

A redescription, a revalidation, and a new description within the microhylid genus *Austrochaperina* (Anura: Microhylidae)

RAINER GÜNTHER

Museum für Naturkunde, Invalidenstr. 43, 10115 Berlin, Germany; rainer.guenther@mfn-berlin.de

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Abstract

The genus *Austrochaperina* FRY, 1912, currently includes 23 species of small and medium-sized frogs which occur primarily in New Guinea and its surrounding islands. Through studies of the frog fauna carried out in various years between 1998 and 2003 in the Wondiwoi Mountains at the base of the Wandammen Peninsula, located on the border between the Indonesian provinces of Papua and Papua Barat, the author noted three forms in the genus *Austrochaperina*. One of these has already been described as a new species, *A. minutissima*, by GÜNTHER (2009). The second is most likely *A. macrorhyncha* (KAMPEN, 1906), which was described from a single available specimen from the Vogelkop Peninsula. Data provided herein by the author makes it clear that the current definition of this species is not accurate and that a redescription of it is necessary. In connection with this is the revalidation of another species, *A. punctata* (KAMPEN, 1913), considered to be a synonym of *A. macrorhyncha*. The third form is considered to be new to science, and it is described as such in this paper. This species occurs at an elevation of from 400–650 m above sea level in and on leaf litter primarily near streams in primary rainforest. The adult is 25–30 mm long. It is differentiated from related species in several body proportions and by its characteristic advertisement calls, and from the sympatric but obviously not syntopic *A. macrorhyncha* in the base sequences of the mitochondrial 12S rDNA- and 16S rDNA-genes as well.

Kurzfassung

Die Gattung *Austrochaperina* FRY, 1912 umfasst z. Z. 23 Arten kleiner und mittelgroßer Frösche, die vorwiegend auf Neuguinea und den umliegenden Inseln vorkommen. Bei Untersuchungen der Froschfauna in den Wondiwoi Bergen an der Basis der Wandammen Halbinsel, Grenze zwischen den indonesischen Provinzen Papua und Papua Barat, die in mehreren Jahren zwischen 1998 und 2003 durchgeführt wurden, fand der Autor auch drei Formen der Gattung *Austrochaperina*. Eine dieser Formen wurde bereits als *A. minutissima* GÜNTHER, 2009 neu beschrieben. Bei der zweiten Form handelt es sich höchstwahrscheinlich um *Austrochaperina macrorhyncha* (KAMPEN, 1906), die anhand eines einzelnen Exemplars von der Vogelkop Halbinsel beschrieben worden war. Die vom Autor hier vorgelegten Befunde verdeutlichen, dass die jetzige Definition dieser Art nicht zutrifft, weshalb eine Wiederbeschreibung (redescription) notwendig wurde. Im Zusammenhang damit steht auch die Revalidierung der bisher als Synonym von *A. macrorhyncha* angesehenen Art *Austrochaperina punctata* (KAMPEN, 1913). Bei der dritten Form handelt es sich um eine weitere für die Wissenschaft neue Art, die im Verlauf der vorliegenden Arbeit beschrieben wird. Sie lebt in 400–650 m über NN in und auf der Laubschicht und bevorzugt die Nähe von Bächen im primären Regenwald. Die adulten Tiere sind 25–30 mm groß. Sie unterscheidet sich von den anderen Arten im gleichen Größenrahmen in mehreren Körperproportionen und durch ihre charakteristischen Paarungsrufe, von der sympatrischen aber nicht syntopen *A. macrorhyncha* auch in den Basensequenzen der mitochondrialen 12S rDNA- und 16S rDNA-Gene.

Key words

Anura, *Sphenophryne*, new species, morphology, bioacoustics, ecology, western New Guinea.

Introduction

ZWEIFEL (2000) splits the Australopapuan microhylid frog genus *Sphenophryne* sensu PARKER (1934) into four genera, for all of which names were already available, namely *Austrochaperina* FRY, 1912 which includes 23 species at present; *Liophryne* BOULENGER, 1897 with 8 species at present; *Oxydactyla* KAMPEN, 1913 with four species; and *Sphenophryne* PETERS & DORIA, 1878 with one species¹. The most important morphological character to diagnose the genus *Austrochaperina* is deemed to be that species of this genus have bony clavicles that reach from the scapula almost to the midline of the pectoral girdle. Various authors (for example TRUEB, 1973 and ZWEIFEL, 2000) consider the presence of bony clavicles in microhylid frogs to be a plesiomorphic trait. KÖHLER & GÜNTHER (2008) stated in their mitochondria based phylogeny of Papuan microhylids that “*Austrochaperina* forms a monophyletic group with *Copiula major*, *C. pipiens*, and *C. obsti...*” but did not draw taxonomic consequences from this statement. According to molecular studies by PELOSO *et al.* (2015), the three former *Austrochaperina* species – *A. derongo* ZWEIFEL, 2000, *A. guttata* ZWEIFEL, 2000, and *A. rivularis* ZWEIFEL, 2000 – with bony clavicles, should belong to the genus *Copiula* MÉHELY, 1901, a genus that was characterized until then by the trait “absence of clavicles”. Thus we are now confronted with the fact that the most important morphological character (presence or absence of bony clavicles) used to define the genera *Austrochaperina* and *Copiula* is no longer valid. More detailed studies are required either to redefine both genera or to synonymize them. In this case *Copiula* MÉHELY, 1901 would have priority over *Austrochaperina* FRY, 1912. I refrain from this step here, awaiting phylogenetic analyses that comprise more material.

According to ZWEIFEL (2000), snout-vent lengths of the adults in the genus *Austrochaperina* range from 20 to 50 mm. Most species are surface dwellers on and below leaf litter, and some inhabit riparian habitats along small streams. The genus is distributed from sea level to elevations of approximately 2000 m above sea level (a.s.l.). Most species occur on the main island of New Guinea, some on adjacent islands, and four in northern Australia (FROST, 2017).

During field work in the Wondiwoi Mountains at the base of the Wandammen Peninsula, Papua Province, Indonesian New Guinea, in various years between 1998 and 2003, together with indigenous helpers I found, among others, three species of *Austrochaperina*: one extremely small form which has already been described as *Austrochaperina minutissima*; a second form which obviously belongs to *A. macrorhyncha* and requires a redescription of that species and revalidation of another; and a third form which belongs to a new species that is described later in this paper.

Material and methods

Frogs of the redescribed and newly described species were collected by the author and his helpers at night after they were located by their advertisement calls or serendipitously during the day. Various 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, after which the animals were fixed in formalin. All specimens were later transferred to 75 % ethanol in the Berlin Museum. One specimen of *Austrochaperina macrorhyncha* 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 and SVL are more or less identical, but according to my experience the measurement error is higher in the latter and therefore I prefer to use the former);
- TL tibia length: external distance between knee and ankle;
- TaL length of tarsus: external distance, tarsal and ankle joints held at right angles;
- T4L distance from tip of 4th toe to proximal end of inner metatarsal tubercle;
- T4D transverse diameter of disc of 4th toe;
- T1D transverse diameter of disc of 1st toe;
- F3L length of 3rd finger from tip of this finger to proximal edge of inner metacarpal elevation;
- F3D transverse diameter of disc of 3rd finger;
- F1D transverse diameter of disc of 1st 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;
- EST distance from anterior corner of orbital opening to tip of snout;
- 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 of the redescribed and the newly described species are currently housed in the Museum für Naturkunde Berlin (ZMB) and bear registration numbers of this in-

¹ See Appendix.

stitution. Part of the type series will be transferred to the Museum Zoologicum Bogoriense (MZB), Cibinong, West Java, Indonesia, after completion of my studies.

Material compared

- Austrochaperina alexanderi* GÜNTHER, RICHARDS & DAHL, 2014: type series, Muller Range, PNG;
A. archboldi ZWEIFEL, 2000: AMNH 66719 (holotype), 66720, 66722–25 (paratypes), Eastern Highland Province of PNG;
A. basipalmata (KAMPEN, 1906): ZMB 25718, 62246–247, upper reaches of the Sepik River, and ZMB 25786, 85589–598, also from the Sepik River; PNG;
A. blumi ZWEIFEL, 2000: UPNG 9529–31, 9534, 9537 (all paratypes), Eipomek, Jayawijaya District, PPI;
A. laurae GÜNTHER, RICHARDS & DAHL, 2014: type series, Muller Range, PNG;
A. macrorhyncha (KAMPEN, 1906): RMNH 4630 (holotype), southeastern corner of the Vogelkop Peninsula, Manikion area, PPI;
A. mehelyi (PARKER, 1934): MCZ A-28406, Huon Peninsula, PNG;
A. minutissima GÜNTHER, 2009: type series, Wondiwai Mountains, PPI;
A. novaebritanniae ZWEIFEL, 2000: MCZ A-73085-86 (paratypes), East New Britain Province, PNG.
Chaperina (now *Austrochaperina*) *punctata* KAMPEN, 1913: ZMA 5747, 5750 (Went Mountains), ZMA 5751, 5752 (Heuvelbivak, Lorentz River), ZMA 25754 (Hellwig Mountains), all ZMA specimens are syntypes and originate from PPI; ZMB 85605–610, near the village of Silimo, 1600 m a.s.l., about 40 km south of Wamena, Jayawijaya Mountains, PPI;
Copiula derongo (ZWEIFEL, 2000): MCZ A-132891, A-132913-14, A-132918, A-132978, A-132999 (all of them paratypes), Western Province of PNG near Derongo; ZMB 70334, 70335, 70329, Yapen Island, PPI;
Copiula guttata (ZWEIFEL, 2000): MCZ A-132843-45 (all of them paratypes), Gulf Province of PNG near Uraru.

