

A NEW FROG OF THE GENUS *TAUDACTYLUS* (MYOBATRACHIDAE)
FROM MID-EASTERN QUEENSLAND WITH NOTES
ON THE OTHER SPECIES OF THE GENUS

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ABSTRACT

Taudactylus liemi sp. nov. is described from montane rainforest mid-eastern Queensland. New data on the distribution and natural history of the other species of the genus (*T. acutirostris*, *T. diurnis*, *T. eungellensis* and *T. rheophilus*) are presented. A phylogeny has been devised for *Taudactylus* and aspects of the biogeography of the genus are discussed.

In 1975, the Australian Biological Resources Survey provided funds to enable the Australian and Queensland Museums to survey frogs and reptiles in rainforest sites of mid-eastern Queensland, as part of an overall survey of the rainforests of Queensland. The preliminary results of these surveys have been presented in Broadbent and Clark (1976), Queensland Museum (1976) and Covacevich (1977).

A large series of specimens of a new species was collected from two sites (Mt William and Crediton). These frogs were clearly referable to the genus *Taudactylus* because of the presence of T-shaped terminal phalanges (Fig. 1D), but were distinctly different from *T. eungellensis* described from the same area by Liem and Hosmer (1973). The new species is here described as *T. liemi*, in recognition of the contribution to herpetology made by Dr David Liem.

Measurements are in millimetres and ratios are expressed as percentages. Specimens are housed in the Queensland Museum (QM), and the Australian Museum (AM). Abbreviations follow Liem and Ingram (1977).

***Taudactylus liemi* sp. nov.**
(Figs 1, Plate 1B)

MATERIAL EXAMINED

HOLOTYPE. Adult female, QM J32625, Crediton, ME.Q. (21° 12'S, 148° 33'E), 15-22 April 1975, collected by J. Covacevich, P. Filewood and R. Monroe.

PARATYPES. AM R47499-505, Mt William, 21-26 April, 1975, P. Webber; AM R47831, Eungella, 1975, P. Webber; QM J34420 18 km N. of Dalrymple Heights, December 1978, G.J. Ingram; QM J31515-8, Dalrymple Heights, 3 July, 1974, G. Czechura; QM J32618-24 (J32618 cleared specimen), J32626-33, J32660-8, J32694, same data as holotype.

DIAGNOSIS: Differs from *T. diurnis* and *T. eungellensis* by very small discs on fingers and toes; from *T. acutirostris* by the lack of dorsolateral skinfolds and in snout shape (in profile, rounded vs wedge shaped and curved upwards); and from *T. rheophilus* by the lack of extensive brown mottling ventrally, and by dorsal markings (presence of a dark triangle between the eyes and a dark lyre on the back). *T. rheophilus* is also more robust and has a larger HW/SWL. Liem and Hosmer (1973) give 37-42 for the latter whereas the range for *T. liemi* is 26-36.

DESCRIPTION OF HOLOTYPE: SVL 28.1, TL 11.7, TL/SVL 42, HW 8.4, HW/SVL 30, ED 3.1, ED/HW 37, EN 2.5, IN 3.4, EN/IN 74. Dorsal aspect of snout blunt, acuminate, rounded in profile. Loreal region sloping. Canthus rostralis distinct, curving in from eye and then out to nose, then converging anteriorly to form an acuminate snout. Pupil horizontal and oval shaped. Tympanum concealed. Tongue hinged in front, widest posteriorly where it is rounded; narrow and straight anteriorly. Vomerine teeth absent. Fingers unwebbed, slightly expanded distally. Length of

