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SPECIES OF THE *GUENTHERI* GROUP OF *PLATYMANTIS* (AMPHIBIA: RANIDAE) FROM THE PHILIPPINES, WITH DESCRIPTIONS OF FOUR NEW SPECIES

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Species of the *guentheri* group of Philippine *Platymantis* are revised. *Platymantis guentheri* is rediagnosed. Four species, previously confused with *guentheri*, (*P. rabori*, *P. negrosensis*, *P. luzonensis*, and *P. banahao*) are described.

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In a recent paper (Brown et al. 1997) three species-groups (assemblages) of Philippine *Platymantis* were diagnosed, based on different combinations of digital characters. In the same paper, species of the *hazelae* group were revised.

For convenience those diagnoses are briefly restated. The *hazelae* Group. — This Group is diagnosed by the following combination of characters: (1) terminal phalanx a wide "T"; (2) disks of fingers, except first, broadly dilated; (3) first finger much shorter than second, not reaching beyond midpoint between subarticular tubercle and disk; (4) digits proximal to disks much broader than deep, the result of wide dermal flanges; (5) subarticular tubercles large, round, and only moderately protruding; (6) toe disks smaller than finger disks.

The *guentheri* Group. — (1) terminal phalanx a moderate to wide "T"; (2) disks of fingers, except first; moderately to broadly dilated; (3) first finger shorter than second, reaching as far as base of disk for some species; (4) digits proximal to disks about as deep as broad, the result of narrow, dermal flanges; (5) subarticular tuber-

cles large and strongly protruding; (6) toe disks smaller than finger disks.

The *dorsalis* Group. — (1) terminal phalanx bluntly rounded to pointed; (2) tips of fingers blunt, without disks, or with small to moderate disks; (3) first finger slightly shorter, about as long as, or slightly longer than second; (4) digits proximal to disks about as deep as broad; (5) subarticular tubercles large, strongly protruding and frequently pointed; (6) finger disks smaller than to slightly larger than toe disks.

History of the Collections of Philippine Species of the *guentheri* Group

The data base for this revision of the *Platymantis guentheri* Group is the result of over a hundred years (1882–1996) of field sampling and observations by numerous workers. The accumulation of data before 1954 was very slow. It has accelerated since then. It is appropriate that readers understand some of the reasons for this, as well as the problems that limit the collection of field data even now.

During the period from 1882 to 1954, the species of the *guentheri* Group, like those of the *hazelae* Group (Brown et al. 1997) were only rarely collected because of the sampling techniques typical of most field work in the Philippine Islands during that period. Taylor's extensive surveys on several islands during the period 1912–1922 produced only a few examples of any species of these two species Groups.

Cornufer (= *Platymantis*) *guentheri* was described on the basis of a single specimen from Dinagat Island (Boulenger 1882). This species was redescribed by Taylor (1920) based on two specimens from Bunawan, Agusan del Norte Province, Mindanao. He does not mention additional examples of this species in his later papers (1922a, 1922b, 1922c, and 1923). In the 1920 paper, however, he did recognize a second species of the *guentheri* Group, *Cornufer worcesteri* from Mt. Apo in Davao Province, Mindanao (Stejneger 1905). Taylor's surveys on several of the islands during the period 1912–1922 employed sampling techniques which exploited the fauna inhabiting the forest floor and low shrub and tree habitats, but not the more arboreal habitats of the species in the *guentheri* and *hazelae* Groups.

During the period from 1922 until World War II little field work was undertaken. Thus at the time of Inger's (1954) monograph on the Philippine frogs, the samples of *P. guentheri* were still very limited: Philippines 2, Dinagat 1 (type of *guentheri*), Luzon 3, Polillo 4, Leyte 1, and Mindanao 8 (including the type of *Cornufer worcesteri*).

In 1954 the senior authors (Brown and A. Alcala) began their Philippine herpetofaunal studies that have continued to the present time. A population of *Platymantis guentheri* on Negros Island was the first identified (Brown and Alcala 1957). Subsequently large samples from populations on both Bohol and Negros Islands were added to the data. This was the result of two factors: (1) the study of herpetofaunas of these two areas from a base at Silliman University for a period of more than a decade (1956–1972) and (2) the use of sampling techniques designed to exploit the arboreal microhabitats of amphibians, such as *Platymantis* and *Philautus*, as well as some genera of geckos and skinks. Other areas such as Dapitan Peak of the Malindang massif, Zamboanga Peninsula, and Mt. Hilong-hilong in northeastern Mindanao were surveyed during one or two expeditions to those rather remote regions using the same sampling techniques, but the samples were small (Alcala 1986). The large samples accumulated for Negros and Bohol did provide evidence of the presence of two species on Bohol (Brown and Alcala 1963) but only one species on Negros.

It is also important for the reader to understand that there are difficulties which limit follow-up and repetition of some of these surveys. Extensive logging on both Negros and Bohol has greatly reduced the areas of forest normally occupied by these frogs. A brief survey of forest remnants on Cuernos de Negros, southern Negros in 1996 confirmed the continuing presence of a population of *negrosensis* in that area. Whether or not there is an extant population of either *guentheri* or *rabori* in the forest remnants on Bohol remains to be seen. We hope to be able to determine this within the year. A follow-up expedition to the Mt. Hilong-hilong area in northeastern Mindanao presents greater difficulties: (1) the lack of security in the region is a risk to personnel involved and (2) the survey would require a large commitment of men and resources.

The recent modest samples of *luzonensis* and *banahao* from Mt. Banahao and Mt. Maquiling

are the result of a base at the University of the Philippines at Los Baños and the continuing work in the forest of the two mountains by Alcala and Diesmos over the period 1994–1996. Recently, populations of *Platymantis guentheri* on Cataduanes Island (Ross and Gonzales 1992) and Panaon Island at the southern tip of Leyte (Gaulke 1994) and a population of *P. ingeri* on Dinagat Island (Ross and Lazell 1991) have been reported, but the samples are limited to a few specimens.