Comparisons herein of the redescribed, the revalidated, and the newly described species with congeners, are based on the above material, on additional material in the collection of the Museum für Naturkunde, Berlin (ZMB), and on data published in the respective original descriptions and in comparative studies (KAMPEN 1923, NIEDEN 1926, PARKER 1934, LOVERIDGE 1948, ZWEIFEL 2000, and MENZIES 2006).

Abbreviations

- AMNH American Museum of Natural History, New York;
 FMNH Field Museum of Natural History, Zoology Department, Chicago, Illinois, USA;
 FN Field number;
 MZB Museum Zoologicum Bogoriense, Cibinong, Java, Indonesia;
 MCZ Museum of Comparative Zoology, Harvard University, Cambridge, USA;
 PNG Papua New Guinea;
 PPI Papua Province of Indonesia;
 RMNH Naturalis Biodiversity Center, Leiden – (formerly Rijksmuseum van Natuurlijke Historie,) Netherlands;

- SAMA South Australian Museum, Adelaide, Australia;
 ZMA Zoologisch Museum Amsterdam, now Naturalis Biodiversity Center, Leiden, Netherlands;
 ZMB Zoologisches Museum Berlin, by now Museum für Naturkunde, Berlin, Germany.

Redescription of *Austrochaperina macrorhyncha* (KAMPEN, 1906)

Introductory remarks

The description of *Austrochaperina macrorhyncha*, then under the name *Chaperina macrorhyncha*, by KAMPEN in the year 1906 was based on a single specimen collected in the Manikion Region in western New Guinea. According to ZWEIFEL (2000), this region is located at the southeastern corner of the Vogelkop Peninsula. Formerly part of a colony of the Netherlands, this area today is part of the Papua Barat Province of Indonesia. KAMPEN in his 1906-paper also described *Chaperina basipalmata* from the central north of New Guinea. In 1913 the same author described *Chaperina punctata* on the basis of 11 specimens from the “Went-Gebirge” and one specimen from the “Hellwig-Gebirge” which were collected by H. A. LORENTZ during the “Niederländische Süd-Neu-Guinea-Expedition von 1909–10”. The Went Mountains are located about 400 km, and the Hellwig Mountains about 600 km, southeast of the type locality of *C. macrorhyncha*. In the description of *C. punctata* no characters are mentioned that differentiated this new taxon from *C. macrorhyncha*. In 1919, KAMPEN synonymised, without comments, *C. punctata* (as *Sphenophryne punctata*) with *Sphenophryne basipalmata* and in 1923 the same author synonymised, because of the “existence of specimens intermediate between the three species”, *S. punctata* and *S. basipalmata* with *S. macrorhyncha*. PARKER (1934) and LOVERIDGE (1948) shared this opinion.

In the profound revision of the Australopapuan genus *Sphenophryne*, ZWEIFEL (2000) resurrected the genus *Austrochaperina* to accommodate a large part of the hitherto *Sphenophryne* species. He treated *Austrochaperina macrorhyncha* and *A. basipalmata* as valid species, and *Chaperina* alias *Sphenophryne punctata* as a synonym of *A. macrorhyncha*. In the redefinition of the latter he used, besides the holotype of *Chaperina macrorhyncha*, mostly type material of *Chaperina punctata*. A decisive point used to treat *macrorhyncha* and *punctata* as conspecific was to regard the small-sized (22 mm SVL) holotype of *A. macrorhyncha* as a juvenile specimen of the larger-sized *punctata* species (adults more than 30 mm SVL). But, due to the poor preservation status of this holotype, neither he nor others could confirm or refute this assumption.

During field work in the Wondiwai Mountains (near the base of the Wandammen Peninsula) between 1998 and 2003 I and indigenous helpers collected a total of



Fig. 1a. Dorsal view of the preserved ZMB 62235 as a “typical” representative of *Austrochaperina macrorhyncha*.

Fig. 1b. Ventral view of the preserved ZMB 62235.

Fig. 1c. Lower surface of the right hand of *Austrochaperina macrorhyncha*, ZMB 62235.

Fig. 1d. Lower surface of the right foot of ZMB 62235.

9 adult specimens of the genus *Austrochaperina* at 700–950 m a.s.l. which, according to their morphology and their advertisement calls, belong to one and the same species. I decided to refer them to *A. macrorhyncha* mainly because of their size (22.8–24.9 mm SUL) and their body ratios that better agree with that of the holotype than those of *A. punctata*, and their capture locality that is much closer (a distance of about 130 km) to the type locality than are localities for *A. punctata*. Moreover, we did not find any other *Austrochaperina* in the Wondiwoi Mountains larger than 28 mm SUL. From this it follows that the definition of *A. macrorhyncha* by ZWEIFEL (2000) seems to be incorrect and that the species once more has to be redescribed.

Redescription

Holotype of *Austrochaperina macrorhyncha*: RMNH 4630, collected February 14–21, 1903, by the Netherlands New Guinea Expedition.

Type locality. Manikion region at the southeastern corner of the Vogelkop Peninsula, today Papua Barat Province of Indonesia.

Material basis for the redescription. RMNH 4630, sex undetermined; ZMB 62235 (FN 6590), male, collected 29 July 1998; ZMB 62237 (FN 7013), male; ZMB 62238 (FN 7014), female, both coll. 26 August 1999; ZMB 62601 (FN 7267), female; ZMB 62602 (FN 7268), male; ZMB 62603 (FN 7269), male, now an osteological preparation, all three coll. 09 May 2000; ZMB 70326 (FN 7697), male; ZMB 70327 (FN 7698), male; ZMB 70328 (FN 7699), male, all three coll. 06 June 2003. Collection sites were in the Wondiwoi Mountains, base of the Wandammen Peninsula, at 700–950 m a.s.l. Collectors of all specimens were R. GÜNTHER, M. KAPISA, and S. MARANI.

Diagnosis. With a snout-urostyle-length of 22.0 mm in the holotype of unknown sex, 22.8–23.8 mm in seven adult males and 24.3–24.9 mm in two adult females, *A. macrorhyncha* clearly belongs to the small-sized species in its genus, and with only minor size differences between sexes. Finger discs small (ratio F3D/SUL in the holotype 0.030 and 0.026–0.032 in the series from the Wondiwoi Mnts.), internarial distance large (ratio IND/SUL in the holotype 0.123 and 0.122–0.140 in the above series). Ground colour of dorsal surfaces light brown to middle brown with sparse dark brown spots and dots, no vermiform markings. Sides of head and flanks with many larger and smaller dark brown spots and flecks and on the whole darker and more speckled than dorsal surfaces. Chin through chest and inferior thighs and shanks more or less maculated, abdomen without or with only little mottling. Pale rostral pad present but weakly developed. Advertisement calls consist of long series (30–100 s) of harsh, pulsed notes with duration of 58–74 ms; repetition rate 1.8–2.4 notes/s.

Description of the preserved ZMB 62235 as a typical representative of *Austrochaperina macrorhyncha*

Morphology and colouration. An adult male with a snout-urostyle length of 22.8 mm (Fig. 1a and 1b). For measurements and body-ratios see Table 1. Head in the region of the tympana as wide as the remaining body. Snout tip rounded in dorsal view, in profile protruding. Nostrils laterally directed and much closer to snout tip than to eyes, distance between nares distinctly greater than distance between eye and naris. Only traces of nares visible from above. Canthus rostralis straight from eye up to nostril and gently rounded. Loreal region steep. Tongue slender, elongate, half free posteriorly, and with a very weak posterior indentation. Prepharyngeal ridges without denticles. Elongate vocal slit on each side of the tongue. Tympanic annulus clearly expressed, its horizontal diameter less than half eye diameter, weak supratympanic skin fold. Eye of moderate size (ED/SUL 0.132), with horizontal pupil. Fore limbs short with short fingers, their tips somewhat broader than penultimate phalanges (Fig. 1c); terminal grooves present on all finger discs; metacarpal and sub-articular tubercles weakly developed; relative length of fingers $3 > 4 > 2 > 1$. Hind limbs more strongly developed than fore limbs. Discs of toes 3 and 4 clearly wider than penultimate phalanges, those of toes 2 and 5 somewhat wider, and that of toe 1 not wider than penultimate phalanx (Fig. 1d); all toes with grooves on discs. Inner metatarsal tubercle elongate, outer metatarsal and subarticular tubercles adelomorphic. Relative length of toes $4 > 3 > 5 > 2 > 1$, no webbing. All dorsal and ventral surfaces smooth except for small, dark brown tubercles on the dorsum.