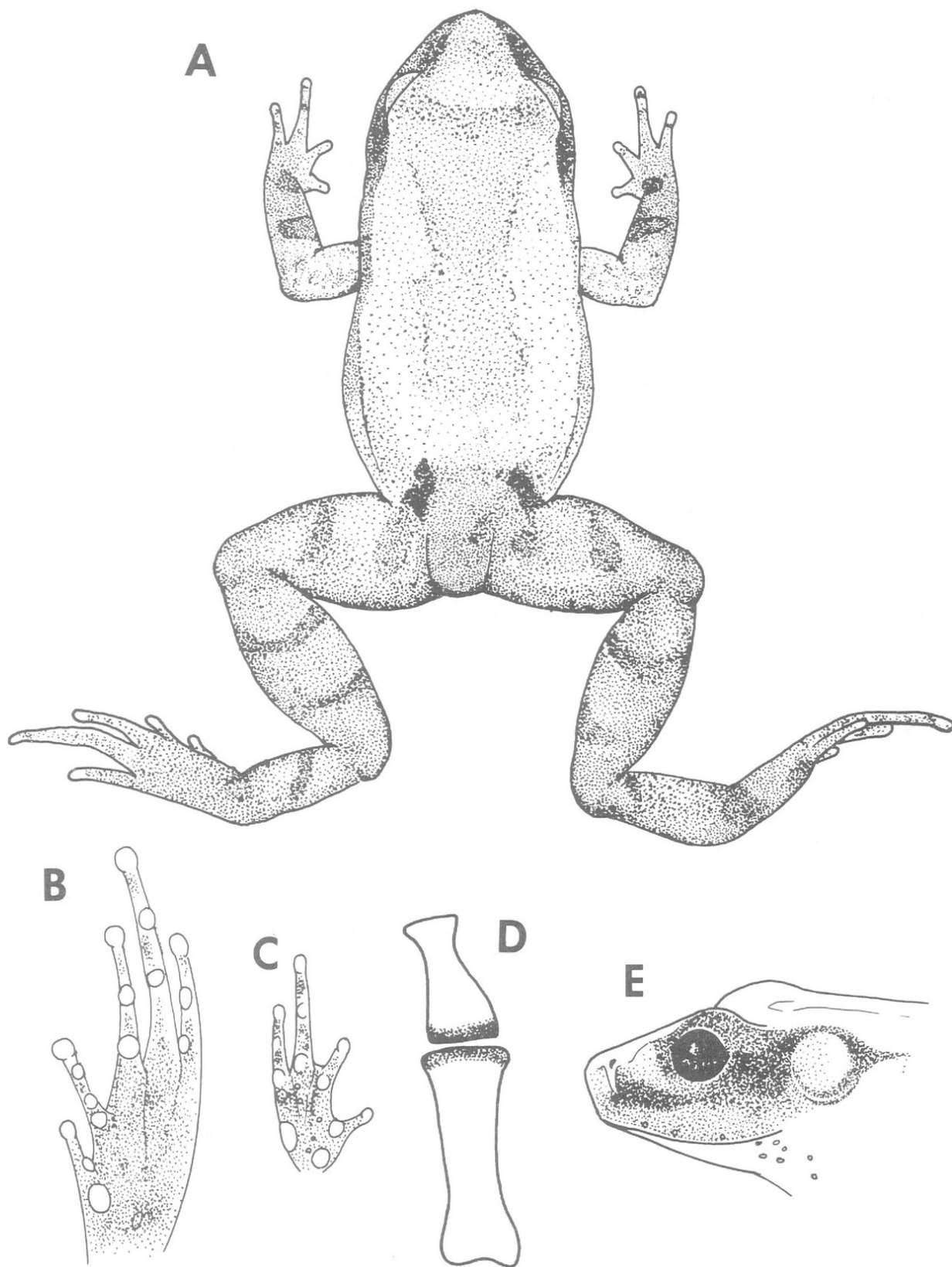


FIG. 1: *Taudactylus liemi*. A, Dorsal view; B, Ventral aspect of foot; C, Ventral aspect of hand; D, T-shaped terminal phalange of 4th toe; E, Side of head.

