellow colour covers almost the entire length of the underside of the hindlimbs.

directly at the roadside. It seemed that the bamboo chambers served as resonators because the calls sounded very loud.

Vocalisation. Sixteen calls from three males were analysed. The advertisement call of the new species is a very loud rattle of 1.55–2.84 s duration, mean 2.43 ± 0.34 s. The call contains 14–20 strongly pulsed notes (Fig. 8), mean 18 ± 2.3 notes/call. Call notes consist of 5–13 pulses, mean of means 9.4 ± 2.03 , range of means 6.5–12.3 pulses/note. Mean note repetition rate 7.4 ± 0.35 , range 6.7–7.8 notes/s. Mean of means of pulse repetition rate 158 ± 19.9 pulses/s, range 120–189. Mean of means of note length 59 ± 5.7 ms, range of means 51–66 ms, absolute range 31–72 ms. Mean of means of internote length 81 ± 1.34 ms, range of means 79–83 ms, absolute range 67–96 ms. First note(s) as a rule is slightly shorter and first internote interval is slightly longer than the following ones. Notes start in full force with the first pulse somewhat apart from its successors. Amplitude of pulses decreases near note end and the single pulses there are difficult to discriminate. Frequencies scatter in a range from 1.5–5.2 kHz. The dominant frequency is at 2.75 kHz and a weak harmonic band has its main frequency at 5.0 kHz (Fig. 9). Air temperature during recording was 23 °C. Frogs were heard calling from 6.30 to 10.30 p.m.

Etymology. The new species is dedicated to the curator of the Herpetological Collection of the Museum für Naturkunde, Berlin, MARK-OLIVER RÖDEL, on the occasion of his 50th birthday in December 2015 and in recognition of his remarkable contributions to our knowledge of the African herpetofauna.

Comparison with other species. About 30 *Oreophryne* species have a cartilaginous connection (vs. a ligamentous connection as in the new species) between procoracoid and scapula and are not considered further in this paragraph. About 20 species have a ligamentous connection between procoracoid and scapula. The probable maximum size range of *O. roedeli* sp. nov. is from 20–28 mm SUL and the species has a rattling advertisement call. Therefore, species smaller or larger than this range and/or with peeping, squeaking, or trilling calls can be separated from the new species on the basis of these characters. There remain 14 species to be compared more closely: *O. albopunctata*, *O. ampelos*, *O. atrigularis*, *O. biroi*, *O. ezra*, *O. furu*, *O. geislerorum*, *O. hypsiops*, *O. kapisa*, *O. loriae*, *O. mertoni*, *O. wapoga*, *O. frontfasciata*, and *O. wolterstorffi*. None of these species has a uniformly dark grey-brown or black dorsal surface with numerous conspicuous tiny white flecks in life (inconspicuous in preservative), and none has yellow blotches (off-white in preservative) on hind legs, characters typical of the new species. *Oreophryne parkeri* exhibits a dorsal colouration in life similar to that of *O. roedeli* sp. nov., but *O. parkeri* has a peeping advertisement call and lacks yellow blotches on the hind legs.

Oreophryne choerophrynoides sp. nov.

Holotype. ZMB 83019 (FN 7936), adult male, about 10 km direct line N of Fakfak Town, near the road Fakfak Town–Kokas Village, Bomberai Peninsula, West Papua Province, Indonesia, 2°50′07.94″ S and 132°18′20.30″ E (Fig. 1), elevation 860 m a.s.l., collected by R. GÜNTHER and M. KAPISA on 12 September 2008.

Paratypes. ZMB 83020 (FN 7844), ZMB 83021 (FN 7845), ZMB 83022 (7846), all collected on 5 September 2008, other data as for the holotype; ZMB 83023 (FN 7910) collected on 10 September 2008 by R. GÜNTHER and M. KAPISA at 700 m a.s.l. near road Fakfak Town–Kokas, 2°51′28.91″ S and 132°18′08.60″ E. This last specimen is now an osteological preparation.