Snout tip with a weakly developed whitish pad. Dorsal surface of head, body, and extremities beige to light brown with some dark brown dots, mainly on shanks and on sides of dorsum; and inferiorly with a dark brown reticulum, this reticulum continuous to the subocular region. Sides of snout more uniformly dark brown. Basic colour of all ventral surfaces beige; throat, chest, and inferior flanks with a loose brown reticulum and hind limbs with a dense brown reticulum. The colouration was more intense in life.

Morphological variation. The series from the Wondiwoi Mountains consists of 7 adult males and 2 adult females for which measurements and body ratios are listed in Table 1. Sex was determined by inspection of gonads and of secondary sex characters (presence of vocal slits). There are only minor differences in SUL: males measure 22.8–23.8 mm and females 24.3–24.9 mm. Body ratios of both sexes do not differ, therefore both sexes were pooled for the calculation of the ratios. Basic colouration is much the same in all specimens. There are, however, differences in the extent and intensity of mottling of the dorsal and ventral surfaces. A pale inconspicuous rostral pad occurs in all specimens. Fig. 2 shows an adult male of *A. macrorhyncha* in life (ZMB 70327).

Table 1. Body measurements and body ratios of 9 specimens of *Austrochaperina macrorhyncha* from the Wondiwoi Mountains, base of Wandammen Peninsula. Sex and collection data for these frogs are listed in the section “Redescription” herein. All measurements in mm; Reg. No. = Registration number; SD = standard deviation; for explanations of abbreviations for measurements see “Material and methods”.

Reg. No.	ZMB 62235	ZMB 62237	ZMB 62238	ZMB 62601	ZMB 62602	ZMB 62603	ZMB 70326	ZMB 70327	ZMB 70328	Mean ± SD
SUL	22.8	23.1	24.9	24.3	23.3	22.9	23.8	23.1	23.3	
TL	11.1	11.6	11.7	12.3	11.5	11.9	12.1	11.4	10.9	
TaL	7.6	7.0	7.0	7.5	6.9	7.1	7.9	7.3	7.1	
T4L	12.5	12.3	12.2	12.0	11.7	10.4	12.1	11.4	11.5	
T4D	0.8	0.9	1.0	1.0	1.0	0.8	0.9	1.0	1.0	
T1D	0.5	0.6	0.5	0.6	0.5		0.6	0.5	0.5	
F3D	0.6	0.7	0.8	0.7	0.7	0.6	0.7	0.7	0.7	
F1D	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.4	
HL	7.8	7.7	8.6	8.1	8.0	8.1	8.5	8.0	8.4	
HW	8.5	9.1	10.1	9.3	9.2	8.2	9.2	9.4	9.0	
END	1.8	1.9	2.0	2.0	2.0	2.0	1.9	2.0	1.8	
IND	3.2	2.9	3.1	3.0	3.0	2.8	2.9	3.1	3.1	
EST	3.0	3.2	3.5	3.2	3.4		3.1	3.3	3.1	
SL	3.6	4.0	4.2	4.0	4.2		4.1	4.0	3.8	
ED	3.0	3.1	3.6	3.1	3.0	3.1	3.0	3.2	2.9	
TyD	1.3	1.0	1.3	1.5	1.2	1.3	1.4	1.1	1.3	
TL/SUL	0.49	0.50	0.47	0.51	0.49	0.52	0.51	0.49	0.47	0.49 ± 0.017
TaL/SUL	0.33	0.30	0.28	0.31	0.30	0.31	0.33	0.32	0.30	0.31 ± 0.016
T4L/SUL	0.55	0.53	0.49	0.49	0.50	0.45	0.51	0.49	0.49	0.50 ± 0.027
T4D/SUL	0.035	0.039	0.040	0.041	0.043	0.035	0.038	0.043	0.043	0.040 ± 0.003
F3D/SUL	0.031	0.030	0.032	0.029	0.030	0.026	0.029	0.030	0.030	0.030 ± 0.002
T4D/F3D	1.33	1.29	1.25	1.43	1.43	1.33	1.29	1.43	1.43	1.36 ± 0.07
T1D/F1D	1.00	1.20	1.00	1.20	1.00		1.20	1.00	1.25	1.11 ± 0.11
HL/SUL	0.34	0.33	0.35	0.33	0.34	0.35	0.36	0.35	0.36	0.35 ± 0.011
HW/SUL	0.37	0.39	0.41	0.38	0.39	0.36	0.39	0.41	0.39	0.39 ± 0.016
HL/HW	0.92	0.85	0.85	0.87	0.87	0.99	0.92	0.85	0.93	0.89 ± 0.049
END/SUL	0.079	0.082	0.080	0.082	0.086	0.087	0.080	0.087	0.077	0.082 ± 0.004
IND/SUL	0.140	0.126	0.124	0.123	0.129	0.122	0.122	0.134	0.133	0.128 ± 0.006
END/IND	0.56	0.66	0.65	0.67	0.67	0.71	0.66	0.65	0.58	0.65 ± 0.047
EST/SUL	0.132	0.139	0.141	0.132	0.146		0.130	0.143	0.133	0.137 ± 0.006
SL/SUL	0.158	0.173	0.169	0.165	0.180		0.172	0.173	0.163	0.169 ± 0.007
ED/SUL	0.132	0.134	0.145	0.128	0.129	0.135	0.126	0.139	0.124	0.132 ± 0.007
TyD/SUL	0.057	0.043	0.052	0.062	0.052	0.057	0.059	0.048	0.056	0.054 ± 0.006
TyD/ED	0.43	0.32	0.36	0.36	0.40	0.42	0.47	0.34	0.45	0.39 ± 0.052

Distribution. Maniok Region at the southeastern corner of the Vogelkop Peninsula, Papua Barat Province of Indonesian New Guinea; Wondiwoi Mountains at the base of the Wandammen Peninsula, border between Papua and Papua Barat Provinces. According to my own observations in the years 2000 and 2008, *A. macrorhyncha* also occurs in the Fakfak Mountains on the Bomberai Peninsula, Papua Barat Province (Fig. 8).

Habitat and ecological notes. All *A. macrorhyncha* specimens in the Wondiwoi and Fakfak Mountains were found at elevations of between 700 and 950 m a.s.l. perched on the ground in and on the leaf layer in primary rain forest. Males started to call at dusk, the main call intensity was between 6 and 9 p.m., and some calls were heard later at night. A second *Austrochaperina* species, *A. minutissima*, lives syntopic with *A. macrorhyncha* in the Wondiwoi Mountains, and a third species lives there at elevations of between 450 and 700 m a.s.l. and could

not be allocated to a known species. It will be described as new to science later in this paper.

Vocalisation. *Austrochaperina macrorhyncha* utters long series of harsh, pulsed calls or notes. I prefer the latter term in the following text. Mean duration of note series 50 s, range 30–97 s. Mean note repetition rate in these 5 series 2.1 notes/s, range 1.78–2.50 notes/s. Mean note length 66.1 ± 5.3 ms, range 58–74 ms, n = 45. Mean internote interval length 336 ± 90.5 ms, range 222–525 ms, n = 45. All notes are composed of 10–14 pulses (Fig. 3), mean number of pulses per note 11.7 ± 0.76, n = 45. Pulses follow each other more quickly and are more weakly expressed in the first part than in the second part of many notes. In general, the shape of the wave form of a note has a spindle-like appearance. The fundamental frequency band centres at 1.8 kHz and the dominant frequency at 3.6 kHz. There are some more upper harmonic bands. All calls were recorded at air temperatures of from 19 to 20 °C.



Fig. 2. Male of *Austrochaperina macrorhyncha*, ZMB 70327, in life.

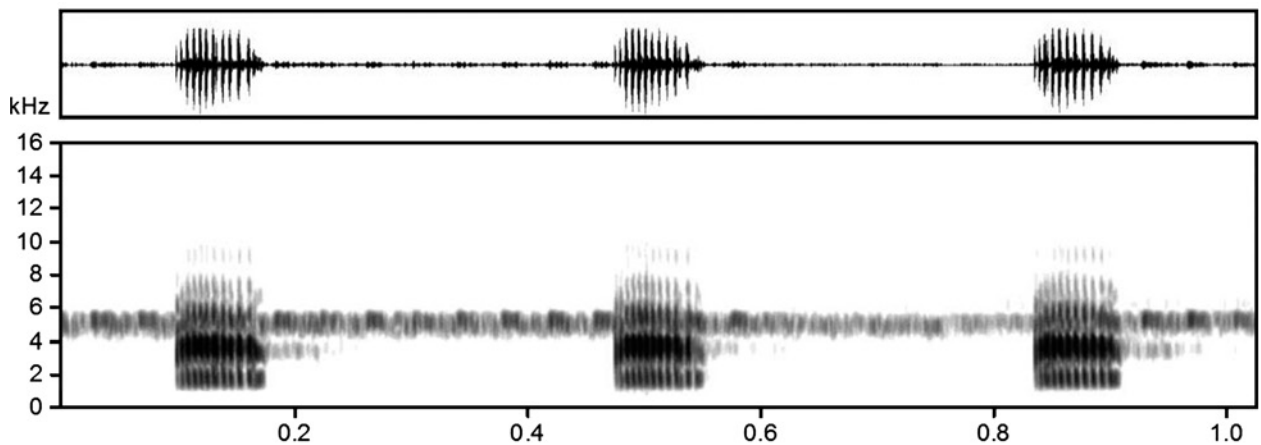


Fig. 3. Wave form (above) and spectrogram (below) of a section with three notes of an advertisement call of *Austrochaperina macrorhyncha*.