MATERIALS AND METHODS

Materials examined include: (1) holotypes of *Platymantis guentheri*, *worcesteri*, and *ingeri*; (2) 17 of the 19 specimens examined by Inger (1954); and (3) most specimens from recent collections that are referable to the *guentheri* group of species. These materials are in the custody of the following institutions: British Museum of Natural History (BMNH), California Academy of Sciences (CAS or CAS-SU), Field Museum of Natural History (FMNH), Museum of Comparative Zoology (MCZ), United States National Museum (USNM), Delaware Museum of Natural History (DMNH), and Carnegie Museum (CM).

Morphometric characters, including snout-vent length (SVL), head length (HL), head width (HW), snout length (SnL), diameter of eye (ED), diameter of tympanum (TD), tibia length (TiL), third finger length from proximal edge of basal tubercle (3FL), diameter of third finger disk (3FD), and diameter of third toe disk (3ToD) were measured to the nearest 0.1 mm using a Helios dial caliper. Other morphological characters include: webbing of toes, shape of terminal phalanges, tubercles of hands and feet, skin ornamentation, head shape, vomerine teeth, and color pattern.

SYSTEMATIC SECTION

Key to *guentheri* Group Species

1a. Dorsum smooth, without distinct ridges and usually with few tubercles mostly limited to upper eyelids and dorsolateral area (Fig. 4A, B) 2

1b. Dorsum with prominent ridges and scattered tubercles (Fig. 2) 3

2a. Third toe not webbed beyond basal tubercle on outer side of third toe; brown pigmentation of venter prominent on belly as well as head and throat; advertisement call (Fig. 1A) . . . . . *P. banahao*

2b. Third toe webbed to midpoint tubercles or beyond on outer side of third toe; brown pigmentation of venter mostly under head and throat; advertisement call (Fig. 1B) . . . . . *P. luzonensis*

3a. TiL usually greater than 55% of SVL; 3FD less than 6% of SVL and usually less than 100% of TD; SVL 27–40 mm for males . . . . . *P. guentheri*

3b. TiL usually less than 52 or 54% of SVL; 3FD usually more than 115% of TD and 7–10% of SVL; SVL 39–50 mm for males 4

4a. Third toe not webbed beyond basal tubercle on outer side; numerous long ridges on dorsum; snout with few or without tubercles; venter with scattered, small granules . . . . . *P. rabori*

4b. Third toe webbed to about midpoint between tubercles or more distal on outer side; few long ridges on dorsum; snout with 2 or 3 rows of tubercles; venter nearly smooth; advertisement call (Fig. 1c) . . . . . *P. negrosensis*

The *Platymantis guentheri-ingeri* Problem. — Reexamination of 17 of the 19 specimens assigned to *Platymantis guentheri* by Inger (1954) indicates that the Mindanao sample includes four examples (CM 3424–25 and FMNH 50571, 50573) that fit the diagnosis of *P. ingeri*. Reexamination of the holotype of *Platymantis guentheri* along with the small series from Dinagat Island reported as *P. ingeri* by Ross and Lazell (1991) shows them to be one species that better fits the diagnosis of *P. ingeri* (Brown and Alcala 1963) than that of *P. guentheri* (Brown and Alcala 1963, or Inger 1954).

In view of this fact and because of the availability of larger samples from several islands, a rediagnosis and redescription of *Platymantis guentheri* is necessary. Comparison of the *ingeri*-like populations of Dinagat, Mindanao, and Biliran islands shows them to be in general agreement with the type of *guentheri*, and they are therefore assigned to that species. Because the Bohol population, described as *ingeri*, re-

veals only a few minor differences in morphometric characters, it is treated as a population of *guentheri*. *Platymantis guentheri* is presently known only from the Greater Mindanao group of islands.

Platymantis guentheri (Boulenger)

Cornufer guentheri: Boulenger, 1882:108 (Type loc.: Dinagat Island, Philippines; holotype in BMNH); (part) Taylor, 1920:308; and (part) Inger, 1954:362.
Cornufer ingeri: Brown and Alcala, 1963:672 (Type loc.: Cantaub, Bohol Island; holotype in CAS).
Platymantis guentheri: (part) Brown and Alcala, 1970b:109.

DIAGNOSIS. — *Platymantis guentheri* differs from Philippine species of the *hazelae* and *dorsalis* Groups in the combination of digital characters used to diagnose the groups (see Introduction); and from other *guentheri* Group species in the following combination of characters: (1) the longer tibia relative to SVL (TiL very rarely less than 57% of SVL and HW nearly always less than 75% of TiL); (2) the smaller finger disks relative to finger length (3FD 4–5% of SVL, rarely as great as 35% of 3FL and very rarely greater than 100% of TD); and (3) the smaller size at maturity (about 25–40 mm); see Tables 1, 2 and 3.

DESCRIPTION. — SVL at maturity 24.4–33.2 mm for 32 males and 27.2–39.6 mm for 45 females; HW 99–112% of HL and 38–44% of SVL; snout round, pointed; upper jaw slightly protruding; SnL 35–45% of HL and 31–41% of HW; eye large; ED 71–97% of SnL, 10–13% of SVL, and 25–33% of HW; tympanum large; canthus rounded; lores concave, moderately oblique; vomerine teeth prominent; fingers without webs; digits proximal to disks about as wide as deep, with only narrow dermal flanges; first finger much shorter than second, reaching about midpoint between subarticular tubercle and disk of second; finger disks, except first, moderately large; 3FD 4–5% of SVL, 25–35% of 3FL, and 73–108% of TD; subarticular tubercles strongly protruding, usually somewhat pointed; one row of supernumerary tubercles; inner and middle metacarpal tubercles large and oval, outer smaller and round; hind limbs long as measured by tibia, TiL 56–64% of SVL and HW 63–75% of TiL; toes webbed: to proximal edge of tubercle on first and second, to various levels of basal tubercle on third, to basal tubercle on fourth, and slightly distal to the basal tubercle on the fifth;

TABLE 1. Snout vent length (SVL, in mm) and extent of toe webs for adults of Philippine species of the *guentheri* Group of *Platymantis* (N = number in sample, F = female, M = male).

