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A NEW MINUTE *OREOPHRYNE* (ANURA: MICROHYLIDAE) FROM THE MOUNTAINS OF IRIAN JAYA, INDONESIA

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ABSTRACT. - A new tiny microhylid frog in the genus *Oreophryne* is described from the mountains of Irian Jaya, Indonesian New Guinea. *Oreophryne minuta*, new species, is distinguished from all congeners in the New Guinea region by its small adult size (males to 11.5 mm) and lack of expanded terminal discs on the fingers and toes. It is known from one locality in mid-montane rainforest (2000 m asl) in the rugged mountains of the Derewo River Basin, where males called from deep within thick clumps of moss growing on large boulders.

KEY WORDS. - Anura, Microhylidae, new species; New Guinea

INTRODUCTION

The microhylid frog genus *Oreophryne* Boettger, 1895 is widespread in the Indo-Australian archipelago between the southern Philippines and New Britain (Zweifel, 1985). The genus reaches its greatest diversity on mainland New Guinea and nearby islands where 14 species are currently recognised (Zweifel, 1985; Zweifel & Tyler, 1982). However, the most recent taxonomic treatments of mainland New Guinean *Oreophryne* were more than 30 years ago (Zweifel, 1956; Tyler, 1964) and numerous undescribed species have been collected in the mountains of Papua New Guinea and Irian Jaya since that time. Here we describe a tiny new species of *Oreophryne* collected during Conservation International's 1998 Rapid Assessment Program (RAP) survey of biodiversity in the headwaters of the Derewo/Wapoga River drainage, Irian Jaya.

MATERIALS AND METHODS

Measurements (to 0.1 mm) were made with dial callipers and a microscope fitted with an ocular micrometer. They were snout-vent length (SVL), tibia length (TL), head width at the angle of the jaws (HW), head length as a straight-line distance from angle of jaws to tip of snout (HL), eye diameter (EYE), inter-narial distance (IN), eye-naris distance (EN), and snout-naris distance (SN). Tips of digits were measured transversely across the widest point; penultimate phalanx was measured transversely across the narrowest point. The tympanum of the new species is indistinct, precluding accurate measurements. Superficial dissection of the pectoral girdle was undertaken to determine the state of the clavicle. Advertisement calls were recorded with a Sony Pro-Walkman tape recorder and Sony ECM-Z200 microphone, and analysed using the AVISOFT SAS-Lab Pro sound analysis program. Specimens are deposited in the Museum Zoologicum Bogoriense, Indonesia (MZB) and the South Australian Museum, Australia (SAMA).

Oreophryne minuta, new species

(Figs 1-7)

Material examined. - Holotype - adult male (MZB Amp.3877), 2000 m, un-named mountain range, Derewo River Basin, Irian Jaya, Indonesia (3°26.527'S, 136°28.365'E), coll. S. Richards & D. Iskandar, 7 Apr.1998.

Paratypes. - (all from same locality as holotype) (MZB Amp.3878, SAMA R54071, R54072) adult males, coll. S. Richards & D. Iskandar, 7 Apr.1998.

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Diagnosis. - A very small *Oreophryne*, adult males reaching 11.5 mm SVL. Tympanum largely obscured by skin. Legs moderately short, tibia less than half of SVL (TL/SVL 0.40-0.42). Fingers and toes short, unwebbed, tips slightly swollen but without expanded terminal discs. Advertisement call a series of rapidly pulsed notes with a very high dominant frequency (6.8-7.5 kHz), produced in quick succession and lasting 1-3 seconds.

Description of holotype. - An adult male (calling when captured) with the following measurements and proportions: SVL 11.5; TL 4.7; HW 4.5; HL 3.5; EYE 1.6; EN 0.8; IN 1.3; SN 0.7; TL/SVL 0.4; EN/IN 0.61; EYE/SVL 0.139; HW/SVL 0.39; Tip of third finger 0.35, Phalanx 0.3; Tip of fourth toe 0.4, Phalanx 0.4.

Head moderately broad, snout bluntly pointed from above, bluntly rounded in lateral view (Fig. 1); canthus short, rounded, almost straight; loreal region steep, almost vertical; nares broadly spaced (IN/SVL 0.104; EN/IN 0.61); tympanum indistinct. Clavicles present but reduced. Vomerine teeth lacking; two transverse palatal ridges of low, rather indistinct lobes. Fingers unwebbed, relative lengths 3>4>2>1, first finger less than one-half length of second. Tips of fingers with faint terminal grooves, slightly swollen but scarcely broader than penultimate phalanges. Ventral surfaces of hands and feet smooth, without subdigital or palmar tubercles or elevations (Fig. 2). Toes unwebbed, relative lengths 4>5>3>2>1. Tips of toes with faint terminal grooves, disc-like but not broader than penultimate phalanges. Hind legs moderately short (TL/SV 0.4). Head and body smooth ventrally. Dorsum smooth, with scattered low tubercles forming an hour-glass pattern, and others aligned longitudinally on body and concentrated on head and post-orbital region. Two distinctly larger tubercles situated on mid-dorsum behind eyes.