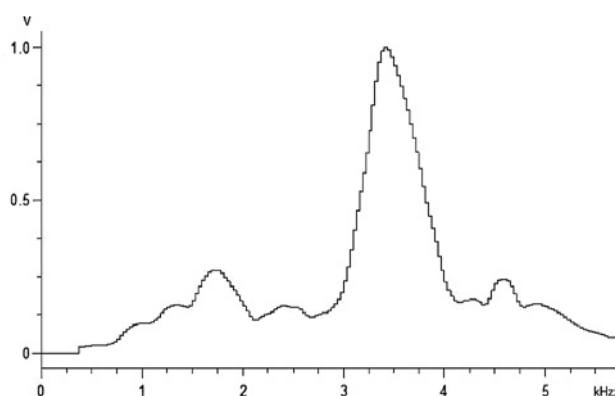


Fig. 4. Power spectrum of three notes of an advertisement call of *Austrochaperina macrorhyncha*.

Comparisons of the Wondiwoi material with the holotype. My own measurements (in mm) of the holotype are as follows: SUL 22.0, TL 10.4, TaL 6.5, L4T 9.4, T4D 0.9, F3D 0.65, HL 7.2, HW 8.0, END 1.8, IND 2.7, ED 2.8, TyD 1.2; TL/SUL 0.47, TaL/SUL 0.29, T4D/SUL 0.041, F3D/SUL 0.030, T4D/F3D 1.38, HL/SUL 0.33, HW/SUL 0.36, HL/HW 0.90, END/SUL 0.082, IND/SUL 0.123, END/IND 0.67, ED/SUL 0.127, TyD/SUL 0.055, TyD/ED 0.43. With a SUL of 22.0 mm the holotype is negligibly smaller than the smallest specimen (22.8 mm) from the Wondiwoi Mountains, but all its body ratios fall within the range of the Wondiwoi specimens. Colour of the faded holotype and its colour as described by KAMPEN

(1906) also fall into the colour variation of the series from the Wondiwoi Mountains.

Comparison with other species. The size of adult specimens of *A. macrorhyncha* most probably varies mainly between 20 and 26 mm. The vast majority of New Guinean species of the genus are clearly larger or smaller. *Austrochaperina blumi* and *A. brevipes* ZWEIFEL, 2000 are the only ones of similar size. On the basis of size, body ratios, and marking, *A. blumi* (see ZWEIFEL, 2000) seems to be a close relative of *A. macrorhyncha*. The best distinguishing features between both are the body ratios IND/SVL (0.097–0.111 in *A. blumi* and 0.122–0.140 in *A. macrorhyncha*) and F3D/SVL (0.031–0.040 in *A. blumi* and 0.026–0.032 in *A. macrorhyncha*). *A. brevipes* clearly has shorter legs (TL/SVL of the holotype 0.36 vs. 0.47–0.52 in *A. macrorhyncha*). *A. gracilipes* FRY, 1912, *A. kosarek* ZWEIFEL, 2000, *A. mehely*, *A. novaebritanniae*, and *A. yelaensis* ZWEIFEL, 2000 “touch” the size range of *A. macrorhyncha* but all have distinctly smaller finger discs.

Revalidation of *Austrochaperina punctata* (KAMPEN, 1913)

From the above redescription of *A. macrorhyncha* it follows that the species *A. punctata* has to be revalidated. It was described by KAMPEN (1913) as *Chaperina punctata* (see above) but six years later it was already transferred by him (KAMPEN, 1919) to the genus *Sphenophryne* PETERS & DORIA, 1878 and synonymized with *S. macrorhyncha*. This opinion was shared by NIEDEN (1926), PARKER (1934), and LOVERIDGE (1948). ZWEIFEL (2000) resurrected the genus name *Austrochaperina* FRY, 1912 and proposed the new combination *Austrochaperina macrorhyncha*, treating *Chaperina punctata* as a synonym of *A. macrorhyncha* just as by the above mentioned authors. In order to redefine *A. macrorhyncha* he relied mainly on the syntypes of *C. punctata*, especially FMNH 100117. The conclusions of ZWEIFEL (2000) were adopted by MENZIES (2006).

The following revalidation of *A. punctata* is based on the original description by KAMPEN (1913), the data given by ZWEIFEL (2000) for *A. macrorhyncha*, and my own studies of five syntypes of *Chaperina punctata* as well as 11 specimens from near Silimo village, southern slopes of Jayawijaya Mountains, Papua Province of Indonesia.

Definition of *Austrochaperina punctata*. Of moderate size, males mature at about 28 mm and females at about 30 mm SVL, known maximum size of males and females about 37 mm SVL. Body ratios based on 20 specimens: TL/SVL 0.44–0.52, HW/SVL 0.31–0.41, F3L/SVL 0.22–0.29, F3D/SVL 0.034–0.054, T4L/SVL 0.43–0.52, T4D/SVL 0.038–0.054, ED/SVL 0.109–0.141, END/SVL 0.063–0.089, IND/SVL 0.096–0.116, END/IND 0.63–0.80.

Morphology. According to ZWEIFEL (2000), 40–41: “... Head narrower than body; snout bluntly pointed,

slightly projecting, loreal region steep, slightly concave; canthus rostralis obvious but rounded; nostrils lateral, barely visible from above, closer to tip of snout than to eye. Eyes large, eyelid about 86% of interorbital distance; tympanum small and indistinct. Relative length of fingers $3 > 4 > 2 > 1$, first about half length of second, all with broadened, rounded discs, that on third finger slightly more than $2 \times$ penultimate phalanx width; subarticular and metatarsal elevations low, rounded, scarcely evident. Toes with a trace of webbing, relative length $4 > 3 > 5 > 2 > 1$, all with well-developed, rounded discs, that on fourth toe broader than disc of third finger; subarticular elevations low and indistinct, inner metatarsal elevation low and elongate, scarcely visible. Skin smooth above and below, some slight wartiness on side of body and upper surface of shank. Other specimens do not vary significantly from this description.

Color and pattern: The syntypes of *punctata* are faded with little or no pattern discernable. KAMPEN (1913: 464) described them as brownish or gray, the back with dark rounded flecks or marbling, loreal region and upper half of temporal region mostly dark, extremities with indistinct dark crossbands or flecked, lower surfaces light, with gray or brown marbling on the throat and limbs. One of the four specimens from Timeka has a gray dorsal ground color with sharply defined, dark vermiform markings on head and body; on the upper surfaces of the legs these coalesce to form a reticulum. The loreal region is dark, the upper lip light spotted, and there is a dark postocular supratympanic streak. The groin and anterior and posterior of thigh are pale with darker spots more evident on the posterior surface. Chin through chest is maculated dark and light gray, and the abdomen is pale and immaculate. Soles and palms are dark gray. The other three specimens have the markings much less evident, almost indistinguishable in one ...”

An image of the frog MZB 3564 that was taken by STEPHEN RICHARDS (SAMA) near the Wapoga Alpha Camp about 145 km NE of Nabire (northern Papua Province), shows a yellowish-brown dorsal and lateral ground colour with coarse dark brown mottling (Fig. 31D in ZWEIFEL 2000).

Advertisement call. STEPHEN RICHARDS recorded a call = note series from a male near Wapoga Alpha camp that was allocated by him and ZWEIFEL (2000) to *Austrochaperina macrorhyncha*. Judging from its remarkable size of 36.8 mm SVL, the producer of this call was obviously not *A. macrorhyncha* but rather *A. punctata*. Concerning its call parameters, I came to similar results as did ZWEIFEL (2000). 126 notes were uttered in 28 seconds, which equals a repetition rate of 4.5 notes/s. Mean duration of 50 notes was 125 ms, SD 7.3, range 111–143 ms; mean duration of 50 internote intervals was 268 ms, SD 67 ms, range 177–485 ms. Number of pulses per note 7–10, first pulse in most notes clearly separated from the following ones, its amplitude lower or of same intensity as that of the following pulses, first pulses of a note were