fingers shortest to longest 1-2-4-3. Large rounded tubercles at base of fingers; rounded outer palmer tubercle twice the size of oval inner tubercle. Toes not webbed but with distinct toe fringes, slightly expanded distally. Length of toes from shortest to longest 1-2-5-3-4. Low rounded tubercles at base of toes with smaller tubercles on joint above on 3rd, 4th and 5th toe; a small oval inner metatarsal tubercle. Skin smooth. Cloacal opening directed posteriorly at mid-level of thighs. Dorsal ground colour grey-brown; a black triangle between eyes, with the hypotenuse stretching from eye to eye and the apex directed backwards; a black lyre marking on neck and back; 'V' marking in front of hind legs with apex directed forwards; two cross bars on forearm, 8 on hind legs; fingers and toes barred. Laterally, ground colour grey-brown; a dark line from snout through eye and curving down into loreal region; side of face dark brown, lips barred; an indistinct dark upper lateral mark from above forelegs and fading at midbody; a dark blotch at beginning of foreleg and on knees. Posterior surface of thighs brown finely speckled with dirty yellow; black markings on either side of cloaca; heels dark. Ventrally, cream with fine brown speckling on legs.

DESCRIPTION OF PARATYPES: SVL 20.9-29.3 (N = 36, mean 26.1). HW 7.2-9.5 (N = 36, mean 8.4). HW/SVL 26-36 (N = 36, mean 32.0). TL 9.6-12.5 (N = 36, mean 11.5). TL/SVL 36-48 (N = 36, mean 44.2). ED 2.2-3.5 (N = 36, mean 2.9). ED/HW 27-44 (N = 36, mean 35.1). EN 2.0-2.5 (N = 36, mean 2.2). IN 2.8-4.0 (N = 36, mean 3.4). EN/IN 55-77 (N = 36, mean 65.5). Vocal sacs present in males. Dorsal and lateral colouring varies from light brown to dark brown when ground colour very dark the markings can be difficult to discern, and when light, they can be faint. Lyre marking on back can extend forward joining up with the triangle between the eye and it can extend backwards breaking up into blotches in front of the 'V' marking in front of the cloaca. Apex of this 'V' is often missing. The hidden tympanum may be defined by a light patch. The upper lateral stripe in some specimens extends backwards and down to the inguinal region. Ventrally there may be more intense brown speckling. Nasal bones narrow, widely separated and not touching sphenethmoid or the maxillary; frontoparietal fontanelle moderately large; zygomatic rami of squamosal as long as otic rami; omosternum present; sternum rounded; terminal phalanges of fingers and toes T-shaped (Fig. 2B).

HABITAT: Rocky streams and their environs in montane rainforest.

DISTRIBUTION: Eungella area west of Mackay, ME.Q., from Mt. William in the north to Crediton in the south.

FIELD NOTES: *T. liemi* is a secretive frog. Males call on land under rocks along the side of rocky streams. In December 1978, they called all day but more commonly at night. G. Czechura (pers. comm.) noted in July 1974 that they were calling in large numbers. There appeared to be no difference between the numbers calling day or night. He found them mostly under rocks during the day and under roots and in the mouth of crayfish burrows during the night. Amplexus was noted as inguinal. In August 1976, he heard no vocalization. At Crediton, in April 1975, individuals were caught inside the rolled up ends of palm fronds (*Archontophoenix* sp.) in an area where no running streams were observed (J. Covacevich, pers. comm.). A number of these individuals were gravid females. The trunk ends of these palm fronds have moist micro-environments inside and are a catchment for water during rain. Gravid females carry 34-51 large eggs measuring 1.7-2.5 mm. Egg masses and tadpoles have not been identified.

Species synchronosympatric with *T. liemi* were *Adelotus brevis*, *Taudactylus eungellensis*, *Mixophyes fasciolatus*, *Litoria chloris* and *L. lesueurii*.

