

A REMARKABLE NEW ASTEROPHRYINE MICROHYLID FROG FROM THE MOUNTAINS OF NEW GUINEA

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Richards, S.J., Johnston, G.R. & Burton, T.C. 1994 12 01: A remarkable new asterophryine microhylid frog from the mountains of New Guinea. *Memoirs of the Queensland Museum* 37 (1): 281-286, Brisbane. ISSN 0079-8835.

Asterophrys leucopus sp. nov. is described from mid-montane rainforest on the slopes of Stolle Mountain in central New Guinea. It is the second known species of this genus, hitherto containing only the poorly known and morphologically bizarre *A. turpicula*. *Asterophrys leucopus* shares with *turpicula* an extremely broad head (almost 50% of SVL), and a skull with a distinct sagittal crest, but lacks elongated, conical spines on the eyelids, prominent subarticular tubercles of the hands and feet, and has a different mating call. □ *Frog, new species, Asterophrys leucopus, Microhylidae, Asterophryinae, New Guinea.*

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Microhylid frogs are a speciose group that exhibit considerable ecological and morphological diversity in the rainforests of New Guinea (Zweifel, 1972). Two subfamilies, Genyophryinae and Asterophryinae, are recognised in the Australopapuan region, but the Asterophryinae are confined to New Guinea and its satellite islands (Zweifel, 1972). In a recent revision of this subfamily Burton (1986) recognised 43 species in 8 genera, three of which (*Asterophrys*, *Hylophorbus*, *Pherohapsis*) were monotypic.

Zweifel (1972) defined *Asterophrys* as possessing fused and rugose nasals, a high, thin sagittal crest on the frontoparietals, and heavy, rugose squamosals which in some specimens join broadly to the maxillae anteriorly. Burton (1986) combined a number of genera (*Asterophrys*, *Hylophorbus*, *Mantophryne*, *Pherohapsis*) in the tribe Asterophryini, characterised by a highly crested ilium, absence of muscle fibres from the dorsal surface of the frontoparietals, reduction of the m. geniohyoideus lateralis internus, a distal origin of the m. tibialis anticus brevis and large subarticular tubercles. *Asterophrys* as conceived by Burton (1986) differs from the rest of the tribe in possessing two supplementary slips to the m. intermandibularis, division of the m. adductor mandibularis posterior longus into two segments, warts on chin large, and the diagnostic characters described by Zweifel (1972). The discovery of a second species of *Asterophrys* allows a refinement of the diagnosis of the genus.

Morphologically, *Asterophrys turpicula* is one of New Guinea's most distinctive frogs. It is a

large microhylid (to 65mm; Parker, 1934) with a broad head and elongated spines on the eyelids. Despite its large size and bizarre appearance, it is a poorly known species; biological information is limited to observations on the diet of several museum specimens (Brongersma, 1953) and the tantalising observations of F. Parker that this species 'calls like a kitten's miaow, and bites and attacks hands quite viciously' (Zweifel, 1972). Although known from widely scattered localities in the western half of the island of New Guinea, *A. turpicula* is represented by few specimens in museum collections (Menzies, 1985).

During surveys of the frog fauna of the mountains of central New Guinea SJR & GRJ made further observations on *A. turpicula* and collected a new species of *Asterophrys* from Stolle Mountain in the headwaters of the Sepik River. Here we describe the new species, and present observations on the biology, mating call and aggressive behaviour of *A. turpicula*.

The new species is a microhylid, confirmed by possession of the m. rectus abdominis pars anteroflecta (Burton, 1980), and an asterophryine, exhibiting the symphygnathous condition (Parker, 1934; Zweifel, 1972). The crested ilium is typical of the tribe Asterophryini, as is the exclusion of muscle fibres from the dorsum of the frontoparietals. This species exhibits the characters unique to *Asterophrys* within the tribe e.g. possession of two supplementary slips to the m. intermandibularis, but the warts on the chin are smaller than those of *A. turpicula*. All of the diagnostic characters of Zweifel (1972)



FIG. 1. *Asterophrys leucopus* sp. nov., Stolle Mountain, Sandaun Province, Papua New Guinea.

are present: the nasals are fused and rugose; the frontoparietals are compressed into a high sagittal crest, the ridge of which is rugose; and the squamosal is enlarged and rugose, broadly contacting the maxilla anteriorly. The only respect in which this species does not conform to the definitions is the poor development of its subarticular tubercles. Given that this is clearly an *Asterophrys* by all other criteria, Burton's (1986) definition of the tribe Asterophryini must be revised to 'subarticular tubercles usually large and prominent'.