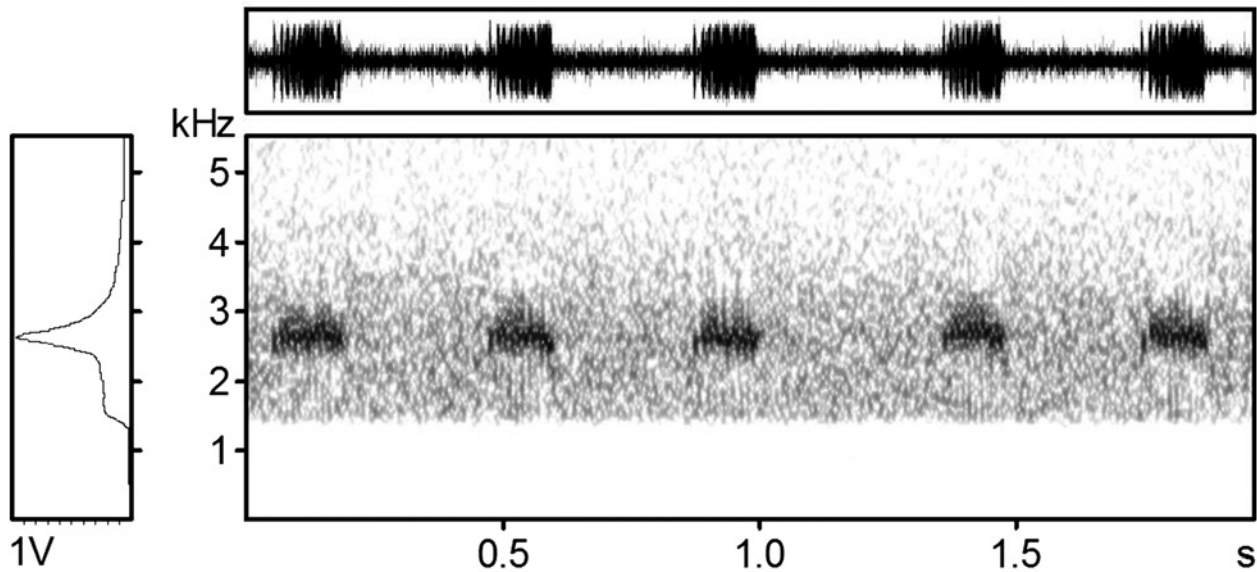


Fig. 5. Wave form (above), spectrogram (below), and power spectrum (left) of a section with five notes of an advertisement call of *Austrochaperina punctata*.

shorter and well separated from one another and the last pulses were longer and merging with one another (Fig. 5). Note succession at the beginning and at the end of the series slower than elsewhere. Duration of notes varies less than duration of note intervals. Dominant frequency 2.6 kHz. Call was recorded at a temperature of 21.6 °C.

Distribution. All localities mentioned by ZWEIFEL (2000) for *Austrochaperina macrorhyncha*, with the exception of the Manikion Region at the southeastern corner of the Vogelkop Peninsula, relate to *A. punctata*. A series of 11 specimens (six of them are deposited in the ZMB collection) originate from near Silimo village, southern slopes of the Jayawijaya Mountains, Yahukimo regency, about 30 km east of the type localities of *A. punctata* in the Went Mountains, Papua Province of Indonesia.

Habitat and ecological notes. According to N. NAIDENOW, who collected the series at Silimo on 30th April, 1998, all specimens were found during the day resting under stones or leaf litter in a streambed. This indicates that *A. punctata* is a streambed dweller, in contrast to *A. macrorhyncha* which is a dweller of the forest floor.

Comparisons with other species. Differences to other species are outlined by ZWEIFEL (2000) under the treatment of *Austrochaperina macrorhyncha* and must not be repeated here. The main differences between *A. punctata* and *A. macrorhyncha* should however be emphasized. Most important is the body size (SVL): the adults of *A. punctata* are as a rule larger than 27 mm and those of *A. macrorhyncha* are smaller than 25 mm. There are also significant differences in some body ratios. Values of *A. punctata* are based on my own measurements of five syntypes (see under “Material compared”), and that of *A. macrorhyncha* are based on nine specimens from the Wondiwoi Mountains): IND/SVL in *A. punctata* 0.108–

0.116 vs. 0.122–0.140 in *A. macrorhyncha*; F3D/SVL in *A. punctata* 0.044–0.054 vs. 0.026–0.032 in *A. macrorhyncha*; T4D/SUL 0.051–0.054 in *A. punctata* vs. 0.035–0.043 in *A. macrorhyncha*; T4D/F3D in *A. punctata* 1.00–1.20 vs. 1.25–1.43 in *A. macrorhyncha*; END/IND 0.70–0.79 in the former and 0.56–0.71 in the latter. All values of the holotype of *A. macrorhyncha* fall into the ranges of the frogs from the Wondiwoi Mountains.

According to ZWEIFEL (2000) and my own observations there is no whitish rostral pad in *A. punctata* but it is present in most specimens of *A. macrorhyncha*. If the note series described above was really produced by *A. punctata*, both species clearly differ also in their advertisement calls: note length of *A. macrorhyncha* ranges from 58 to 74 ms, that of *A. punctata* from 111 to 143 ms; number of pulses per note 10–14 in *A. macrorhyncha* and 7–10 in *A. punctata*; mean note repetition rate 2.1 in *A. macrorhyncha* vs. 4.5 in *A. punctata*; dominant frequency in notes of *A. macrorhyncha* 3.6 and in notes of *A. punctata* 2.6 kHz.

Description of *Austrochaperina rudolfarndti* sp. nov.

Holotype. ZMB 63900 (FN 7301), adult male, Wondiwoi Mountains at the base of Wandammen Peninsula, border Papua Barat and Papua Provinces of Indonesia (2°57'S and 134°38'E; 538 m a.s.l.) collected on 10 May 2000 by R. GÜNTHER, M. KAPISA, and I. TETZLAFF.

Paratypes. ZMB 63898 (FN 6763), coll. 29 July 1998, 700 m a.s.l., male; ZMB 63899 (FN 7216), coll. 07 May 2000, 500 m a.s.l., male; ZMB 70324 (FN 7606), coll. 23 June 2003, 520 m a.s.l., male; ZMB 70325 (FN 7714), coll. 25 June 2003, 530 m a.s.l., female. Collectors were R. GÜNTHER, M. KAPISA, and G. MAREKU.

Diagnosis. With a snout-urostyle-length of 26.8–28 mm in four adult males and 28.0 mm in one adult female,



Fig. 6a. Holotype in life of *Austrochaperina rudolfarndti* sp. nov. in dorsolateral view.

Fig. 6b. Preserved holotype of *Austrochaperina rudolfarndti* sp. nov. in ventral view.

Fig. 6c. Lower surface of the left hand of the preserved holotype of *Austrochaperina rudolfarndti* sp. nov.

Fig. 6d. Lower surface of the right foot of the preserved holotype of *Austrochaperina rudolfarndti* sp. nov.

Table 2. Body measurements and body ratios of the type series of *Austrochaperina rudolfarndti* sp. nov. ZMB 63900 is the holotype, with exception of the adult female ZMB 70325 all types are adult males. All measurements in mm; for explanation of abbreviations see “Material and methods”.

Reg. No.	ZMB 63898	ZMB 63899	ZMB 63900	ZMB 70324	ZMB 70325	Mean ± SD
SUL	28.0	26.8	27.0	26.8	28.0	
TL	12.9	13.2	12.9	12.2	13.1	
TaL	8.1	7.9	8.2	7.4	8.0	
T4L	14.0	13.6	13.8	13.1	13.5	
T4D	1.0	1.0	1.0	0.9	1.2	
T1D	0.6	0.6	0.7	0.6	0.7	
F3D	0.9	0.9	0.8	0.8	1.0	
F1D	0.6	0.6	0.7	0.6	0.8	
HL	10.0	9.1	9.2	8.8	9.3	
HW	10.4	10.5	10.7	10.0	11.0	
END	2.0	1.9	2.0	1.9	2.1	
IND	3.4	3.2	3.3	3.2	3.4	
EST	3.5	3.5	3.3	3.5	3.4	
SL	4.8	5.0	4.8	4.7	5.2	
ED	3.7	3.6	3.5	3.6	3.9	
TyD	1.5	1.3	1.5	1.3	1.3	
TL/SUL	0.46	0.49	0.48	0.46	0.47	0.47 ± 0.013
TaL/SUL	0.29	0.29	0.30	0.28	0.29	0.29 ± 0.007
T4L/SUL	0.50	0.51	0.51	0.49	0.48	0.50 ± 0.013
T4D/SUL	0.036	0.037	0.041	0.034	0.043	0.038 ± 0.004
F3D/SUL	0.032	0.034	0.030	0.030	0.036	0.032 ± 0.003
T4D/F3D	1.11	1.11	1.25	1.13	1.20	1.16 ± 0.061
T1D/F1D	1.00	1.00	1.00	1.00	0.88	0.98 ± 0.054
HL/SUL	0.36	0.34	0.34	0.33	0.33	0.34 ± 0.012
HW/SUL	0.37	0.39	0.40	0.37	0.39	0.38 ± 0.013
HL/HW	0.96	0.87	0.86	0.88	0.85	0.88 ± 0.043
END/SUL	0.071	0.071	0.074	0.071	0.075	0.072 ± 0.002
IND/SUL	0.121	0.119	0.122	0.119	0.121	0.120 ± 0.001
END/IND	0.59	0.59	0.61	0.59	0.66	0.61 ± 0.030
EST/SUL	0.125	0.131	0.122	0.131	0.121	0.126 ± 0.005
SL/SUL	0.171	0.187	0.178	0.175	0.186	0.179 ± 0.007
ED/SUL	0.132	0.134	0.130	0.134	0.139	0.134 ± 0.003
TyD/SUL	0.054	0.049	0.056	0.049	0.046	0.051 ± 0.004
TyD/ED	0.41	0.36	0.43	0.36	0.33	0.38 ± 0.041

A. rudolfarndti sp. nov. belongs to the moderately-sized species of its genus, apparently with no or only minor size differences between sexes. Shanks fairly long (TL/SUL 0.46–0.49), head wide (HW/SUL 0.37–0.40), discs present on all fingers and medium-sized (F3D/SUL 0.030–0.036), internarial distance fairly large (IND/SUL 0.119–0.122). In life, ground colour of dorsal surfaces olive-grey or reddish-grey with some lighter and some darker markings. In preservative, dorsal surfaces brown with few to many dark brown marks. In life and in preservative, ventral surfaces completely off-white or off-white with dark grey mottling, especially on throat and limbs. Sides of head and region from eye to upper flank darker than remaining surfaces. No pale rostral pad. Advertisement calls consist of long series (24–92 s) of harsh, pulsed notes with duration of 55–65 ms; repetition rate 4.5–5.5 notes/s.