CALL: To the ear the call is a short series of 'tinks'. A sound spectrograph of this call is given in Plate 1(B). This is based on a recording by Chris Corben at Dalrymple Heights, Eungella, ME.Q., in January 1976. The energy of the call is concentrated between 3000-4000 HZ, and has a duration of 411 milliseconds. It is composed of 4 pulses, with an individual duration of 81 milliseconds. The number of pulses however, may vary between 1 and 6 but 3 predominates. An individual calls on the average 27 times per minute. The call is easily distinguished from the multipulsed, sharper 'ting' call of *T. rheophilus*, the long multipulsed 'eek, eek, eek . . .' call of *T. acutirostris*, and the soft, short 'eek eek eek' call of *T. diurnis*.

NOTES ON THE OTHER SPECIES OF *TAUDACTYLUS*

Frogs of the genus *Taudactylus*, Straughan and Lee (1966), occur only in isolated montane

rainforest of eastern Queensland, south of Mt Hartley, some 20 km south of Cooktown. They are a conspicuous element of the rainforest fauna where ever they occur, and are almost invariably associated with cool, clear, fast-flowing rocky mountain streams. Three species are sun-loving and diurnal, an unusual habit amongst frogs. Two species have high pitched, very distinct, bell-like calls.

The most recent work on this genus was undertaken by Liem and Hosmer (1973). Since that study, new data on the natural history and distribution of the four previously known species have been compiled. These are summarized below.

***T. acutirostris* (Andersson 1916)**

DISTRIBUTION: Great Dividing Range, north-eastern Queensland from Mt Hartley, Bloomfield area in the north, to Tully Falls in the south.

CALL: To the ear, the call is a series of 'eek-eek-eek . . .' sometimes ending or beginning with sharp metallic notes. Plate 1(c) is a sound spectrograph of part of a call based on a recording by the author at Mt Lewis on 7 Nov., 1975. The call has a dominant frequency of 3000 HZ and the pulses have an individual duration 63 milliseconds. The call is usually from 4–6 seconds long with 17–25 pulses per call. An individual calls on the average 7 times per minute. Males form a chorus.

FIELD NOTES: *T. acutirostris* is mainly active during the day especially on sunny days when they will often 'bask' in the sun. Males call exposed on rocks and will interrupt calling when clouds move in front of the sun. Typically, after a period of exposure on a rock in the sun, individuals move off to forage along the sides of creeks and on the rainforest floor nearby. When disturbed they show no hesitation in jumping into water, be it a still pool or a waterfall. In still pools they lie exposed on the bottom amongst the leaf litter or rocks for several minutes before resurfacing.

COMMENTS: There is much confusion in the literature regarding the call of this species. Clyne (1969) calls it the Tinker Frog and gives the call as a series of metallic 'tinks'. Liem and Hosmer (1973) describe the call as a series of sharp tapping sounds repeated 3–4 times in quick succession. Neither have been verified by further field observations. Males typically call in a chorus sometimes giving sharp metallic notes at the beginning and end of calls but especially during

male-male aggression. The typical call of *T. acutirostris* has been recorded at the upper reaches of Mulgrave River and Charmillan Creek, Ravenshoe (G. Czechura pers. comm.).

***T. eungellensis* Liem and Hosmer, 1973**

DISTRIBUTION: In the ranges west of Mackay, ME.Q., from Clark Range in the north (A. Greer pers. comm.) to Finch Hatton Gorge and Credition in the south.

CALL: Liem and Hosmer (1973) record the call of this species as a high pitched metallic tinkering noise, like a little hammer tapping on metal repeated 4–5 times in quick succession. This has not been verified either by my own field observations or by C. Corben and G. Czechura (pers. comms.). Indeed we have failed so far to discover if it calls at all. *T. liemi* is synchronosympatric with *T. eungellensis* and was at that time undiscovered. It appears Liem and Hosmer have confused the two, and their description may apply to the *T. liemi* call. It would be surprising if a frog without vocal sacs could produce a high pitched, sharp tinkering call.