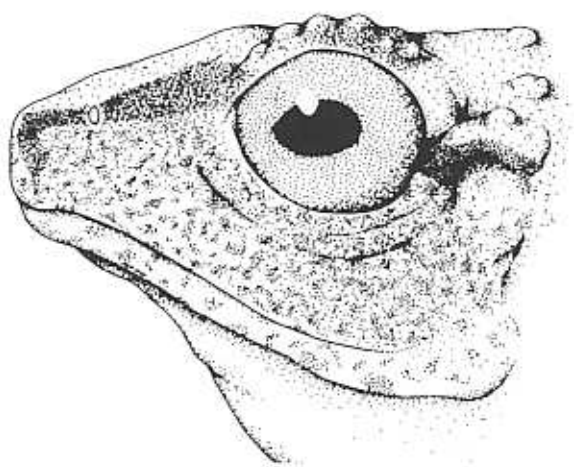

Fig. 1. Lateral view of head of *Oreophryne minuta* new species (SAMA R54072).

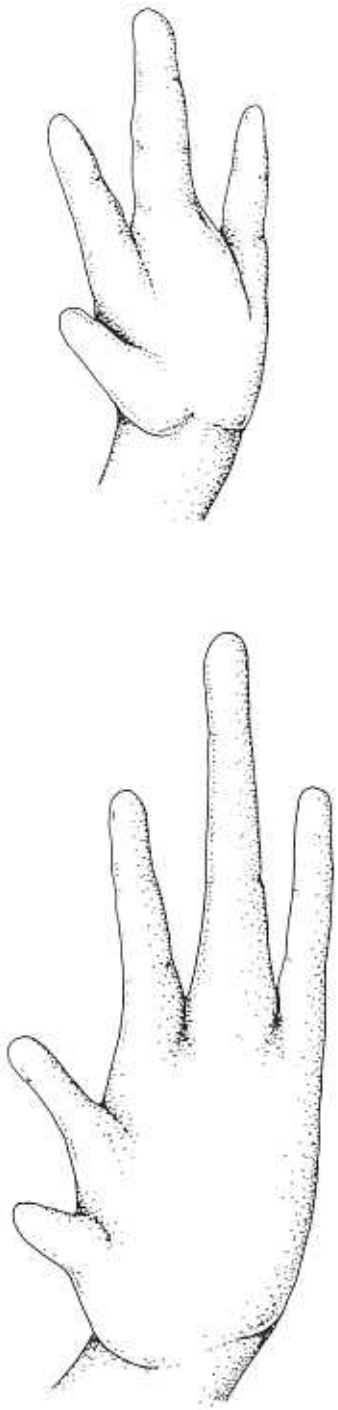

Fig. 2. Palmar and plantar view of hand (top) and foot of *Oreophryne minuta*, new species (SAMA R54072).

In alcohol head, body and limbs brown dorsally. A broad dark brown band from snout through naris and eye, disrupted behind eye and continuing posteriorly from arm as a distinct but patchy lateral band, breaking into scattered dark blotches in the inguinal region. Dark blotches also occur on dorsum posteriorly, and dense dark pigmentation surrounds dorsal portion of vent. Patches of dark pigment dorsally on arms and legs. Two indistinct dark brown dorso-lateral stripes extending posteriorly to anterior edge of pale inguinal ocelli. A pale W - shaped inter-orbital bar bordered posteriorly by a band of dark brown pigment.

Small white spots present below dark lateral band, and across venter. Throat and chest light brown with scattered pale flecks; darker pigmentation concentrated around jaws. Belly and ventral surfaces of arms and legs with brown pigmentation concentrated in discrete patches and scattered flecks, and with scattered white spots and pale areas lacking pigment. Ventral surfaces of hands and feet with scattered brown pigmentation. In life colours more vibrant, band of pigmentation on snout and passing through nostril and eye rich tan, iris brown.