Description of the holotype. An adult male with a snout-urostyle length of 27.0 mm (Figs. 6a and 6b). There is a longitudinal cut in the right body side. For measurements and body-ratios see Table 2. Head in the region of the tympana narrower than in the remaining body. Snout tip rounded in dorsal view and protruding in profile. Nostrils not visible from above, laterally directed, and closer to snout tip than to eyes, distance between nares distinctly greater than distance between eye and naris (END/IND 0.61). Canthus rostralis straight and gently rounded. Loreal region sloping. Tongue large, half free posteriorly, and not notched posteriorly. Anterior prepharyngeal ridges not indented, posterior one denticulate. Elongate vocal slit on each side of the tongue. Tympanic annulus visible, its horizontal diameter less than half eye diameter, supratympanic skin fold present. Eye of moderate size (ED/SUL 0.130), with horizontal pupil. Fore limbs medium-sized with rather short fingers, tips of fingers 2, 3, and 4 clearly wider than penultimate phalanges, that of finger 1 only marginally wider; terminal grooves present on all finger discs; inner metacarpal tubercle more pronounced than outer one and subarticular tubercles; relative length of fingers 3 > 4 > 2 > 1 (Fig. 6c). Hind limbs more strongly developed than fore limbs. Discs of toes 2, 3, and 4 clearly wider than penultimate phalanges, that of toes 1 and 5 somewhat wider than penultimate phalanx, all toes with terminal grooves on discs. Inner metatarsal tubercle clearly visible, subarticular tubercles adelomorphic, and an outer metatarsal tubercle is missing. Relative length of toes 4 > 3 > 5 > 2 > 1, no webbing (Fig. 6d). All dorsal and ventral surfaces smooth.

Colouration in life. Dorsal surface of head, body, and extremities olive-grey with beige flecks mainly on head and flanks (Fig. 6a). Some dark grey spots and stripes on dorsum and limbs. Iris greenish with dark venation and orange inner margin. Basic colour of all ventral surfaces off-white. Throat, chest, and underside of limbs with diffuse brown spots that often converge, abdomen least spotted. Hidden areas of thighs and shanks as well as inguinal region orange.

Colouration in preservative. Ground colour of dorsal surfaces brown with faint dark brown spots and stripes; sides of head and supratympanic stripe dark brown, lower flanks beige and brown mottled. Venter off-white with some brown mottles mainly on sides, throat and chest beige with more intensive brown mottling, and underside of limbs beige with intensive brown mottling too (Fig. 6b). Whitish rostral pad visible in preservative but not in life.

Morphological variation in the type series. The type series consists of four adult males and one adult female for which measurements and body ratios are listed in Table 2. Sex was determined by inspection of gonads and of secondary sex characters (presence of vocal slits). There are only minor differences in SUL: males measure 26.8–28.0 mm and the female 28.0 mm. Body



Fig. 7. Adult female of *Austrochaperina rudolfarndti* sp. nov. (ZMB 70325).

ratios of both sexes do not differ, therefore both sexes were pooled for calculation of ratios. Basic colouration is much the same in all preserved specimens. There are, however, differences in the extent and intensity of mottling of the dorsal and ventral surfaces. Pale rostral pad scarcely developed. The only female exhibited a beige-reddish ground colouration, the orange on the heels more strongly expressed than in the male holotype, and colour of upper iris not green but golden with dark venation (Fig. 7).

Distribution and ecological notes. Found between 400 and 650 m a.s.l. in the Wondiwoi Mountains at the base of the Wandammen Peninsula, border between Papua Province and Papua Barat Province of Indonesia (Fig. 8). This region is covered by primary rain forest in which trees and undergrowth are generally not very dense. All frogs were perched on the ground, mostly between accumulations of dry leaves and sticks at the margin of brooks (Fig. 9). Although one male came out from such a spot, crawled onto a lying stick, and started calling there, it did not go directly into the water. When disturbed, it went back to its hiding place. Such spots seem also to serve as meeting points because there we found a female only

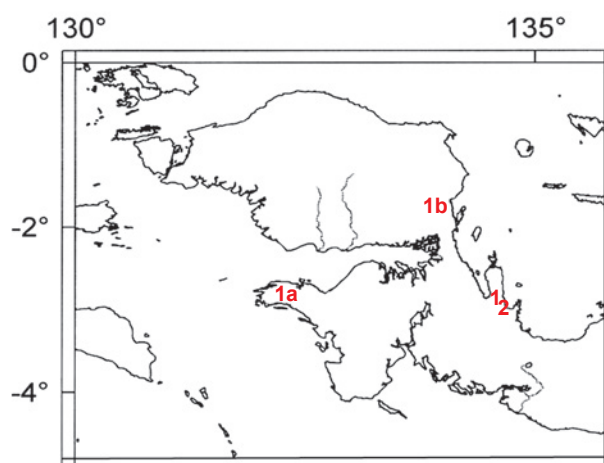


Fig. 8. Map of extreme western New Guinea with collection localities of *Austrochaperina macrorhyncha* in the Wondiwoi Mountains (1), in the Fakfak Mountains (1a), and the type localities of *A. macrorhyncha* (1b) and *A. rudolfarndti* sp. nov. (2).

a few centimetres away from a calling male. The female had only six eggs with a diameter of about 2.0 mm in its ovaries.



Fig. 9. Habitat of *Austrochaperina rudolfarndti* sp. nov., surroundings of the brook “Sungai Maja”, Wondiwoi Mountains, at an elevation of 530 m a.s.l.

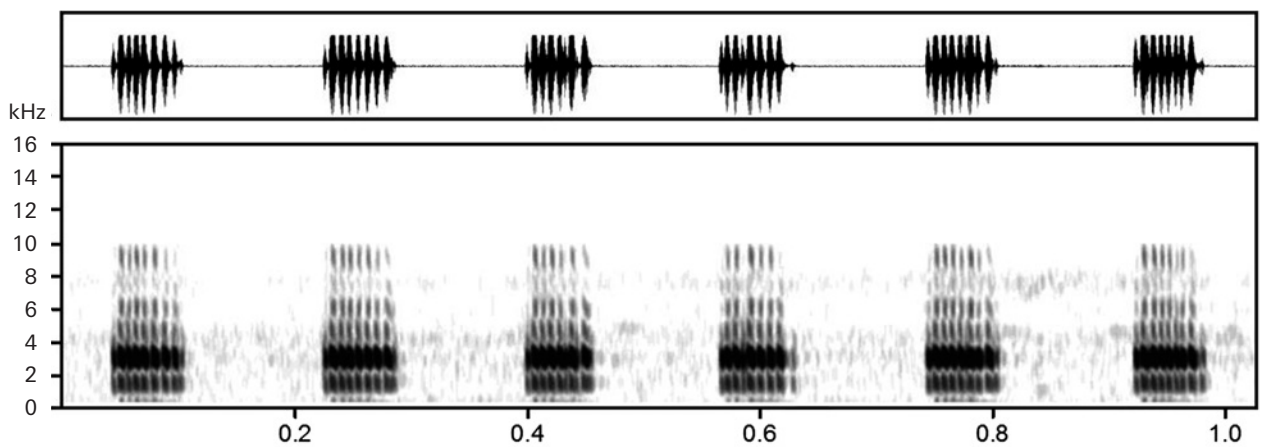
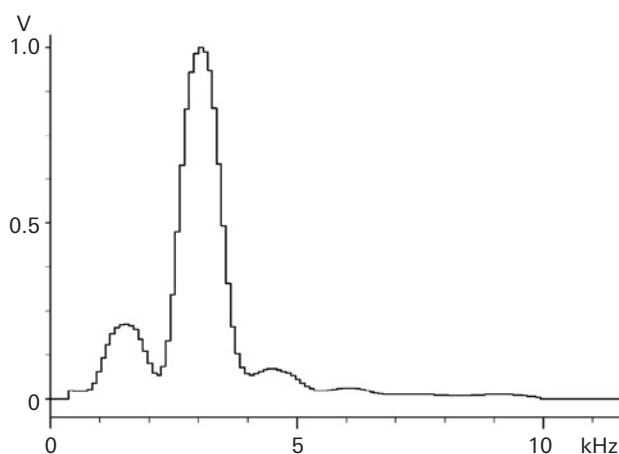


Fig. 10. Wave form (above) and spectrogram (below) of a section with six notes of an advertisement call of *Austrochaperina rudolfarndti* sp. nov.