Diagnosis. A very small species of the genus *Oreophryne* with a snout-urostyle length in males ($n=5$) from 16.2–17.8 mm and large eyes (ED/SUL 0.142–0.152). Ligamentous connection between procoracoid and scapula; no webs between fingers nor between toes. Fifth toe slightly longer or same length as third; finger discs slightly wider than toe discs (ratio T4D/F3D 0.82–0.92). Other characteristic ratios: TL/SUL 0.46–0.51, HL/HW 0.81–0.91, TyD/ED 0.27–0.40 and END/IND 0.79–0.94. Dorsal surfaces in life grey-brown with some irregular dark brown and off-white spots or reddish-brown with dark brown spots; in preservative lighter or darker grey-brown with lighter and darker smaller and larger spots. Advertisement call consists of 3–6 finely pulsed chirps (notes), mean duration of these distinctively pulsed notes 114 ms, repetition rate 3.9–6.0 notes per second (s). Dominant frequency with 6.25 kHz, which is fairly high for the genus.

Description of the holotype (Figs. 10a–d, 11). Adult male with a SUL of 17.6 mm. For measurements and ratios see Table 2. Head broader than long, tip truncate in dorsal view (Fig. 10a) and rounded in profile (Fig. 10b); nostrils directed anterolaterally, very close to tip of snout and visible from above, distance between nares greater than distance between eye and naris (END/IND 0.94); canthus rostralis sharply edged and slightly curved from above; loreal region weakly concave and vertically skewed; tongue broad and long, free posteriorly and laterally, with a weak posterior indentation (during handling the posterior margin was damaged); both prepharyngeal ridges with small denticles; long vocal slits on both sides of mouth floor; tympanum small, near eye, and its margins scarcely visible; supratympanic fold scarcely developed; legs moderately long; fingers unwebbed and with broad and grooved terminal discs, their relative lengths $3 > 4 > 2 > 1$ (Fig. 10c); discs of fingers about twice as wide as penultimate phalanges; no prominent metacarpal or subarticular tubercles; all toes with wide and grooved terminal discs and no webs; no prominent metatarsal or subarticular tubercles; third finger disc wider than that on fourth toe (T4D/F3D 0.83), relative lengths of toes $4 > 5 > 3 > 2 > 1$ (Fig. 10d). In preservative and in life, dorsal surfaces of head and body as well as dorsolateral body surfaces with some tubercles; all ventral surfaces smooth.



Fig. 7. Habitat of *Oreophryne roedeli* sp. nov. in the Fakfak Mountains.

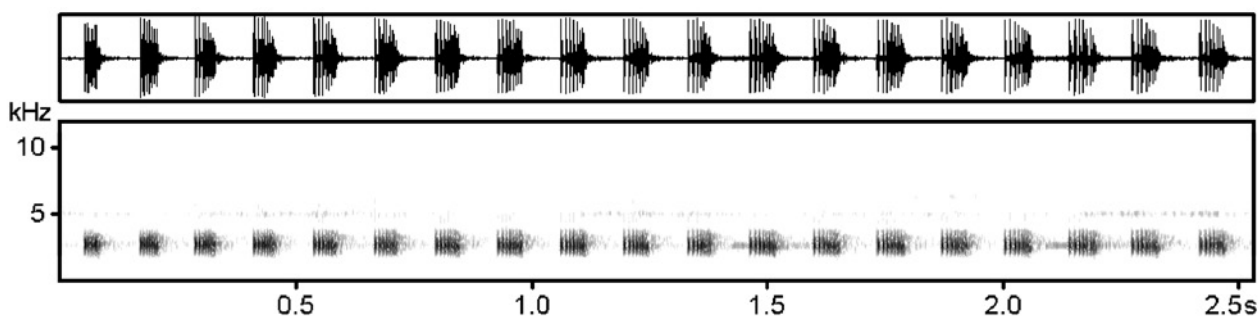


Fig. 8. Wave form (above) and spectrogram (below) of an advertisement call from *Oreophryne roedeli* sp. nov. with 19 notes.