Variation. - Measurements and proportions of the three paratypes, all adult males calling when captured are: SVL 9.2-11.2; TL 3.7-4.8; HW 3.7-4.4; EYE 1.3-1.4; EN 0.7-0.9; IN 1.1-1.2; TL/SVL 0.40-0.42; EN/IN 0.61-0.75; EYE/SVL 0.12-0.17; HW/SVL 0.39-0.48; tip of third finger 0.25-0.35, Phalanx 0.25-0.3; tip of fourth toe 0.3-0.4, phalanx 0.3-0.4.

Colour patterns of the type series are variable, but all specimens exhibit the dark stripe through the nostril and eye, the dorso-lateral stripes and the pale inguinal ocelli. In MZB 3878 and SAMA R54072 the head and body are pale brown, finely stippled with dark brown pigment. Brown pigmentation is concentrated dorsally in two broad stripes starting above the point of arm insertion, and continuing posteriorly to the anterior margin of the pale ocelli. The venter is paler than the holotype, with scattered brown pigmentation, which is more concentrated on the throat and chest. In SAMA R54071 the dark brown dorsal pigmentation is also concentrated in two short dorso-lateral stripes; each is bordered dorsally by a white ridge, and there is a dark inter-orbital bar. The dorsal surfaces of the legs are brown with pale patches, and there is scattered brown and white pigmentation on the venter, concentrated on the throat and only sparsely on the belly. The anterior palatal ridge of MZB 3878 is reduced to a single, distinct median tubercle.

Etymology. - The name of this new species refers to its extremely small size. *Oreophryne minuta* is the smallest known species of *Oreophryne*, and possibly Irian Jaya's smallest terrestrial vertebrate.

Habitat. - The type series was collected in an extremely wet, boulder-filled gully in mid-montane rainforest at an altitude of approximately 2000 m asl. Males were calling at night from deep within thick clumps of moss that covered the boulders and low tree branches (Fig. 3). All specimens were less than 2 metres above the ground, and none were heard calling elsewhere in the forest despite intensive searches over a five-day period. The gully was approximately 100 m above our research camp (1890 m asl), where the surrounding forest was less mossy and contained fewer boulders. No *O. minuta* were heard calling in this area although several other larger, scansorial and arboreal *Oreophryne* species were common around the camp.

Fig. 3. Male *Oreophryne minuta* in calling position.

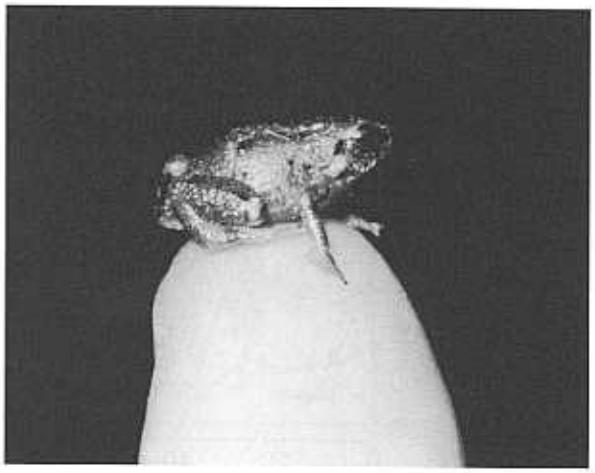

Fig. 4. Adult *Oreophryne minuta* in life.

Advertisement Call. - We recorded four call sequences from three males (Table 1). The call is a series of distinctly pulsed and rapidly repeated notes lasting about 1-3 seconds. The dominant frequency is 6.86-7.45 kHz, and the note repetition rate is 5.32-6.15/s. Pulse repetition rate was variable among frogs. Means ranged from 42.7/s to 86.7/s (Table 1). The number of pulses in a note is remarkably consistent within a call, normally varying by no more than one pulse/note. The only exception was the call illustrated in Fig. 5, in which the introductory note has only three pulses and all other notes except one (with 8) have seven pulses. The wave form of a single note is illustrated in Fig. 6. Calls were uttered at sporadic intervals, usually between about five and 10 minutes apart. However inter-call interval was influenced strongly by weather conditions. On dry nights calling occurred very infrequently making these tiny, ventriloqual animals virtually impossible to locate.