Species	N	SVL	Webbing on 3rd Toe
P. guentheri			not beyond basal tubercle
F	45	27.2–39.6	
M	32	24.4–33.2	
P. rabori			not beyond basal tubercle
F	27	38.4–49.1	
M	22	27.4–33.2	
P. banahao			not beyond basal tubercle
F	–	–	
M	11	27.8–39.4	
P. negrosensis			midpoint between tubercles
F	15	39.3–50.2	
M	25	29.8–39.3	
P. luzonensis			midpoint between tubercles
F	8	35.1–45.3	
M	12	27.1–36.0	

TABLE 2. Comparison of body proportions (in %) of five species of the *guentheri* Group (N = number of specimens).

Species	HW/TiL	3FD/TD	3FD/3FL
P. guentheri			
Range	62–74	73–108	22–35
N	43	43	40
P. rabori			
Range	78–90	114–185	36–44
N	40	30	34
P. negrosensis			
Range	80–92	130–211	35–47
N	20	20	20
P. luzonensis			
Range	79–93	116–193	30–44
N	21	20	21
P. banahao			
Range	85–94	100–193	31–40
N	12	12	11

disks of toes smaller than those of fingers, 3ToD 55–86% of 3FD; subarticular tubercles strongly protruding, usually somewhat pointed; inner metatarsal tubercle oval; outer round; no plantar tubercles; dorsum nearly smooth or with a few tubercles and frequently with a pair of short, dark ridges in a chevron-pattern at shoulder level; venter nearly smooth; posterior thighs nearly smooth or with small granules.

COLOR. — In preservative dorsum light to dark reddish brown or a mottling of the two; usually an anteriorly pointed, darker chevron at the shoulder level; often an interorbital dark blotch, more rarely a broad dorsal, paler band or narrow, pale, dorsolateral stripes; lips dark barred; limbs with pale and dark, irregular transverse bands; venter pale cream, sometimes nearly uniform, but usually with dense, brown flecks beneath head and throat; belly often with scattered brown spots, especially anteriorly.

REPRODUCTION. — None of the egg clutches collected from any of the arboreal sites in the forests on Bohol Island or Mt. Hilong-hilong in Mindanao have been confirmed as *guentheri*. Several gravid females from these sites have 20–24 large (2–3 mm) unpigmented, ovarian or oviducal eggs. These are similar to those of other species of Philippine *Platymantis* that exhibit direct development, and presumably *guentheri* follows that mode.

COMPARISONS. — *Platymantis guentheri* differs from *rabori*, *negrosensis*, *luzonensis*, and *banahao*, species with which it has long been confused, as indicated in the diagnosis and key.

INTER-ISLAND VARIATION. — The samples of *guentheri* from Dinagat, Mindanao, and Biliran islands when compared to the Bohol sample, exhibit slightly greater SVL for females but not for males (Table 2).

ECOLOGICAL NOTE. — As reported by Brown and Alcala (1963) for *ingeri* (= *guentheri*), this species is found in the surface stratum (among leaves and duff of the forest floor, occasionally under logs or rocks, and less frequently in the shrub or arboreal strata). Of a total of 91 specimens (67 Bohol and 18 northeastern Mindanao), 67 (74%) were from the surface stratum; 4 (4.5%) low shrubs, 5(5.5%) on trees, and 15 (16%) in arboreal ferns or leaf axils of *Pandanus*. The ferns inhabited by *guentheri* ranged from 4 to 13 m above the forest floor. The range in elevation is from 700 m (upper dipterocarp) to 1900 m (montane forest) on Mt. Hilong-hilong in northeastern Mindanao.

RANGE. — Known from Mindanao, Dinagat, Bohol, and Biliran islands.

TABLE 3. TiL, HW, ED, TD, FD, and 3FL as a % of SVL. Species of the *guentheri* Group (N = number of specimens).

Species	TiL/SVL	HW/SVL	ED/SVL	TD/SVL	3FD/SVL	3FL/SVL
P. guentheri						
Range	56–64	38–43	10–13	4–6	4–5	14–17
N	20	20	20	20	20	20
P. rabori						
Range	48–54	40–46	13–17	5–7	8–10	20–23
N	20	20	20	20	20	20
P. negrosensis						
Range	47–52	38–43	11–15	4–6	7–9	19–22
N	20	20	20	20	20	20
P. luzonensis						
Range	45–53	39–45	12–14	4–6	6–8	17–22
N	20	20	20	20	20	20
P. banahao						
Range	45–49	40–44	10–14	4–6	5–8	17–21
N	12	12	11	11	11	11

Populations Confused with *Platymantis guentheri*

Populations on Mindanao, Leyte, Bohol, Negros, Luzon, Catanduanes, and Polillo islands that have erroneously been referred to *guentheri* since 1954 (see Inger 1954, Alcala and Brown 1957, Brown and Alcala 1963, and Ross and Gonzales 1992) must now be reevaluated. A search of the literature reveals only one name that is possibly available, *Cornufer* (= *Platymantis*) *worcesteri* Stejneger (1905). *Platymantis worcesteri* is treated as a distinct species by Taylor (1920), but as a synonym of *P. guentheri* by Inger (1954). However, reexamination of the unique holotype of *worcesteri* from Mt. Apo, Mindanao reveals the presence of an intercalary cartilage in the digital skeleton, placing this species in the Rhacophoridae. The shape of the terminal phalanx identifies it as a *Philautus* (Dring 1987; Brown and Alcala 1994). Its specific status and possible priority are the subject of a separate paper. Island populations previously confused with *guentheri* are therefore all unnamed.

Recent collections (about 35 specimens) from Mt. Maquiling and Mt. Banahao in southern Luzon provide evidence that two, cryptic species are sympatric on Luzon, as is the case for Mindanao and Bohol islands. Comparison of these Luzon samples with the large samples (more than 50 specimens from each of the Greater Mindanao and Negros areas) indicates that these four populations differ in several morphological and morphometric characters. These differences are sufficiently great that we treat the populations from the Greater Mindanao, Greater Negros, and the two from Greater Luzon areas as distinct species. The advertisement calls for the two populations on Luzon and the population on Negros also differ from one another (Fig. 1).