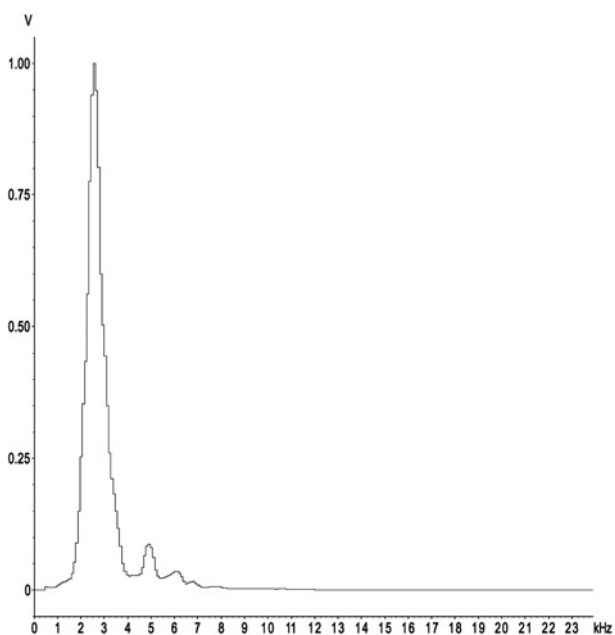


Fig. 9. Power spectrum of a call of *Oreophryne roedeli* sp. nov.

Colour in life. Dorsal surfaces of head, trunk, limbs, and lateral surfaces of body light grey with many irregular shaped brown flecks of different intensity. Dorsal surfaces of limbs moreover with a reddish hue. Conspicuous off-white mid-dorsal line from tip of snout to end of urostyle, an off-white supraciliar and postocular stripe, and a dark brown spot on anterior loreal region and above tympanum. An off-white bar between eyes and an inguinal spot of same colour are less conspicuous. Iris silvery with dark brown venation, conspicuous brown line in the upper part (Fig. 11).

Colour in preservative. All dorsal surfaces, except of thighs, more or less intense grey-brown with irregular small darker brown flecks. Dorsal thighs darker grey-brown with light spots. Loreal and subocular region with larger brown spots, and postocular region with off-white and downward bent longitudinal stripe, this bordered above by a semicircular dark brown spot. Light middorsal line less intensely expressed and light inguinal blotch