Table 1. Advertisement call characteristics of *Oreophryne minute, new species*. Air temperature = 16.2°C

Frog	Dominant frequency kHz	Call length (sec)	Number of notes	Mean note length (SD)	Note repetition rate notes/s	Number of pulses/note	Mean pulse rate (SD)
MZB3877	7.02	1.09	7	0.098 (0.035)	6.06	5-6	57.24 (4.90)
SAMA R54072	7.41	2.06	17*	0.12 (0.006)	5.32	5-6	43.39 (1.67)
SAMA R54072	7.45	1.33	8	0.13 (0.005)	5.77	5-6	42.69 (4.14)
N/A	6.86	2.78	17	0.085 (0.019)	6.15	4-8	86.72 (23.5)

*Structural features based on four notes only

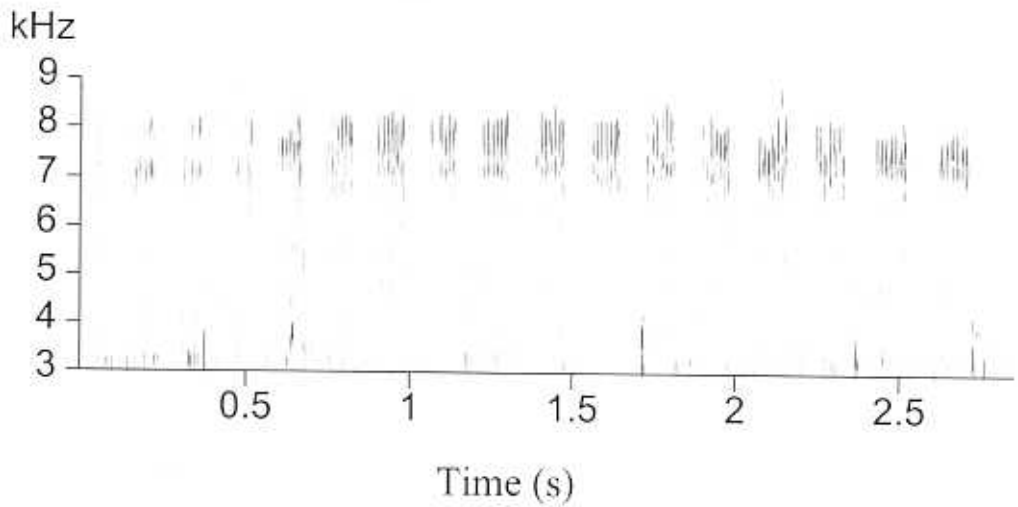

Fig. 5. Spectrogram of an *Oreophryne minuta* call. Air Temperature = 16.2°C.

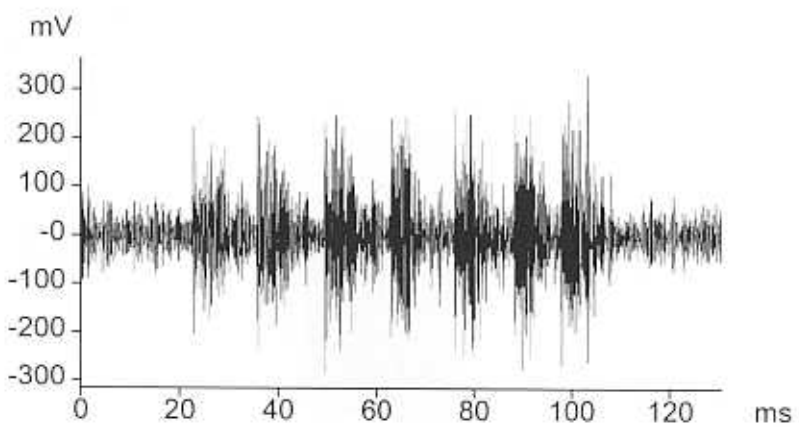

Fig. 6. Wave form of a single note extracted from the call illustrated in Figure 5.

Comparison with other species. - The extremely small adult size of *Oreophryne minuta* distinguishes it from all known *Oreophryne*. Even allowing for a somewhat wider size range with the collection of additional material (including females), it is unlikely that this species will greatly exceed one half the size of the smallest known *Oreophryne* species, *O. wolterstorffi*; (approx 22 mm; Tyler, 1964). It is further distinguished from all known species by the absence of expanded terminal discs on the fingers and toes. The only small *Oreophryne* with relatively small discs (*O. brevicrus*) is nearly twice the size of *O. minuta* (males to 21 mm vs 11.5 mm) and has somewhat shorter legs (TL/SVL 0.323-0.416 (Zweifels pers. comm) vs 0.40-0.42 in *O. minuta*) so is unlikely to be confused with the new species.

The tiny *Aphantophryne minuta* is known from a single female measuring 12mm SVL (Zweifel & Parker, 1989). In many respects it is similar to *O. minuta* but lacks clavicles and procoracoids. It is further distinguished from *Oreophryne minuta* in having moderately conspicuous scapular folds, and in lacking the dark dorso-lateral stripes that are a consistent feature of *O. minuta*. *Cophixalus verecundus* is another very small species (males to 17.2mm) with poorly developed digital disks and like *O. minuta* males calling at night were concealed in moss (Zweifel & Parker, 1989). *Cophixalus verecundus* differs from *minuta* in lacking clavicles and procoracoids, in having a moderately well developed first finger, and in its mating call which is a "rapid train of click-like pulses giving the aural effect of a soft buzz "(Zweifel & Parker, 1989, p18, fig. 12B).