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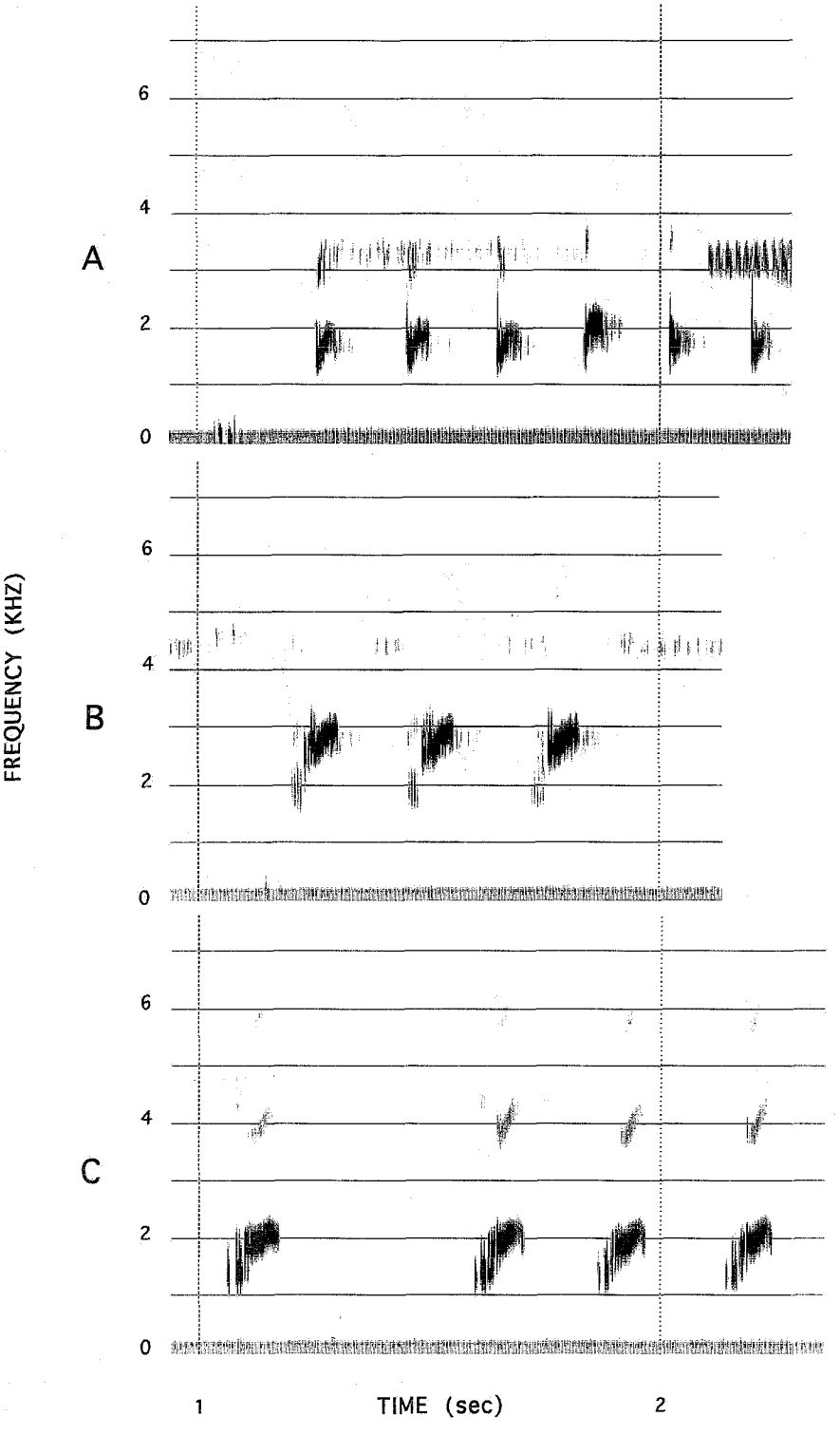
FIGURE 1. Advertisement calls of: A. *Platymantis banahao* (CAS 201532), B. *P. luzonensis* (PNM5495), C. *P. negrosensis* (PNM 5493).


FREQUENCY (KHZ)
A
B
C
6
4
2
0
1
TIME (sec)
2

Platymantis rabori new species
(Fig. 2)

Cornufer guentheri (part): Brown and Alcala, 1963:674.
Platymantis guentheri (part): Brown and Alcala, 1970b:109.

The diagnosis and description of this species are based on a large sample (230 specimens) from Bohol Island. Small samples of five or six specimens from Leyte and Mindanao islands are assigned to this species but are not designated as paratypes.

Holotype. — CAS 136889, a gravid female, collected at Cantaub, Sierra Bullones, Bohol Island, February 13, 1972, by L. Alcala and party.

Paratypes. — Bohol Island (same general locality as holotype): CAS-SU 17284, 21721, 21723, 21733, 21738–39, 21741, 21748, 21756, 21775–81, 23148–64, 23166–68, 23170–82, 23184–212, 23222–23, 23425; CAS 136888, 136890–137006, 138169–70, 139019–21, 145697, 145699, 186065; FMNH 134987–88; MCZ 39052–53; PNM 5282.

Description of holotype. — A gravid female (measurement in mm) SVL = 48.9, HL = 18.5, HW = 20.7, TiL = 23.8, SnL = 7.8, ED = 6.6, TiL = 2.5, 3FL = 10.2, 3FD = 3.5, 3ToD = 1.8; dorsum with tubercles and some ridges; toe-webs to basal tubercle or beyond except for fourth toe.

DIAGNOSIS. — *Platymantis rabori* differs from species of the *hazelae* and *dorsalis* Groups in the combination of characters diagnosing those groups (see Introduction). It differs from other species of the *guentheri* Group in these characters: (1) snout without tubercles or only a few; (2) dorsum with some tubercles as well as short and long ridges; (3) venter posterior to forelimbs with scattered, small granules; (4) toe webs reach about midpoint of tubercle on first and second toes, midpoint or distal edge of basal tubercle of third toe, and does not reach basal tubercle or only its basal edge on fourth toe.