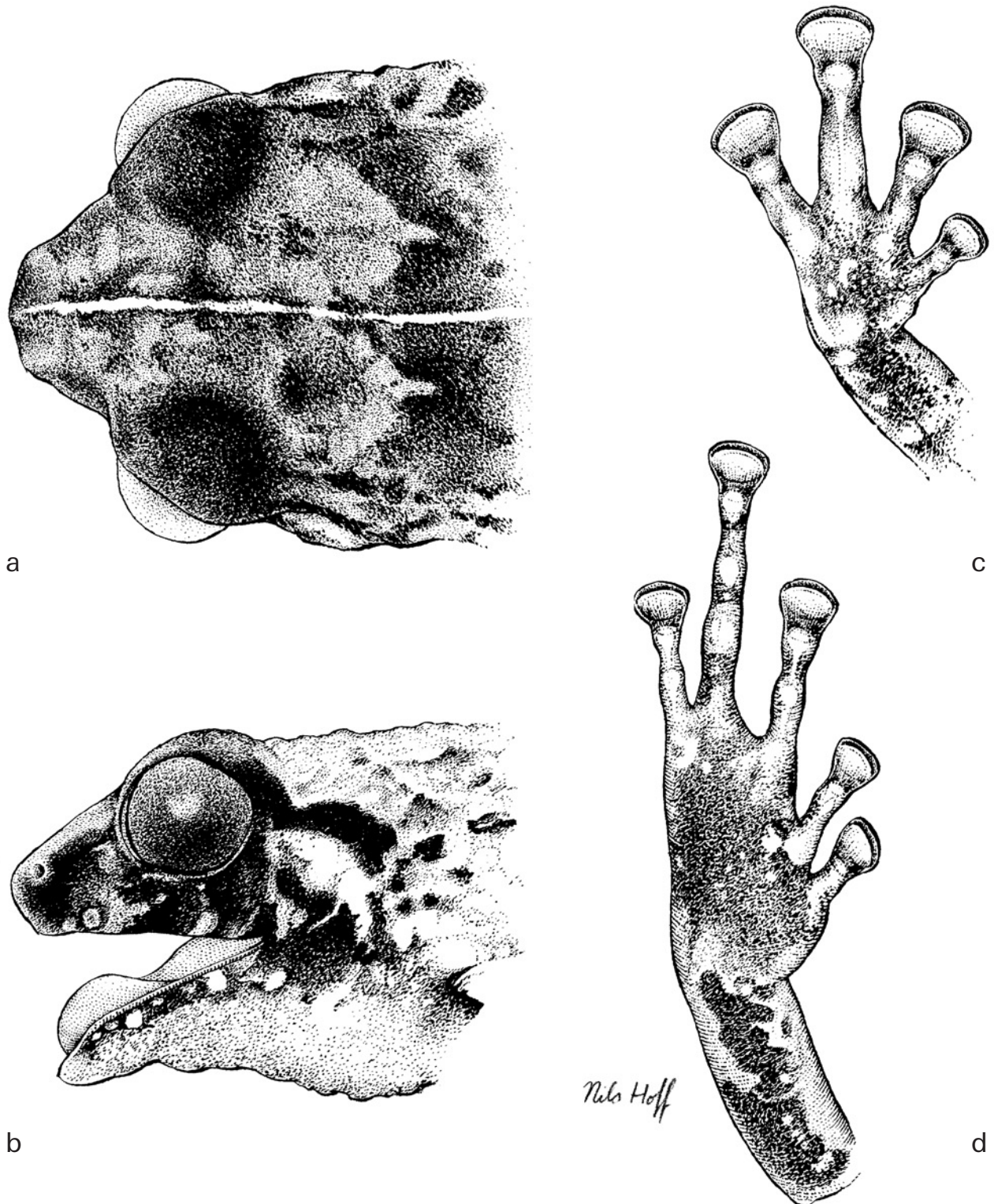


Fig 10. Preserved holotype of *Oreophryne choerophrynoides* sp. nov. (a) head in dorsal view, (b) head in profile, (c) palmar view of right hand, (d) plantar view of right foot.

more strongly expressed than in life. Ventral surfaces off-white with a dense pattern of middle-brown and dark brown dots that are partly arranged in diffuse flecks and blotches. Such areas are more common on throat and hind legs than on abdomen. An off-white longitudinal line on throat.

Morphological characters of the paratypes. For body measurements and ratios of the four male paratypes see Table 2. Colour of dorsal surfaces in life varies considerably between specimens. ZMB 83020 (Fig.12) is predominantly dark red with diffuse brown marbling; thighs, shanks, and feet predominantly brown. In ZMB



Fig. 11. Dorsolateral view of the holotype of *Oreophryne choerophrynoides* sp. nov. in life.



Fig. 12. Dorsolateral view of the paratype ZMB 83020 of *Oreophryne choerophrynoides* sp. nov. in life.



Fig. 13. Dorsolateral view of the paratype ZMB 83021 of *Oreophryne choerophrynooides* sp. nov. in life.



Fig. 14. Dorsolateral view of the paratype ZMB 83022 of *Oreophryne choerophrynooides* sp. nov. in life.

Table 2. Body measurements and body ratios of the type series of *Oreophryne choerophrynoidea* sp. nov. ZMB 83019 is the holotype, all types are adult males, all measurements in mm. Inv.-No. = registration number; SD = Standard deviation; explanation of measurements in “Material and methods”.