FIELD NOTES: *T. eungellensis* is similar in behaviour to *T. acutirostris* except in the case of calling males.

***T. rheophilus* Liem and Hosmer, 1973**

DISTRIBUTION: Great Dividing Range, NE. Q., from Thornton Peak, Daintree area, in the north to Mt Lewis in the south.

CALL: To the ear, the call is a series of sharp metallic 'tink-tink-tink'. Plate 1(A) is a sound spectrograph of the call based on a recording by the author at Mt Lewis on 6 December, 1975. It shows a dominant frequency of 5500 HZ and a lower harmonic containing nearly as much energy around 2750 HZ. The pulses have an individual duration of 31 milliseconds. The call is usually between 4–5 seconds long with 11–15 pulses per call. On the average an individual will call 5 times per minute.

FIELD NOTES: This species is a very secretive frog. It calls day and night but mainly during the day. Male calling sites are usually under rocks or roots and individuals may be partly in water. Calls form a chorus.

T. diurnis Straughan and Lee, 1966

DISTRIBUTION: Conondale Ranges (Czechura 1975) and Blackall Ranges in the north to Mt Nebo, D'Aguilar Range in the south.

CALL: As Liem and Hosmer (1973) have noted, males do not have vocal sacs but can vocalize. This is especially evident in captivity. To the ear, the call is soft 'eek-eek' sometimes with sharper notes, and is reminiscent of *T. acutirostris*. In the field, the call is heard especially during male-male aggressive encounters. No breeding choruses have been noted.

FIELD NOTES: *T. diurnis* and *T. eungellensis* are very similar in behaviour. Individuals forage into late evening.

PHYLOGENY

The following characters were used in the preparation of Table 1, and the construction of the cladogram (Fig. 2). These show the relationships between the five species of *Taudactylus*. The data for species other than *T. liemi* are taken from Liem and Hosmer (1973). (1) represents the apomorphic character-state and (0) the plesiomorphic character-state.

TABLE 1: CHARACTER-STATES OF THE SPECIES OF *TAUDACTYLUS*.

Species	Characters						
	1	2	3	4	5	6	7
<i>T. diurnis</i>	0	0	1	1	1	1	1
<i>T. eungellensis</i>	0	0	1	1	1	1	1
<i>T. acutirostris</i>	1	1	0	0	0	0	1
<i>T. rheophilus</i>	1	1	0	0	0	0	1
<i>T. liemi</i>	1	1	0	0	0	0	1

0 = plesiomorphic, 1 = apomorphic.

1. EXPOSURE OF FRONTOPARIETAL FONTANELLE: Following the reasoning of Lynch (1978), the lack of an exposed fontanelle, or the presence of a very small fontanelle (1), is considered to be apomorphic and an extensive fontanelle (0), plesiomorphic.

2. NASALS CONTACTING THE MAXILLARY: Large nasals contacting the maxillary (0) are considered to be plesiomorphic, and small nasals not contacting (1), apomorphic.

3. OMOSTERNUM: Liem and Hosmer (1973) are followed in considering the lack of an omosternum (1) apomorphic, and presence (0), plesiomorphic.

4. VOCAL SACS: Because most male frogs possess vocal sacs, the absence of sacs (1) is considered apomorphic, and presence (0), plesiomorphic.

5. DIGITAL DISCS: Liem and Hosmer (1973) are followed in considering broad digital discs (1) as apomorphic, and narrow discs (0) as plesiomorphic.

6. SUBARTICULAR TUBERCLES OF FINGERS: Liem and Hosmer (1973) regarded absence of these tubercles (1) as apomorphic, and their presence (0) as plesiomorphic.

7. T-SHAPED TERMINAL PHALANGES: The T-shaped terminal phalanges is unique to *Taudactylus* and is thereby considered autoapomorphic (1) for the genus.