Methods of measurement (in millimetres) follow Zweifel (1972). SVL=snout-vent; TL=tibia length; EN=eye-naris; IN=internarial distance; SN=snout-naris distance; HW=head width; HL=head length; ED=eye diameter. Measurements of ear diameter are excluded because the tympanum of this species is indistinct. Minimal dissection was performed to give access to the musculature and bones of the skull, and superficial musculature of the throat and abdomen relevant to the generic diagnosis. Deep features such as the *m. geniohyoideus* and *m. tibialis anticus brevis* were not examined. We have not examined types of the two species synonymised

with *Asterophrys turpicula*; *A. leopoldi* and *A. steini*. The status of these species was addressed by both Brongersma (1953) and Zweifel (1972).

Specimens are deposited in the following museums; Queensland Museum (QM), University of Papua New Guinea (UP) and South Australian Museum (SAM).

SYSTEMATICS

Asterophrys leucopus sp. nov. (Figs 1-3)

MATERIAL EXAMINED

HOLOTYPE: QMJ58650, adult male, collected by S.J. Richards and G.R. Johnston, Stolle Mountain, Sandaun (West Sepik) Province, Papua New Guinea, 4°48'S, 141°39'E, 1600m, 4-5.vii.93.

PARATYPES: UP8442, SAMR43785, adult males, same collection data as holotype.

DIAGNOSIS

A moderately large microhylid frog, males 43.0-46.8 SVL, distinguished from all other Australopapuan microhylid frogs by the following combination of characters: head extremely broad (44.5-48.8% of SVL), frontoparietals com-

pressed into high sagittal crest, distinct tubercles on eyelids, palmar and plantar surfaces of hands and feet with greatly reduced pigmentation and poorly developed subarticular tubercles, six pale tubercles around lower jaw, mating call a musical series of rapidly repeated introductory notes and more slowly repeated terminal notes, uttered at irregular intervals.

DESCRIPTION OF HOLOTYPE

An adult male with the following measurements: SVL 43.0; TL 17.1; EN 4.3; IN 3.5; HW 21.0; HL 14.0; ED 5.0; SN 1.5; disc of third finger 1.2 (penultimate phalange 0.9); disc of fourth toe 1.2 (0.8). Body robust, limbs short (TL/SVL 0.39). Head almost triangular in dorsal view, snout steep, projecting beyond lower jaw, obtusely angular in lateral view; canthus rostralis straight, moderately defined (disrupted by tubercles); loreal region steep, slightly concave; nostrils lateral, much closer to tip of snout than to eye (EN/SN 2.9), eye to naris distance greater than internarial distance (EN/IN 1.2). A series of six distinct tubercles on the lower jaw (Fig. 2). Eyes small, orbit not visible in ventral view, pupil horizontal; tympanum indistinct. Vomerine teeth absent, vocal slits present, anterior palatal ridge short, posterior palatal ridge long, distinct, with 7 denticles. Relative lengths of fingers 3>4>2>1; discs weakly developed, without grooves, but distinctly broader than penultimate phalanges, subarticular tubercles low and indistinct, no

metacarpal tubercles. Toes unwebbed, relative lengths 4>3>5>2>1; discs weakly developed, same size as finger discs; subarticular elevations and inner metatarsal tubercle low and indistinct. Skin covered with scattered tubercles dorsally, tending to form longitudinal rows (Fig. 1); tubercles on eyelids large, prominent but not forming elongated conical spines (Figs 1, 2); skin almost smooth ventrally.

In preservative dorsum grey with irregular pinkish markings, sometimes bordered by black and concentrated as follows: on tubercles, some bordered by black and in others pinkish markings joined to form stripes along rows of tubercles. A wide pink longitudinal bar posteriorly on dorsum, bordered laterally by distinct black markings. No vertebral stripe. Ventral surface dark grey (almost black) anteriorly with pale flecks, becoming paler posteriorly with spots and mottling of pale cream. Palmar surfaces of hands almost completely white, pigmentation on plantar surfaces of feet reduced, restricted primarily to centre of plantar surface, absent on toes. Tubercles on lower jaw pale, tongue white.

VARIATION

The two paratypes are adult males. Selected measurements of these two specimens are (SAMR43785/UP8442): SVL 46.8/43.1; TL 17.4/16.6; EN 4.4/4.0; IN 2.1/3.3; HW 21.9/19.2; ED 4.8/5.4; SN 1.7/1.5. The main variation is in the colour pattern. In life all three specimens in

the type series are mottled light and dark pinkish brown, with irregular black patches on the dorsal and lateral surfaces. The tips of the dorsal tubercles are pink, and the prominent tubercles on the lower jaw, and palmar and plantar surfaces of the hands and feet, are pale cream. However one paratype (SAMR43785) has a pale cream vertebral stripe running the full length of the body. This stripe is thinner anteriorly, broadens to about 1.5mm posteriorly and continues along the entire length of each thigh.



FIG. 2. Head of *A. leucopus* sp. nov. showing distinct pale tubercles on jaw.