Inv.-No.	ZMB 83020	ZMB 83021	ZMB 83022	ZMB 83023	ZMB 83019	Mean ± SD
SUL	17.5	17.8	16.2	16.7	17.6	17.2±0.68
TL	8.3	8.3	8.2	8.2	8.1	
TaL	5.7	6.0	5.7	5.5	5.7	
L4T	8.1	7.9	8.0	8.0	7.6	
T4D	1.0	0.9	1.1	1.1	1.0	
L3F	4.8	4.9	4.8	5.1	5.0	
F3D	1.1	1.1	1.2	1.3	1.2	
F1D	0.7	0.6	0.7	0.6	0.6	
T1D	0.7	0.6	0.7	0.6	0.6	
HL	5.7	5.9	5.4	5.8	5.9	
HW	7.0	6.5	6.6	6.5	7.1	
SL	2.8	3.0	3.0	2.6	2.9	
END	1.5	1.5	1.4	1.6	1.5	
IND	1.9	1.7	1.7	1.9	1.6	
ED	2.6	2.7	2.4	2.4	2.5	
TyD	0.7	0.9	0.7	0.7	1.0	
TL/SUL	0.47	0.47	0.51	0.49	0.46	0.48±0.02
TaL/SUL	0.33	0.34	0.35	0.33	0.32	0.33±0.01
T1D/SUL	0.040	0.034	0.043	0.036	0.034	0.037±0.004
T4D/SUL	0.057	0.051	0.068	0.066	0.057	0.060±0.007
T4L/SUL	0.46	0.44	0.49	0.48	0.43	0.46±0.025
F3D/SUL	0.063	0.062	0.074	0.078	0.068	0.069±0.007
F1D/SUL	0.040	0.034	0.043	0.036	0.034	0.037±0.004
T1D/F1D	1.00	1.00	1.00	1.00	1.00	1.00±0.0
T4D/F3D	0.91	0.82	0.92	0.85	0.83	0.87±0.046
HL/SUL	0.33	0.33	0.33	0.35	0.33	0.33±0.009
HW/SUL	0.40	0.37	0.41	0.39	0.40	0.39±0.015
HL/HW	0.81	0.91	0.82	0.89	0.83	0.85±0.045
SL/SUL	0.160	0.168	0.185	0.156	0.165	0.167±0.011
END/IND	0.79	0.88	0.82	0.84	0.94	0.85±0.058
ED/SUL	0.149	0.152	0.148	0.144	0.142	0.147±0.004
TyD/ED	0.27	0.33	0.29	0.29	0.40	0.32±0.051

83021 (Fig. 13), sides of body off-white and become light grey upward, sides with irregularly-shaped and -sized brown spots; dorsal surfaces of head and body darker brown with conspicuous, irregularly shaped red spots in scapular region, middle dorsum, and sacral region; red spots on dorsal surfaces of all limbs; there is a yellowish inguinal spot. Dorsal and lateral surfaces of ZMB 83022 (Fig. 14) light grey-yellowish with a dense pattern of tiny blackish and some larger blackish spots; fore and hind limbs with a reddish hue. All specimens exhibit a W-shaped mark on anterior back, this mark off-white, yellowish, or red, and its two posterior tips are formed by tubercles with a yellowish tip. Undersides of all specimens off-white with a dense pattern of tiny dark brown dots that may cluster to form diffuse spots and blotches in some regions; such spots occur for example on abdomen and on inferior thighs of ZMB 83020 (Fig. 15). In

preservative, dorsal surfaces predominantly yellowish (ZMB 83020) or brownish (remaining three specimens) with a few smaller dark brown and larger light yellowish (reddish in life) areas.

Characteristic of all five types are a light middorsal line, a light bar between the eyes bordered posteriorly by dark blotches or stripes, a dark brown supratympanic blotch bordered inferiorly by a light downward bent blotch, a dark-brown spot on anterior flank, and a light inguinal blotch of variable shape. Ventral surfaces of preserved specimens much lighter than in life.