DESCRIPTION. — SVL 27.4–35.3 mm for 22 males and 38.4–49.1 mm for 27 females; HW 107–125% of HL and 40–46% of SVL; snout rounded, upper jaw only slightly protruding; SnL 36–42% of HL and 30–40% of HW; ED 77–98% of SnL, 24–33% of HW, 13–17% of SVL; tympanum exposed; TD 31–45% of ED and 5–7% of SVL; canthus rounded; lores moderately oblique, concave; fingers without webs and with very narrow, lateral, dermal flanges; first finger much shorter than second, reaching about midway between tubercle and disk or slightly beyond; disks of fingers (except first) broadly dilated, truncate; 3FD 33–43% of 3FL and 120–180% of TD; subarticular tubercles large, strongly protruding and somewhat pointed; one row of supernumary tubercles; inner metacarpal tubercle prominent, large oval; middle and outer large, low; hind limbs long, TiL 48–54% of SVL and HW 76–88% of TiL; toes webbed, first toe to base or midpoint of subarticular tubercle, second to about midpoint of tubercle, third to midpoint or distal edge of tubercle, fourth short of basal tubercle or to its proximal edge, fifth beyond basal tubercle or midpoint between tubercles (Fig. 3a); subarticular tubercles like those of fingers; inner metatarsal tubercle prominent, elongate, outer small, round to oval; disks of toes smaller than of fingers, 3 ToD 41–51% of 3FD; plantar surface smooth; snout smooth or with a few tubercles; a white-tipped tubercle on posterior upper eyelid; dorsum posterior to eyes with some tubercles as well as short and intermediate length ridges; throat smooth; venter posterior to forelimbs with small, scattered granules; posterior thighs with moderate granules.

COLOR. — In preservative background color of dorsum variable, tannish brown to light chocolate brown, dorsal ridges with narrow, blackish borders; a few specimens with a narrow, median pale stripe or a pair dorso-laterally; venter pale, with chocolate brown flecks and pale spots, groin and anterior thighs similarly flecked, but without prominent, pale creamy spots.

In life the color is variable as in preservative but the dark background phase appears darker, almost blackish brown. The short dorsal ridges are outlined in black. The vertebral or median pale stripes, when present, are tannish brown to almost grayish.

REPRODUCTION. — Gravid females examined for eggs have large (about 2 mm) eggs in the ovaries or oviducts. Egg masses collected from arboreal ferns (*Asplenium*) or leaf axils of *Pandanus*, habitats most frequently occupied by adults of this species as well as *Platymantis guentheri* and *Philautus surdus*, all give evidence of a direct development mode, but the only ones including sufficiently late stages to assign to genus and species are examples of *Philautus*

FIGURE 2. *Platymantis rabori* from Mindanao Island.

surdus. None of the clutches have been positively identified with this species.

ETYMOLOGY. — Named for Dioscoro S. Rabor, Filipino ornithologist and mammalogist, who added greatly to our knowledge of the ranges of Philippine amphibians and reptiles.

COMPARISONS. — *Platymantis rabori* differs from *guentheri*, *negrosensis*, *luzonensis*, and *banahao* as indicated in the diagnosis and key.

ECOLOGICAL NOTE. — Preferred microhabitat is arboreal ferns or leaf axils of *Pandanus*. Of 56 examples collected in 1962 in original forest near Cantaub, Sierra Bullones, Bohol Island 50 were from arboreal ferns, 4 from leaf axils of *Pandanus* and 2 from duff on the forest floor. The elevation is between 500 and 800 m (Brown and Alcala 1963). This contrasts with *Platymantis guentheri* with 41 of 57 specimens from the forest floor and only 9 from arboreal ferns. In a later (1972) study of the arboreal fern microhabitat in the same forest area on Bohol, 88 specimens were *P. rabori* and 20 were *P. guentheri*. The height range of the ferns for *P. rabori* is 0.5 to 12.5 m.

RANGE. — Populations are recorded from Bohol, Leyte, and Mindanao islands.

Platymantis negrosensis new species

Cornufer guentheri: Alcala and Brown, 1957:182; Brown and Alcala, 1961:632, 1964:600.

Platymantis guentheri (part): Brown and Alcala, 1970b:109.

This new species, like the sympatric *Platymantis hazelae*, has been extensively studied in the