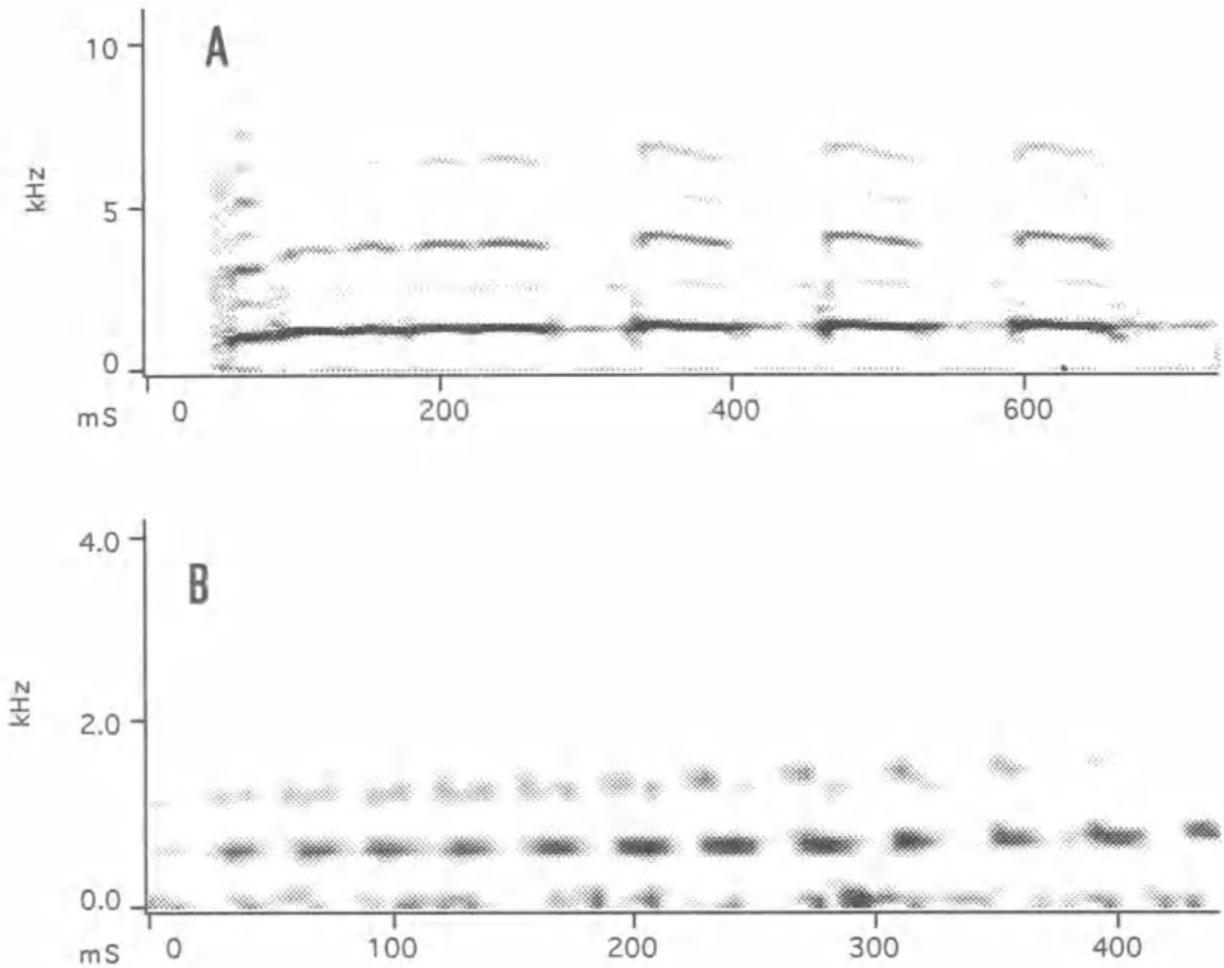


FIG. 3. Mating calls. A, *Asterophrys leucopus* sp.nov., holotype, QMJ58650, Stolle Mountain, Sandaun Province. Air temperature = 17.8°C; B, *A. turpicula*, near Kiunga, Western Province. Air temperature = 27.0°C.

MATING CALL

The call of *A. leucopus* is a series of rapidly repeated introductory notes followed by a series of slower terminal notes. A call recorded on 5.vii.93 (air temp. at calling site 17.8°C) lasted approximately 0.6s (Fig. 3A). The call is well tuned, the dominant frequency is about 1.25KHz, and the second and fourth harmonics are emphasised giving the call a musical quality. It is quite distinct from the call of *A. turpicula*, which is a short, ascending trill. A single call of *A. turpicula* recorded at Drimdemasuk Village, approximately 12km upstream from Kiunga on 14.xi.91 is illustrated for comparison in Fig 3B. The dominant frequency starts at 0.6 KHz and finishes at 0.8KHz. A distinct harmonic starts at 1.2KHz and finishes at 1.6KHz. The call lasts for 0.45s.