Distribution and ecological notes

This new species was found only in forested regions of the Fakfak Mountains (Bomberai Peninsula, western New Guinea), near the road Fakfak Town–Kokas at from 700 to 900 m a.s.l. The collected specimens perched on leaves of shrubs and trees at 1–3 m above ground. One specimen roosted and called from inside a “pouch” formed by leaves. It could not be seen from above but only through a lateral slit in the “pouch”. Minimal distance between calling males was 3 m. Males were heard calling from 6.30 to 11.00 p.m., when field work ceased.

Vocalisation. The advertisement call of four males was recorded. It consists of 3–6 notes, mean 4 ± 0.8 notes/call, $n=26$, each note with a distinct pulse pattern (Fig. 16). Mean duration of 26 calls from these four males was 0.85 ± 0.24 s, range 0.55–1.54 s. Mean of means ($n=22$) of note length 114 ± 7.9 ms, range of means 96–129 ms, absolute range of note length 78–116 ms. Mean of means ($n=22$) of internote interval length 129 ± 24.7 ms, range of means 95–181 ms, absolute range of intervals 86–196 ms. Mean of means of pulses/note ($n=19$) 18.7 ± 1.69 , range of means 15.5–21.0, absolute range 14–25 pulses/note. Mean of means ($n=19$) of pulses/s 165 ± 19.7 , range of means 132–195 pulses/s. Mean number of notes/call 4 ± 0.8 , range 3–6, $n=26$. Mean note repetition rate/s 4.8 ± 0.57 , range 3.9–6.0, $n=26$. First note and first internote interval nearly always the longest of all notes and intervals and first note nearly always with highest number of pulses. Wave forms of notes with a spindle-like appearance (Fig. 16) caused by slowly increasing pulse amplitudes (increasing sound intensity) at the beginning, and with slowly decreasing pulse amplitudes at the end of the note. Interpulse intervals become shorter during the course of the notes. Range of frequencies roughly from 3 to 8.0 kHz, dominant frequency at 6.25 kHz (Fig. 17). Such a high dominant frequency is unusual for species of the genus *Oreophryne*. Minimal interval between two calls of one male was 15 s; a male usually called at intervals of 30–60 s. Frequently, two males called at almost exactly the same time. In these cases, one started a call and immediately a second responded vigorously. It gave me the impression that the second was the dominant and that it tried to drown out the first. Air temperatures during recording were between 21 °C and 23 °C.



Fig. 15. Ventral view of the paratype ZMB 83020 of *Oreophryne choerophrynoides* sp. nov. in life.

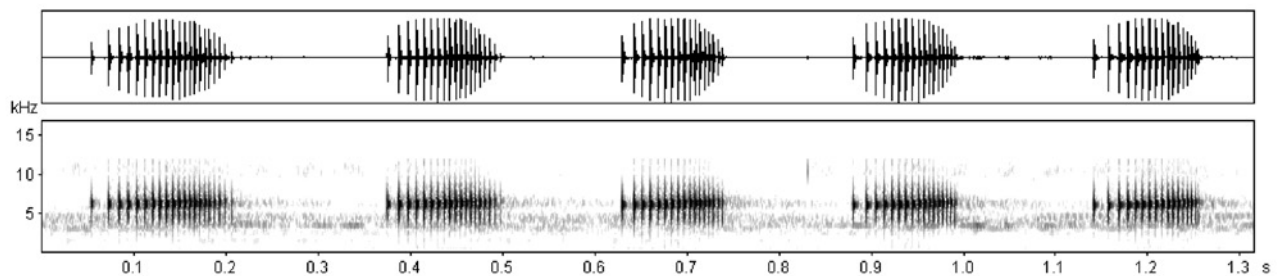


Fig. 16. Wave form (above) and spectrogram (below) of an advertisement call from *Oreophryne choerophrynoides* sp. nov. with 5 notes.