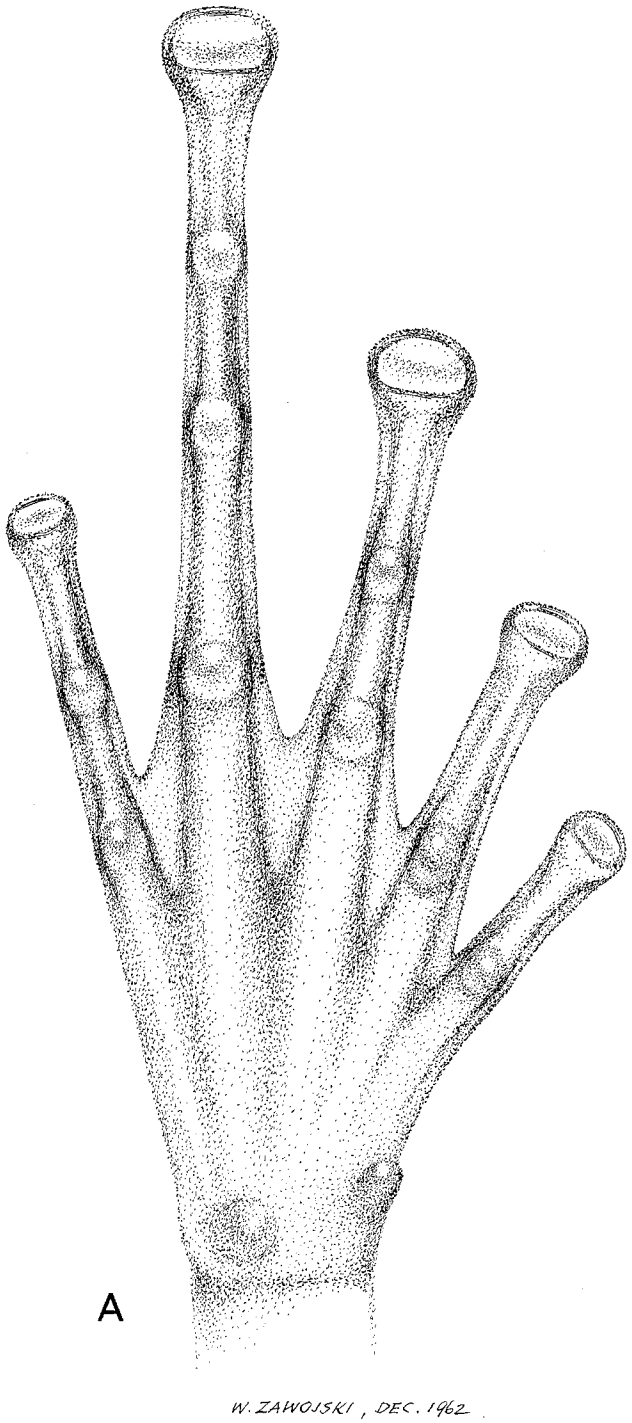
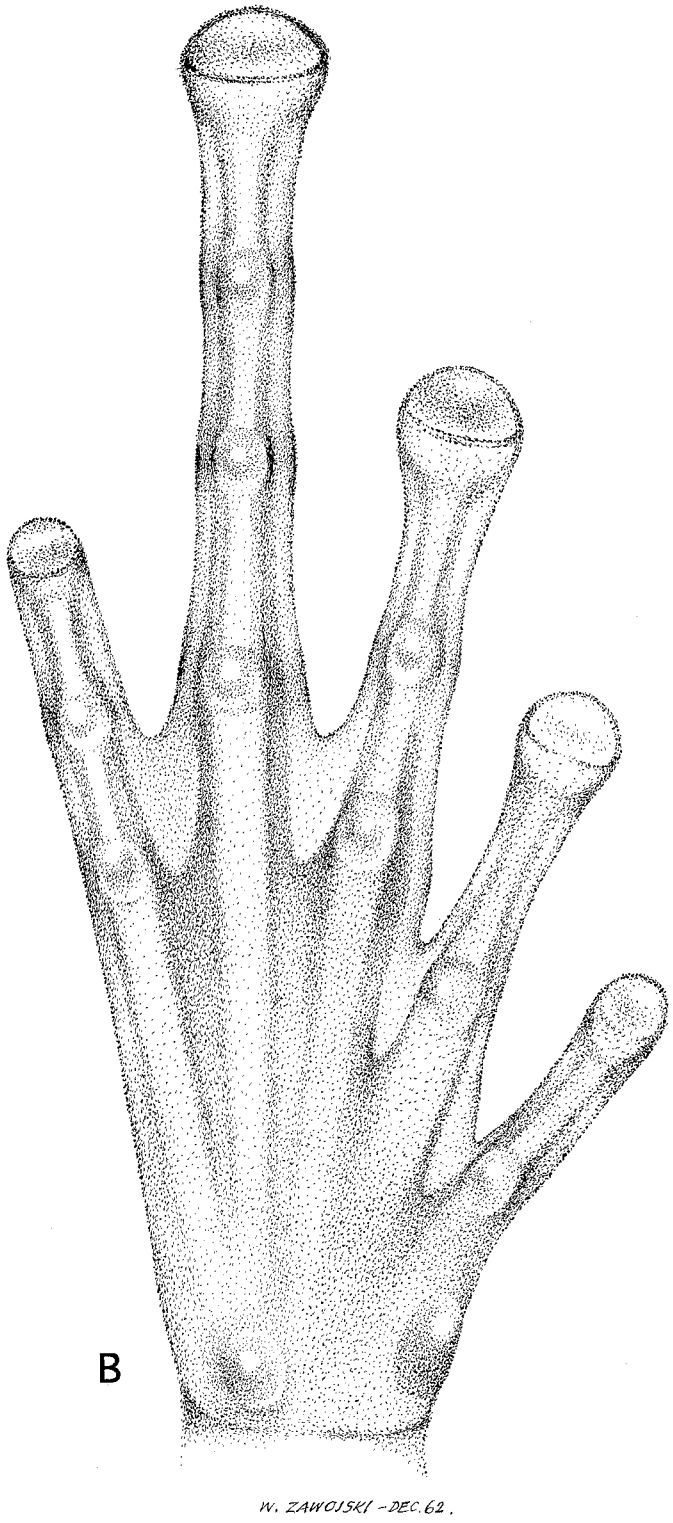


FIGURE 3. Undersurface of foot, showing webbing and tuberculation: A. *Platymantis rabori* (illustrative of the webbing-pattern of *rabori*, *guentheri*, and *banahao*); B. *P. negrosensis* (illustrative of the webbing-pattern of *negrosensis* and *luzonensis*).


B
W. ZAWOJSKI - DEC. 62.

field over the past 35 years, and its biology is thus better known than that of most species of the genus.

Holotype. — CAS 137416, an adult female, collected in original forest at Lake Balingsasayao, Negros Oriental Province, Negros Island, on September 19, 1972, by L. Alcala.

Paratypes. — Negros I. (same locality as holotype): CAS 137386–415, 137417–28; Cuernos de Negros: CAS-SU 17996–18002, 18434–35, 18487, CAS 89804; other localities of Negros I.: CAS-SU 19527–30, 23703, CAS 128903–12, 128914, 128919, 133863, 133899–905, 133911, 133955–56, 133988, 134319, 134325–26, 137993–138000, 138151–60, 138213, 138215, 138232–33, 138236–39, 138245–46, 139281, 139283, 139286, 145611–20, 145807–08, 145851–52, 145892, 145973–74, 147332, 147335–43, 185651, 200202–07; PNM 5283; USNM 512300.

Description of holotype. — An adult female (measurement in mm): SVL = 50.2, HL = 17.7, HW = 120.9, SnL = 6.7, ED 5.7, TD = 2.5, TiL = 24.4, 3FL = 10.3, 3FD = 4.6, 3 ToD = 1.9; dorsum with tubercles and short ridges; toe-webs beyond basal tubercle except for fourth toe.

DIAGNOSIS. — *Platymantis negrosensis* differs from the *hazelae* and *dorsalis* Groups of species in those characters that diagnose the groups (see Introduction); and from other species of the *guentheri* Group in: (1) two or three rows of tubercles on snout; (2) usually only short ridges and some tubercles on dorsum; (3) toe webs usually reach distal edge of tubercle or beyond for first and second toes, midway between tubercles on third toe, and distal edge of basal tubercle or beyond on fourth; (4) venter nearly smooth; (5) advertisement call.