Discussion. - The description of *Oreophryne minuta* brings to 12 the number of *Oreophryne* species currently recognised from mainland New Guinea. Three additional species are known from islands immediately to the east; *Oreophryne inornata* and *O. insulana* (Goodenough Island) and *O. brachypus* (New Britain). The taxonomic status of several species is unclear, and uncertainty about the status of *O. biroi* and several taxa that have been synonymised or confused with it, has hindered research on this group for many years.

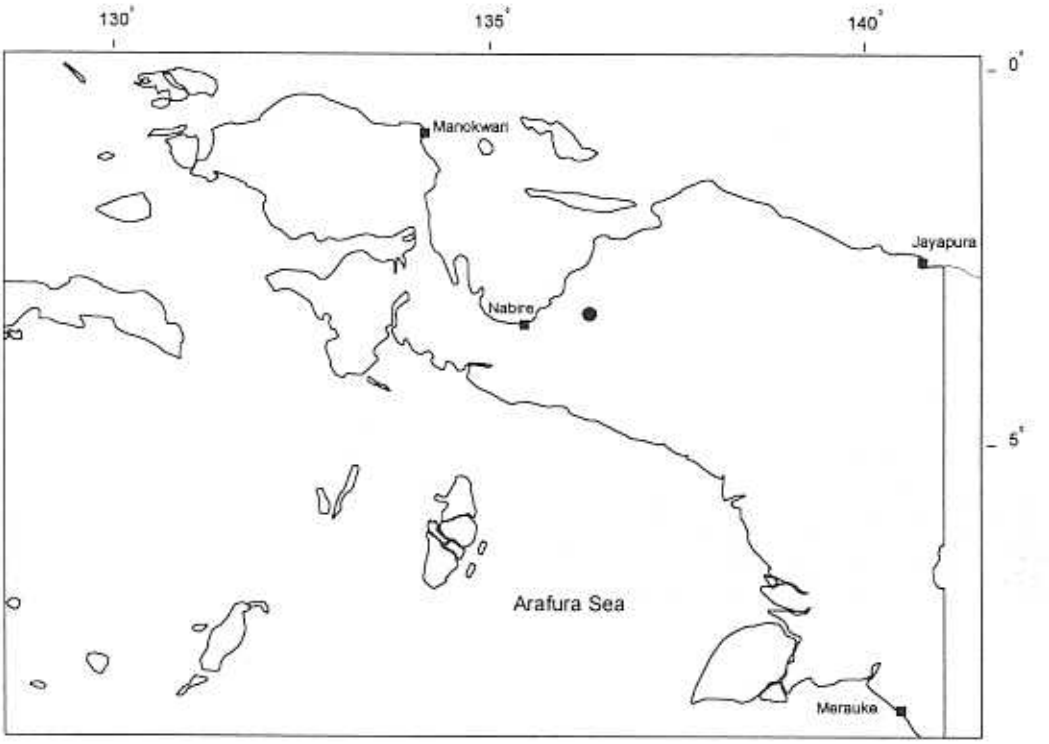

Fig. 7. Collection locality of *Oreophryne minuta*, new species, in Irian Jaya, Indonesia.

Although we did not determine the form of the procoracoid-scapula connection or other osteological characters, due to the extremely small size and fragile nature of the pectoral girdle, and the limited material available in the type series, there appears to be no obvious relationship between the new species and previously described taxa. Indeed, the lack of expanded digital discs is a feature unique among currently recognised *Oreophryne* and is probably a derived character within the genus.

Zweifel & Allison (1982) argued that reduction of the first finger is a derived character in the genus *Cophixalus*, and suggested that small size, reduced digital discs and wide internarial span may also be derived characters in that genus. It is interesting to note that *Cophixalus sphagnicola*, which shares this suite of features with *O. minuta*, is also most commonly found in clumps of moss (Zweifel & Allison, 1982). Whether these characters are adaptations to life in mossy habitats at or close to the ground warrants further investigation.

The senior author has collected more than 15 undescribed species of *Oreophryne* in western Papua New Guinea, and we collected an additional 10 species, including *O. minuta*, during the 1998 RAP biodiversity survey in Irian Jaya (Richards et al., 2000). It appears likely that further studies will reveal *Oreophryne* to be one of the most taxonomically and ecologically diverse microhylid genera in New Guinea.

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