Vocalization. *Austrochaperina rudolfarndti* sp. nov. utters long series of harsh, pulsed notes. Duration of three note series was 24 s, 92 s and 35 s. Mean note repetition rate in these three series was 5.47 notes/s, range 5.28–5.60 notes/s. Mean note length 59.2 ± 4.57 ms, range 55–66 ms, $n=93$. Mean internote interval length 119 ± 11 ms, range 95–154 ms, $n=93$. All notes are composed of 6–11 pulses (Fig. 10), mean number of pulses per note 8.4 ± 1.17 , $n=93$. Pulses follow each other even-

Fig. 11. Power spectrum of six notes of an advertisement call of *Austrochaperina rudolfarndti* sp. nov.

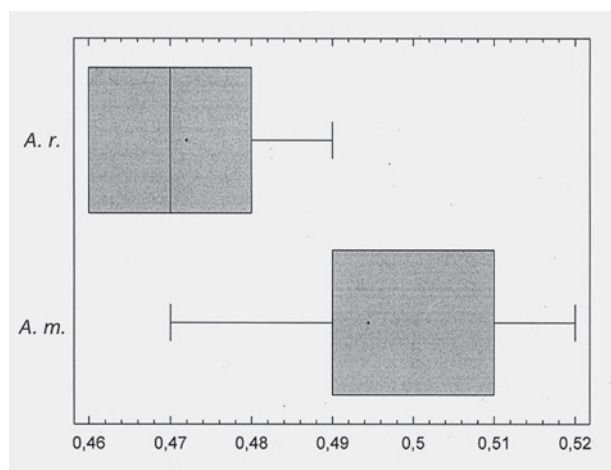


Fig. 12. Box-Whisker-Plot of the ratio TL/SUL in *Austrochaperina rudolfarndti* sp. nov. (*A. r.*) in comparison to *A. macrorhyncha* (*A. m.*).

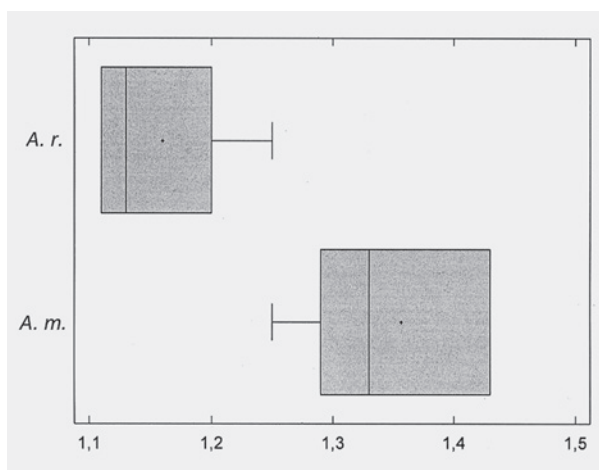


Fig. 13. Box-Whisker-Plot of the ratio T4D/F3D in *Austrochaperina rudolfarndti* sp. nov. (*A. r.*) in comparison to *A. macrorhyncha* (*A. m.*).

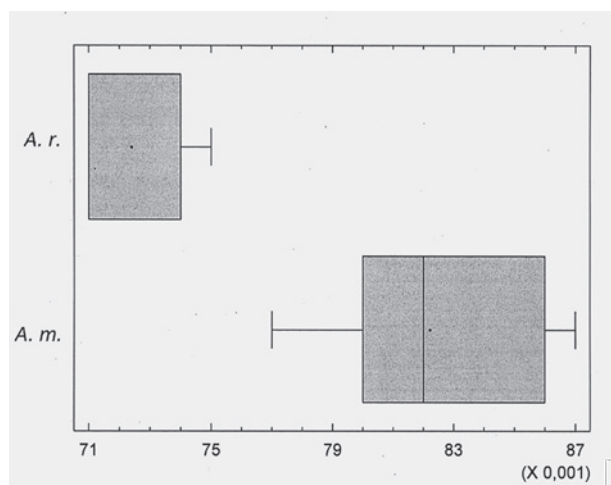


Fig. 14. Box-Whisker-Plot of the ratio END/SUL in *Austrochaperina rudolfarndti* sp. nov. (*A. r.*) in comparison to *A. macrorhyncha* (*A. m.*).

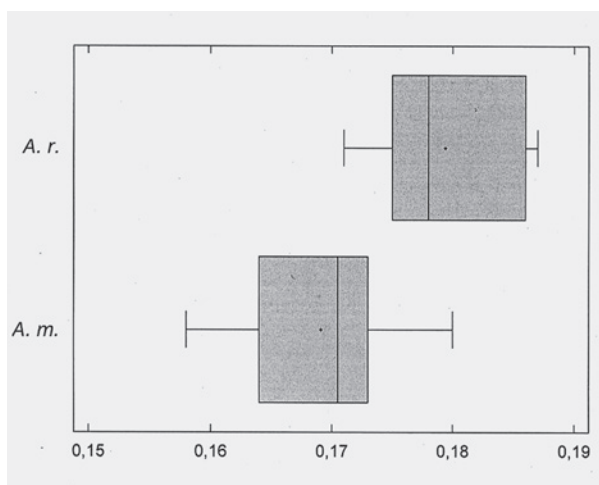


Fig. 15. Box-Whisker-Plot of the ratio EST/SUL in *Austrochaperina rudolfarndti* sp. nov. (*A. r.*) in comparison to *A. macrorhyncha* (*A. m.*).

ly within the notes and first and last pulse have a lower amplitude than the others. The fundamental frequency band centres at 1.55 kHz and the dominant frequency at 3.10 kHz. Depending on sound volume of the recording, there is a higher or lower number of upper harmonic bands (Fig. 10, below). All calls were recorded at air temperatures of from 20 to 22 °C.

Etymology. This new species is dedicated to my dear colleague and friend Dr. RUDOLF G. ARNDT, professor emeritus of Stockton University, Galloway, New Jersey, USA, who tweaked the English language of this and some of my other manuscripts and who supported my studies on New Guinean anuran amphibians.

Comparison with other species. *Austrochaperina rudolfarndti* sp. nov. occurs sympatric but largely or completely allotopic with *A. macrorhyncha* and *A. minutissima*. It differs clearly from both by its larger body

size (*A. minutissima* did not exceed 17 mm SUL and *A. macrorhyncha* did not exceed 25 mm SUL). *A. rudolfarndti* sp. nov. and *A. macrorhyncha* differ significantly also in the medians of the following body ratios: TL/SUL ($p=0.035$, Fig. 12), TaL/SUL ($p=0.030$), T4D/F3D ($p=0.004$, Fig. 13), END/SUL ($p=0.003$, Fig. 14), IND/SUL ($p=0.005$), and EST/SUL ($p=0.010$, Fig. 15). Values of these ratios are given in Tables 1 and 2. Both species differ also in their advertisement calls: note repetition rate in *A. macrorhyncha* is 1.78–2.50 vs. 5.28–5.60 in *A. rudolfarndti* sp. nov., length of internote intervals in *A. macrorhyncha* is 222–525 ms vs. 95–154 ms in *A. rudolfarndti* sp. nov., mean number of pulses per note is 11.7 ± 0.76 in *A. macrorhyncha* vs. 8.4 ± 1.17 in *A. rudolfarndti* sp. nov. Moreover, KÖHLER & GÜNTHER (2008) found considerable differences in the base sequences of the 12S and 16S rDNA gene between both species. In their paper, *A. rudolfarndti* sp. nov. is designated as *Austrochaperina* sp. 1 (ZMB 70324 and 70325) and

A. macrorhyncha is designated as *Austrochaperina* sp. 2 (ZMB 70326 and 70327).

The following species have a clearly greater body size than *A. rudolfarndti* sp. nov.: *A. alexanderi*, *A. archboldi*, *A. hooglandi* ZWEIFEL, 2000, *A. palmipes* ZWEIFEL, 2000, and the formerly included in *Austrochaperina* species *derongo*, *guttata* and *rivularis*. According to biochemical studies by PELOSO *et al.* (2015) these last three species should belong in the genus *Copiula*.

The following species have a clearly smaller body size than *A. rudolfarndti* sp. nov.: *A. brevipes*, *A. gracilipes*, *A. kosarek*, *A. blumi*, *A. mehely*, *A. minutissima*, *A. novaebritanniae*, *A. polysticta* ZWEIFEL, 2000, and *A. yelaensis*.

The next group of species is of similar size and is compared in more detail:

Austrochaperina adamantina ZWEIFEL, 2000 is known from a single adult female with 28 mm SVL. It differs from *A. rudolfarndti* sp. nov. in many body ratios (*adamantina* vs. *rudolfarndti*): TL/SVL 0.43 vs. 0.46–0.49; ED/SVL 0.125 vs. 0.130–0.139; HW/SVL 0.34 vs. 0.37–0.40; IND/SVL 0.098 vs. 0.119–0.125; F3D/SVL 0.041 vs. 0.030–0.036; END/IND 0.74 vs. 0.059–0.066; F3L/SVL 0.22 vs. 0.23–0.26 and T4L/SVL 0.45 vs. 0.48–0.51.