DESCRIPTION. — SVL 29.8–39.3 mm for 25 males and 39.3–50.2 mm for 15 females; HW 105–125% of HL and 38–43% of SVL; snout rounded to round-pointed, SnL 35–42% of HL and 30–36% of HW; ED 86–104% of SnL, 29–36% of HW, and 11–15% of SVL; tympanum exposed, TD 25–43% of ED and 4–6% of SVL; canthus rounded; lores moderately oblique, concave; fingers without webs; first finger much shorter than second, reaching beyond basal tubercle to midway between tubercles of second finger; disks of fingers (except first) broadly dilated, truncate and with narrow, dermal flanges proximal to disks; 3FD 35–47% of 3FL, 130–211% of TD, and 7–9% of SVL; 3FL 19–22% of SVL; subarticular tubercles large, strongly protruding; one row of supernumary tubercles; inner metacarpal tubercle elongate to oval; middle and outer low, usually partially fused; hind limb moderately long, TiL 46–53% of SVL and HW 80–92% of TiL (only three of 20 below 83%); toes webbed: to midpoint or distal edge of subarticular tubercle on first toe, distal edge or slightly beyond tubercle on second toe, about midway between tubercles or slightly beyond on third toe; basal tubercle or slightly beyond on fourth toe, and usually base of distal tubercle on fifth toe; disks of toes smaller than those of fingers, 3ToD 38–54% of 3FD; subarticular tubercles large, protruding; plantar area smooth; inner metatarsal tubercle elongate; outer round; plantar area smooth (Fig. 3b); usually two or three rows of low tubercles on snout; few to numerous short ridges and usually some tubercles on dorsum; a few including one pale-tipped tubercle on upper eyelids; venter usually smooth; posterior thighs with small granules.

COLOR. — In preservative background color of dorsum and upper lateral surfaces somewhat reddish brown to chocolate brown; dorsal ridges with narrow, blackish borders; venter with dense brown flecks or numerous brown spots; groin area and adjacent surface of thighs creamy-white with brown intrusions.

In life the dorsal background color is variable as it is for preserved specimens, but the dark specimens appear darker in life. The vertebral or dorsolateral stripes are grayish to tan.

REPRODUCTION. — *Platymantis negrosensis*, like other species of *Platymantis* for which the life cycle is known, produce large, unpigmented eggs which undergo direct development within the egg capsule. Clutch size was reported as 8–47 (Alcala 1962) but a couple of gravid females (SVL about 45 mm) indicate a clutch size of ± 40. The clutch of eight from the leaf axil of an arboreal fern may have been that of *Platymantis hazelae* (clutch size 5–9). The developmental period to hatching is reported as 39+ days. For more detail on development see Alcala (1962) and Brown and Alcala (1983).

ADVERTISEMENT CALL. — The call of *negrosensis* sounds like "kwek-kwek-kwek." The first, brief part of each note is between 1,000 and about 2,000 Khz. The second, longer part of the note is between 1,200 and about 2,300 Khz. The

TABLE 4. Some advertisement call parameters for *Platymantis negrosensis*, *P. luzonensis*, and *P. banahao* (n = number of voice records, s = seconds).

Species	n	Sound to human ear	Notes in a series	Frequency (Khz)	Length of note (s)
P. negrosensis	2	Kwek-Kwek	1 or 2–5 in succession	1000–2300	0.106–0.122
P. luzonensis	3	Kwenk-Kwenk	1 or 2–6 in succession	1800–3300	0.106–0.116
P. banahao	4	Tut-Tut-Tut	6–24 in succession	1200–2400	0.0593–0.1125 (usually < 0.100)

duration of each note is about 0.1060–0.1220 seconds, and the time between notes ranges from about 0.15 to 0.54 seconds. There are usually three to four notes in quick succession following an initial note that is separated by a longer interval (see Fig. 1C and Table 4).

ETYMOLOGY. — The name is derived from Negros, the name of the island where this species occurs.

COMPARISONS. — *Platymantis negrosensis* differs from other species of the *guentheri* Group as indicated in the diagnosis and key.

ECOLOGICAL NOTE. — Of 36 specimens collected in the mountains of southern Negros during field work 1956–58, 28 are from arboreal ferns, 5 from leaf axils of *Pandanus*, 2 from leaf axils of gabi plants, and 1 on the forest floor. This species occurs in the upper dipterocarp and submontane forest zones at elevations from about 500 to 1050 m. During field surveys in the Lake Balinsasayo area in 1970 and 1972, this species was found in arboreal ferns ranging from about 2–24 m above the forest floor.

RANGE. — Known only from Negros Island, primarily from populations in the southern mountains. Only one specimen was recorded from Mt. Canlaon in northern Negros during a field survey in 1962.

Platymantis luzonensis new species
(Fig. 4)

Platymantis guentheri (part): Inger, 1954:362; Brown and Alcala, 1970b:109.

Recent samples from populations on various mountains in southern Luzon Island and on Catanduanes Island have added to our knowledge of the variability of this species, but, except for the populations on Mt. Banahao and Mt. Maquiling, the samples are, at this time, too small to determine if they should be treated as subspecies or new species. We therefore limit the holotype and paratypes to the Banahao-Maquiling samples.

Holotype. — CAS 196368, a female, collected in forest at about 600 m elevation, Mt. Maquiling, Laguna Province, Luzon Island, Philippines, July 11, 1994, by Angel C. Alcala.

Paratypes. — CAS 196364, 196369–70, 200404–08, 201544–45, 201538–39 Mt. Maquiling; CAS 201218–21 Mt. Banahao at Lucban.

Description of holotype. — An adult female (measurement in mm): SVL = 44.9, HL = 15.6, HW = 18.8, TiL = 20.3, SnL = 6.2, ED = 5.2, TD = 1.95, 3FL = 8.3, 3FD = 3.5, 3ToD = 1.7, TiL = 20.3. A few low tubercles on dorsum, posteriorly; toes about half webbed.