HABITAT AND HABITS

The holotype was calling from an exposed mossy tree root in closed canopy mid-montane rainforest at approximately 1600m on the slopes of Stolle Mountain. The two paratypes were collected from a mossy tree stump and the forest floor respectively. At this altitude most of the forest is covered with a thick layer of wet moss, against which the frogs were well camouflaged (Fig. 1).

The stomach of the holotype contained two large centipedes and a clump of moss, and one of the paratypes (SAMR43785) contained a small, partly digested microhylid frog (probably a *Cophixalus*) measuring 17.7 SVL.

Despite repeated handling we did not observe aggressive behaviour in *Asterophrys leucopus*. *A. turpicula*, with which it shares a number of bizarre morphological characters, exhibits two

forms of aggressive behaviour: (1) an aggressive posture in which the body is inflated and the mouth is held wide open exposing the blue tongue (Fig. 4), a posture similar to that displayed by the blue-tongued lizard *Tiliqua scincoides* and (2) lunging behaviour, in which the frog leaps at potential predators mouth agape, actively biting the 'predator' and often maintaining a strong grip for over 3 minutes. The blue tongue of this species is conspicuous during aggressive encounters.



FIG. 4. Aggressive gaping behaviour of *Asterophrys turpicula* collected at Tabubil, Western Province, July 1993.

DISTRIBUTION

Known only from the type locality.

COMPARISON WITH OTHER SPECIES AND COMMENTS ON *A. TURPICULA*

Asterophrys leucopus is a morphologically distinctive microhylid frog, and only two species are likely to be confused with it. *Asterophrys turpicula* has a head as broad as *A. leucopus*, but differs in having the mid-dorsum smooth, in the possession of an elongated, spine-like tubercle on each eyelid, two prominent tubercles on the lower jaw that are the same colour as the dorsum, (vs 6 pale cream tubercles), a blue tongue, pigmented hands and feet, very distinct subarticular tubercles, and a different mating call (Fig. 3B). *A. turpicula* calls from below the surface of the forest floor, while *A. leucopus* calls from exposed positions.

The two species have not been found in sympatry. During our surveys *A. turpicula* was a common species in lowland and hill forest (to approximately 600m) between the Fly River (Kuambit, near Kiunga) and the southern foothills of the Star Mountains, Western Province, PNG. *A. turpicula* has adapted to disturbed environments and was common in suburban gardens in the mining town of Tabubil in November 1991 and July 1993; males were calling in both of these months suggesting that the breeding season is extended if not continuous in this perpetually wet environment (Hyndman &

Menzies, 1990). *A. leucopus* was not found at any sites between 60 and 3200m on the southern slopes of the Star Mountains. The type (and only known) locality for *A. leucopus* is on the northern side of the central cordillera, where all of the type series were collected in rainforest.

Genyophryne thomsoni is the only other microhylid with a head as broad as *A. leucopus*, but is a smaller species (maximum recorded SVL 38), lacks finger discs and the jaws are not symphygnathine (Zweifel, 1971; 1972).

ETYMOLOGY

From the Greek 'leukos' = white, 'pous' = foot, referring to the distinctive white (pale cream in life) feet of this species.

REMARKS

Through the courtesy of Mr James Menzies (UPNG) we have examined two *Asterophrys* specimens (UP8362 & UP8472) from the Vogelkop Peninsula of Irian Jaya. They are males, SVL 54 and 40 respectively and have enlarged and rugose squamosals and a sagittal crest. They differ from *A. leucopus* in having distinct subarticular tubercles and pigmented feet, and differ from both *A. leucopus* and *A. turpicula* in lacking large tubercles on the lower jaw. They further differ from *A. turpicula* in lacking blue colouration on the tongue in preservative. In most other respects they resemble *Asterophrys*, and it is likely that when additional

material is collected the generic definition of *Asterophrys* will have to be further refined.

ACKNOWLEDGEMENTS

Field work in Papua New Guinea by SJR & GRJ was funded in part by a grant from the Peter Rankin Trust Fund for Herpetology and a James Cook University Research Grant (to SJR). Ok Tedi Mining Limited provided invaluable logistical support in the field. We are particularly grateful to Murray Eagles, Ian Wood, Andrew Storey, Andy Mai and Kayemen Bakowa of the OTML Environment Department. The Gregory family, Rob Lachlan, James Menzies and Ian Burrows provided generous hospitality and assistance in PNG, and Keyt Fischer of Mekil Research Station enthusiastically supported our work on Stolle Mountain. Roselyn Busasa (Institute of Papua New Guinea Studies) and Dr Navu Kwapena (Department of Conservation and Environment) greatly facilitated the processing of our research visas and export permits respectively.

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