From the cladogram in Figure 2, it can be seen that there are two sister groups in *Taudactylus* — the *T. diurnis* complex (*T. diurnis* and *T. eungellensis*) and the *T. acutirostris* complex (*T. acutirostris*, *T. rheophilus*, and *T. liemi*). The latter group is presented as a trichotomy. Dichotomies are to be preferred; however, unless they are supported by characters, they are invalid (Platnick and Shadab 1978).

The *T. diurnis* complex is regarded as apomorphic because it contains more apomorphies than its plesiomorphic sister group, the *T. acutirostris* complex (Table 1).

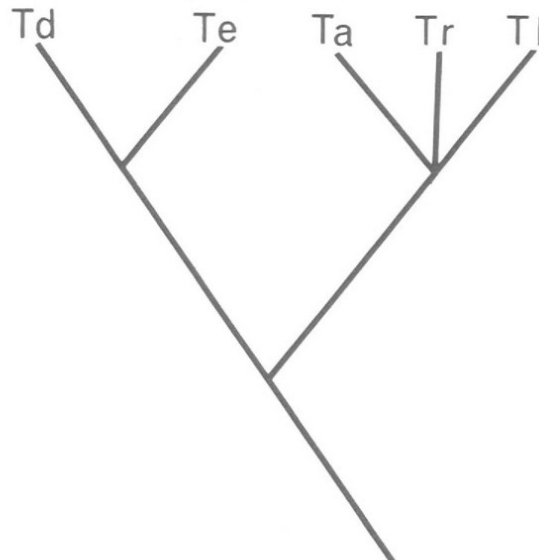


FIG. 2: Cladogram of the species of *Taudactylus*. Td = *T. diurnis*, Te = *T. eungellensis*, Ta = *T. acutirostris*, Tr = *T. rheophilus*, Tl = *T. liemi*.

BIOGEOGRAPHY

Hennig (1966) has stated that sister groups should be allopatric and that the most primitive sister groups remain near the centre of origin of the overall group. The *T. acutirostris* complex is the pleisiomorphic sister group, and is centred in northeast Queensland. Thus, it would seem reasonable to assume that this area was the centre of origin of the genus *Taudactylus*. Probably, the *T. diurnis* complex evolved from a *T. acutirostris* complex-like ancestor that invaded the rainforests of southern Queensland and became isolated there during rainforest contractions. Later, as the rainforest once again extended, the *T. diurnis-eungellensis* ancestral group may have reinvaded northern Queensland, and again become isolated by subsequent contractions, such that a northern group (*T. eungellensis*), and a southern group (*T. diurnis*) were formed. The ancestor of *T. liemi* may have been similarly isolated by rainforest contractions in mid-east Queensland.

It is difficult to reconstruct the evolution *T. acutirostris* and *T. rheophilus* with an allopatric model. The latter is synchronosympatric with the former, although *T. acutirostris* is distributed a little further north and south, and occurs at lower altitudes.

T. rheophilus and *T. liemi* are restricted to areas that acted as rainforest refugia (Mt Lewis, Thornton Peak, Eungella — Webb and Tracey, in press) during dry periods of the Pleistocene. The other species, although having important refugia within their range, have colonized rainforest areas nearby.

No species of *Taudactylus* occur in New Guinea or in rainforests north of the Daintree River 'block'. This is not surprising as it is unlikely that the high altitude, clear cool, fast-flowing rainforest streams necessary for *Taudactylus* existed during the dry Pleistocene periods when land connections were extant (Kikkawa, Monteith, and Ingram, in press; Covacevich and Ingram, in press).