Austrochaperina aquilonia ZWEIFEL, 2000 is known from two male specimens with SVL of 31.0 and 23.3 mm. The best character to distinguish both taxa is the ratio F3D/SVL: it is 0.021–0.026 in *A. aquilonia* and 0.030–0.036 in *A. rudolfarndti* sp. nov. There are three more body ratios to distinguish both species: IND/SVL in *A. aquilonia* 0.111–0.118 and in *A. rudolfarndti* sp. nov. 0.119–0.125; F3L/SVL 0.22–0.23 in *A. aquilonia* and 0.23–0.26 in *A. rudolfarndti* sp. nov.; T4L/SVL 0.44–0.48 in *A. aquilonia* and 0.48–0.51 in *A. rudolfarndti* sp. nov.

Austrochaperina blumi females “touch” the size range of the new species. But, with SVL of 22.6–24.4 mm in four males, these are clearly smaller than males of *A. rudolfarndti* sp. nov. There are significant differences between both species in the following body ratios: IND/SVL in *A. blumi* 0.097–0.111 vs. 0.119–0.122 in *A. rudolfarndti* sp. nov.; END/IND in *A. blumi* 0.67–0.80 vs. 0.59–0.66 in *A. rudolfarndti* sp. nov.; and HW/SVL in *A. blumi* 0.34–0.38 vs. 0.37–0.40 in *A. rudolfarndti* sp. nov.

Austrochaperina laurae differs by its uniform strongly brown colouration with a few whitish dots of all dorsal surfaces and a yellow ground coloration of the ventral surfaces vs. an olive or beige-grey dorsal ground colouration with dark grey or brown spots and a beige ground colouration of the ventral surfaces. It has smaller eyes (ED/SUL 0.108–0.127, $n=8$) than *A. rudolfarndti* sp. nov. (ED/SUL 0.130–0.139) and different advertisement calls. The note series of *A. laurae* last “only” 0.9–2.5 s, note repetition rate is 6.6–7.4 notes/s, and mean number of pulses per note is 5.3 ± 0.9 .

Austrochaperina parkeri ZWEIFEL, 2000 is only known from the holotype, a female of 30.6 mm SVL. It differs

from *A. rudolfarndti* sp. nov. in various body proportions (comparing former to latter): ED/SVL 0.105 vs. 0.130–0.139; TL/SVL 0.44 vs. 0.46–0.49; HW/SVL 0.35 vs. 0.37–0.40; IND/SVL 0.105 vs. 0.119–0.125; END/SVL 0.070 vs. 0.071–0.082; END/IND 0.67 vs. 0.059–0.066; F3L/SVL 0.21 vs. 0.23–0.26, and T4L/SUL 0.43 vs. 0.48–0.51.

Austrochaperina punctata males and females are as a rule larger than 30 mm and those of *A. rudolfarndti* sp. nov. are smaller than 30 mm SUL. Five syntypes of *A. punctata* differ from the type series of *A. rudolfarndti* sp. nov. in the following body ratios (*punctata* vs. *rudolfarndti*): END/SUL 0.077–0.089 vs. 0.071–0.075; IND/SUL 0.108–0.116 vs. 0.119–0.122; END/IND 0.70–0.79 vs. 0.59–0.66; F3D/SUL 0.044–0.054 vs. 0.030–0.036; T4D/SUL 0.051–0.054 vs. 0.034–0.043. Advertisement call notes of *A. punctata* range from 111 to 143 ms, that of *A. rudolfarndti* sp. nov. from 55 to 65 ms, and inter-note intervals in *A. punctata* range from 177 to 485 ms, that of *A. rudolfarndti* sp. nov. from 95 to 154 ms.

Austrochaperina septentrionalis ALLISON & KRAUS, 2003 with a SVL of 28.4–31.6 mm is slightly larger than *A. rudolfarndti* sp. nov., has shorter legs (TL/SVL 0.41–0.46 vs. 0.46–0.49), smaller eyes (0.098–0.110 vs. 0.130–0.139), narrower snout (IND/SUL 0.095–0.110 vs. 0.119–0.122), and shorter toes (T4L/SVL 0.36–0.41 vs. 0.48–0.51). Moreover, call series are shorter in *A. septentrionalis* (7–9 s vs. up to 90 s), and note repetition rate is faster (9.3–9.6 notes/s vs. 5.3–5.6 notes/s) than in *A. rudolfarndti* sp. nov.

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References

- ALLISON, A. & KRAUS, F. (2003): A new species of *Austrochaperina* (Anura: Microhylidae) from northern Papua New Guinea. – *Journal of Herpetology*, **37**(4): 637–644.
- BOULENGER, G.A. (1897): Descriptions of new lizards and frogs from Mount Victoria, Owen Stanley Range, New Guinea, collected by Mr A. S. Anthony. – *The Annals and magazine of natural history* (ser. 6), **19**: 6–13.
- DINGERKUS, G. & UHLER, L.D. (1977): Enzyme clearing of alcian blue stained whole small vertebrates for demonstrating cartilage. – *Stain Technology*, **52**: 229–232.
- FROST, D.R. (2017): Amphibian Species of the World: an online reference, version 6.0 (03/20/2017), American Museum of Natural History, New York. Available from: <http://research.amnh.org/herpetology/amphibia/index.php>
- FRY, D.B. (1912): Description of *Austrochaperina* a new genus of Engystomatidae from north Australia. – *Records of the Australian Museum*, **9**(1): 87–106.
- GÜNTHER, R. (2009): A new and minute species of *Austrochaperina* (Amphibia: Anura: Microhylidae) from western New Guinea. – *Vertebrate Zoology*, **59**(1): 81–89.
- 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.
- KAMPEN, P.N. VAN (1906): Amphibien. – *Nova Guinea, Zoologie*, Leiden, **5**: 163–180.
- KAMPEN, P.N. VAN (1913): Amphibien, gesammelt von der niederländischen Süd-Neu-Guinea-Expedition von 1909–10. – *Nova Guinea, Zoologie*, Leiden, **9**: 453–465, pl. XI.
- KAMPEN, P.N. VAN (1919): Die Amphibienfauna von Neu-Guinea. – *Bijdragen tot de Dierkunde*, **21**: 51–56.
- KAMPEN, P.N. VAN (1923): Amphibia of the Indo-Australian Archipelago. – E.J. Brill, Leiden, The Netherlands, 304 pp.
- KÖHLER, F. & GÜNTHER, R. (2008): The radiation of microhylid frogs (Amphibia: Anura) on New Guinea: A mitochondrial phylogeny reveals parallel evolution of morphological and life history traits and disproves the current morphology-based classification. – *Molecular Phylogenetics and Evolution*, **47**: 353–365.
- LOVERIDGE, A. (1948): New Guinea reptiles and amphibians in the Museum of Comparative Zoology and the United States National Museum. – *Bulletin of the Museum of Comparative Zoology*, **101**: 305–430.
- MÉHELY, L.V. (1901): Beiträge zur Kenntnis der Engystomatiden von Neu-Guinea. – *Természetráji Füzetek*, **24**: 169–271.
- MENZIES, J. (2006): The frogs of New Guinea and the Solomon Islands. – *Pensoft, Sofia-Moscow*, 345 pp.
- NIEDEN, F. (1926): Anura II. Engystomatidae. – *Das Tierreich*, **49**: 1–110.
- PARKER, H.W. (1934): A monograph of the frogs of the family Microhylidae. – London, British Museum (Natural History), VIII + 208 pp., figs. 1–67, 2 maps.
- PELOSO, P.L.V., FROST, D.R., RICHARDS, S.J., RODRIGUES, M.T., DONNELLAN, S., MATSUI, M., RAXWORTHY, C.J., BIJU, S.D., LEMMON, E.M., LEMMON, A.R. & WHEELER, W.C. (2015): The impact of anchored phylogenomics and taxon sampling on phylogenetic inference in narrow-mouthed frogs (Anura, Microhylidae). – *Cladistics*, (2015): 1–28.
- PETERS, W. & DORIA, G. (1878): Catalogo dei rettili e dei batraci raccolti da O. Beccari, L.M. D'Albertis e A.A. Bruijn nella sotto-regione Austro-Malese. – *Annali dei Museo Civico di Storia naturale, Genova*, **13**: 323–450.
- TRUEB L. (1973): Bones, Frogs, and Evolution. In: VIAL, J.L. (ed.): *Evolutionary biology of the anurans*. – University Missouri Press, Columbia, Missouri, Chapter 2: 65–132.
- ZWEIFEL, R.G. (2000): Partition of the Australopapuan microhylid frog genus *Sphenophryne* with descriptions of new species. – *Bulletin of the American Museum of Natural History*, **253**, 1–130.

Appendix

While this manuscript was already in press, new proposals by Rivera et al. (2017) were made concerning, among others, the systematics of these genera.

RIVERA, J.A., KRAUS, F., ALLISON, A. & BUTLER, M.A. (2017): Molecular phylogenetics and dating of the problematic New Guinea microhylid frogs (Amphibia: Anura) reveals elevated speciation rates and need for taxonomic reclassification. – *Molecular Phylogenetics and Evolution*, **112**: 1–11.