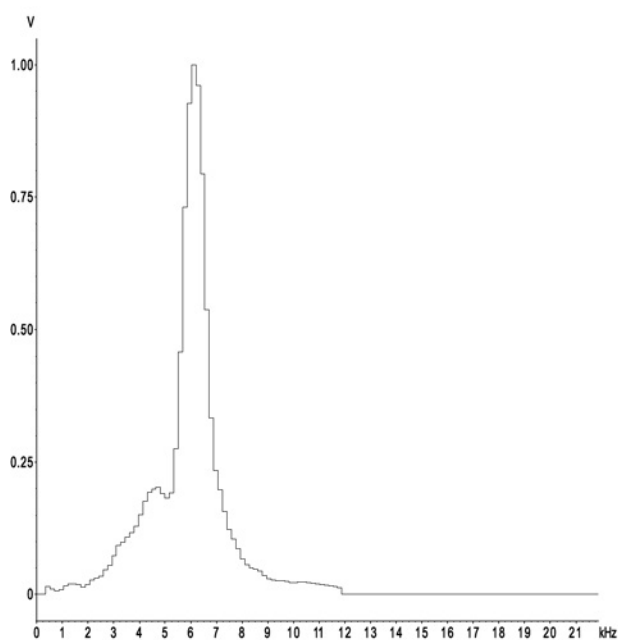


Fig. 17. Power spectrum of a call from *Oreophryne choerophrynoides* sp. nov.

Etymology. The advertisement call of the new species is extremely similar to that of some members of the genus *Choerophryne*, especially to the call of *Choerophryne arndtorum* from Yapen Island (see GÜNTHER 2008). The specific epithet *choerophrynoides* means similar to *Choerophryne* and refers to this fact.

Comparison with other species. Most *Oreophryne* species are distinctly larger (males measure more than 20 mm SVL) than the new species (of 16.2–17.8 mm SVL). The following species with 15–20 mm SVL in (at least some) males, and thereby falling into the assumed size range of *O. choerophrynoides* sp. nov., have a cartilaginous connection between the procoracoid and scapula (ligamentous in the new species) and can be differentiated from it by this character: *Oreophryne albomaculata*, *O. alticola*, *O. asplenicola*, *O. brevicrus*, *O. brevirostris*, *O. cameroni*, *O. gagneorum*, *O. graminis*, *O. habbemensis*, *O. notata*, *O. oviprotector*, *O. parkopanorum*, *O. pseudasplenicola*, and *O. waira*. The majority of these species, moreover, also differ in body proportions and in advertisement calls. Only a few species in the size range

of *O. choerophrynoidea* sp. nov. have a ligamentous connection between the procoracoid and the scapula. Of these, *O. geminus* is an alpine species with scarcely broadened finger and toe discs vs. strongly broadened finger and toe discs in the new species; *O. kapisa* utters rattles of 1.0–1.8 s duration with an average repetition rate of 26.4 notes/s; *O. sibilans* has a peeping advertisement call vs. chirping calls in *O. choerophrynoidea* sp. nov.; and in *O. terrestris*, the finger and the toe discs are barely wider than the penultimate phalanges, ratio TL/SVL is 0.34–0.44 (vs. 0.46–0.51 in the new species), and its call contains 12–16 notes with a note duration of 33–60 ms (vs. 3–6 notes/call and 96–129 ms note length in the new species).

Acknowledgements

The curators and their assistants of the herpetological collections of the institutions mentioned in “Material and methods” provided valuable help by sending comparative material. Field work and collection of voucher specimens were permitted by representatives of Belai Besar Konservasi Sumber Daya Alam (KSDA), Sorong. MARTINUS KAPISA (Biak); ANDREAS, FRANK, and APNER PIAHAR (Kampung Lusiperi near Fakfak Town); and CHRISTIAN BERGMANN (Berlin) helped during field work. Family PIAHAR also permitted the collection of frogs on their property. NILS HOFF (formerly ZMB now FH Bielefeld) prepared Figures 2a–d and YVONNE ROGENMOSER (Zürich) prepared Figures 10a–d. RUDOLF ARNDT (Pomona, New Jersey, USA) kindly read the manuscript and made a number of helpful editorial comments. To all of these persons I would like to express my sincerest thanks.