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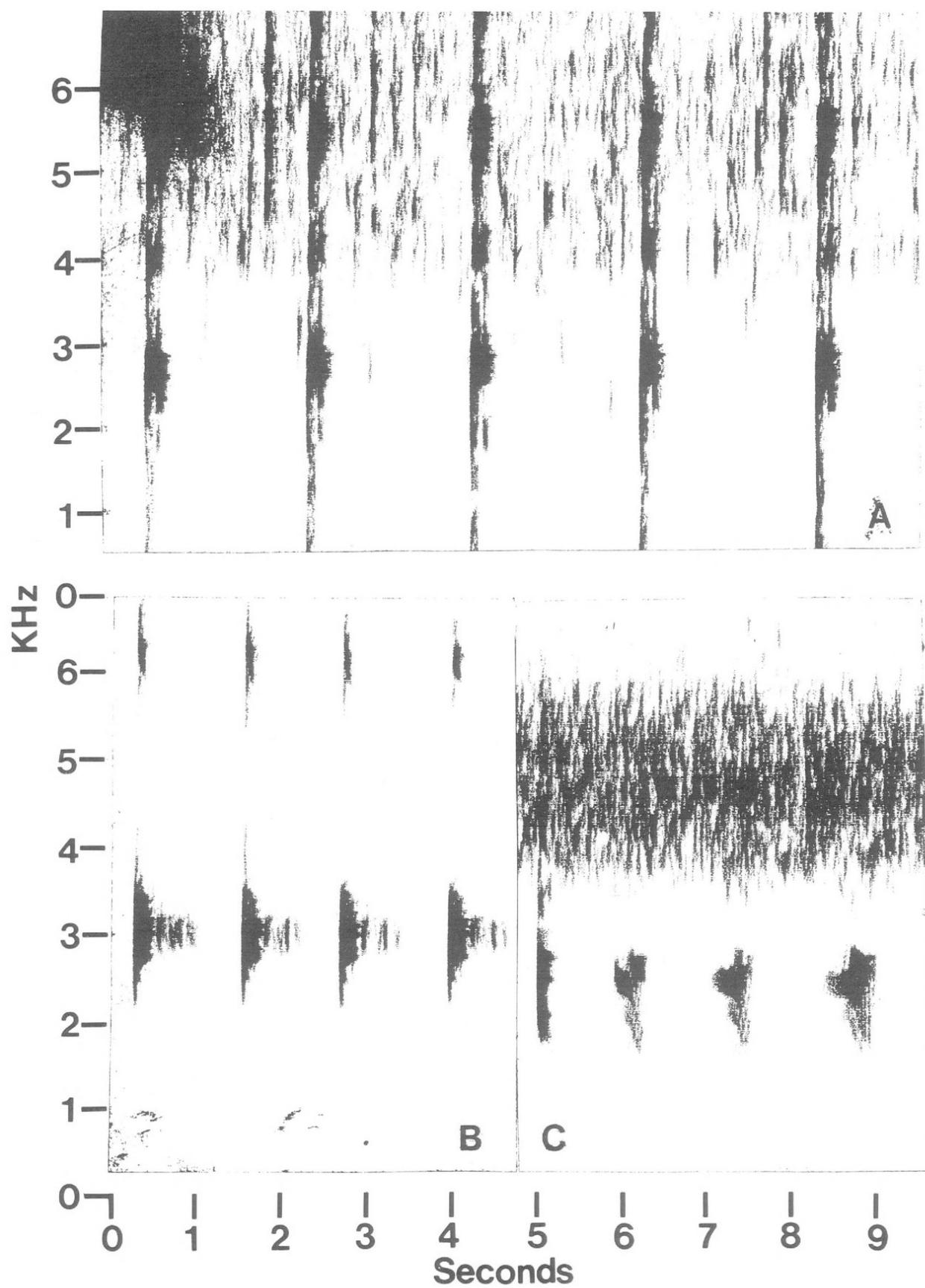
PLATE I

Sonographs of the calls of *Taudactylus*.

A: *T. rheophilus*

B: *T. liemi*

C: *T. acutirostris*





Ingram, Glen J. 1980. "A new frog of the genus *Taudactylus* (Myobatrachidae) from mid-eastern Queensland with notes on the other species of the genus." *Memoirs of the Queensland Museum* 20, 111–119.

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