References

DINGERKUS, G. & UHLER, L.D. (1977): Enzyme clearing of alcian blue stained whole small vertebrates for demonstration of cartilage. – *Stain Technology*, **52**: 229–232.

FROST, D.R. (2015): Amphibian Species of the World: an online reference. Version 6.0. – Electronic database available at <http://research.amnh.org/herpetology/amphibia/index.html>

GÜNTHER, R. (2003a): Three new species of the genus *Oreophryne* from western Papua, Indonesia. – *Spixiana*, **26**(2): 175–191.

GÜNTHER, R. (2003b): Further new species of the genus *Oreophryne* (Amphibia, Anura, Microhylidae) from western New Guinea. – *Zoologische Abhandlungen (Dresden)*, **53**: 65–85.

GÜNTHER, R. (2008): Descriptions of four new species of *Choerophryne* (Anura, Microhylidae) from Papua Province, Indonesian New Guinea. – *Acta Zoologica Sinica*, **54**(4): 653–674.

GÜNTHER, R. & RICHARDS, S.J. (2011): Five new microhylid frog species from Enga Province, Papua New Guinea, and remarks on *Albericus alpestris* (Anura, Microhylidae). – *Vertebrate Zoology*, **61**(3): 343–372.

GÜNTHER, R., RICHARDS, S.J. & DAHL, C. (2014): Nine new species of microhylid frogs from the Muller Range in western Papua New Guinea (Anura, Microhylidae). – *Vertebrate Zoology*, **64**(1): 59–94.

GÜNTHER, R., RICHARDS, S.J. & ISKANDAR, D. (2001): Two new species of the genus *Oreophryne* from Irian Jaya, Indonesia (Amphibia, Anura, Microhylidae). – *Spixiana*, **24** (3): 257–274.

GÜNTHER, R., RICHARDS, S.J., BICKFORD, D. & JOHNSTON, G.R. (2012): A new egg-guarding species of *Oreophryne* (Amphibia, Anura, Microhylidae) from southern Papua New Guinea. – *Zoosystematics and Evolution*, **88** (2): 223–230.

GÜNTHER, R., RICHARDS, S., TJATURADI, B. & ISKANDAR, D. (2009): A new species of the microhylid frog genus *Oreophryne* from the Mamberano Basin of northern Papua Province, Indonesian New Guinea. – *Vertebrate Zoology*, **59**(2): 147–155.

KRAUS, F. (2011): New frogs (Anura: Microhylidae) from the mountains of western Papua New Guinea. – *Records of the Australian Museum*, **63**: 53–60.

KRAUS, F. (2013): Three new species of *Oreophryne* (Anura, Microhylidae) from Papuan New Guinea. – *ZooKeys*, **333**: 93–121.

KRAUS, F. & ALLISON, A. (2009): New microhylid frogs from the Muller Range, Papua New Guinea. – *ZooKeys*, **26**: 53–76.

RICHARDS, S.J. & ISKANDAR, D. (2000): A new minute *Oreophryne* (Anura: Microhylidae) from the mountains of Irian Jaya, Indonesia. – *Raffles Bulletin of Zoology*, **48**(2): 257–262.

ZWEIFEL, R.G. (2003): A new species of microhylid frog, genus *Oreophryne*, from Papua New Guinea. – *American Museum Novitates* **3419**: 1–8.

ZWEIFEL, R.G., COGGER, H.G. & RICHARDS, S.J. (2005): Systematics of microhylid frogs, genus *Oreophryne*, living at high elevations in New Guinea. – *American Museum Novitates* **3495**: 1–25.

ZWEIFEL, R.G., MENZIES, J.I. & PRICE, D. (2003): Systematics of microhylid frogs, genus *Oreophryne*, from the North Coast Region of New Guinea. – *American Museum Novitates* **3415**: 1–31.