DIAGNOSIS. — Differs from species of *Platymantis* of the *hazelae* and *dorsalis* Groups in those characters that diagnose the groups. *Platymantis luzonensis* differs from species of the *guentheri* Group, other than *banahao*, in the skin of snout and dorsum being smooth or nearly so. It differs from all species but *negrosensis* in the greater webbing which reaches the distal edge of the basal tubercle on first and second and midway between tubercles on fourth. It differs from

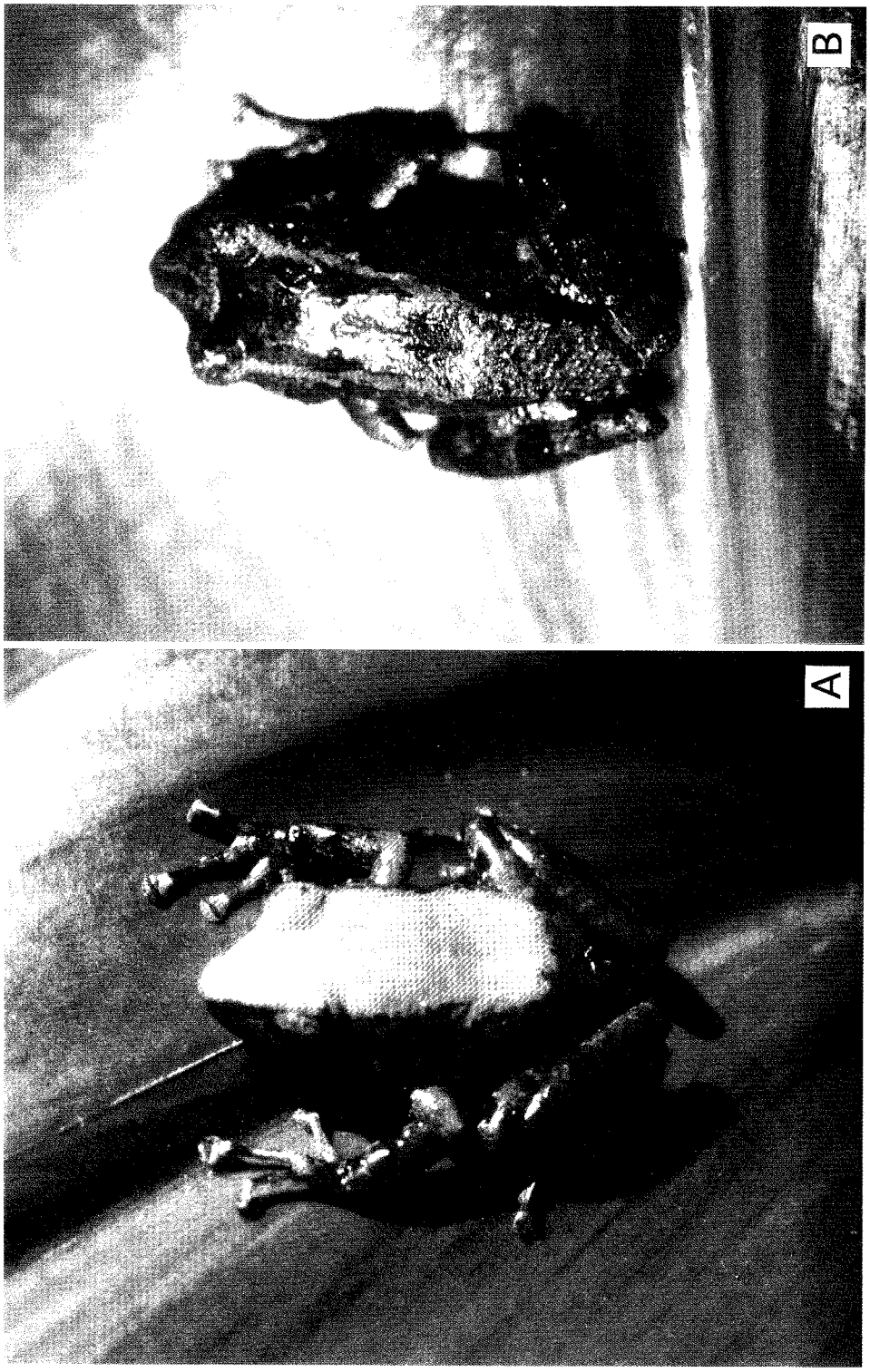


FIGURE 4. A. *Platymantis banahao* (CAS 201544) from Mt. Banahao, Luzon Island, B. *Platymantis luzonensis* (CAS 201539) from Mt. Banahao, Luzon Island.

banahao in the lighter pigmentation of the venter. It also differs from *negrosensis* and *banahao* in its advertisement call.

DESCRIPTION. — SVL 27.1–36.0 mm for 12 mature males and 35.1–45.3 mm for 8 females; HW 106–123% of HL and 39–45% of SVL; snout round-pointed; upper jaw moderately protruding and 30–35% of HW: ED 83–100% of SnL, 26–34% of HW, and 12–14% of SVL; tympanum exposed; TD 28–45% of ED and 4–6% of SVL; canthus rounded; lores moderately oblique, concave; fingers without webs, only slightly broader than deep throughout length proximal to disk; lateral, dermal flanges very narrow; first finger much shorter than second, reaching midway or slightly more between tubercle and disk of second finger; disks of fingers (except first) broadly dilated, truncate; 3FD 30–43% of 3FL, 116–193% of TD, and 6–8% of SVL; 3FL 17–22% of SVL; subarticular tubercles large, strongly protruding; one row of supernumary tubercles; inner metacarpal tubercle large, oval, prominent large; outer small, more round; hind limbs long, TiL 44–54% of SVL and HW 79–93% of TiL; toes webbed: to about distal edge of basal tubercle on inside of first and second toes, nearly halfway between tubercles on third, and halfway between to near basal edge of distal tubercle on fifth toe (Polillo specimens exhibit similar webbing); disks of toes smaller than those of finger 3ToD 33–49% of 3FD; subarticular tubercles prominent, usually slightly pointed; plantar area smooth; inner metatarsal tubercle elongate; outer small round; dorsum and upper lateral surfaces smooth with no distinct ridges and at most only a few vague tubercles; venter smooth; posterior thighs with some small, low granules. Polillo specimens exhibit more tubercles and short ridges on dorsum and upper lateral surfaces.

COLOR. — In preservative background color of dorsum tannish to pale brown with variable darker blotches; sometimes with pale dorsolateral streaks or a pale vertebral line; venter densely flecked with light brown under head and throat and scattered brown spots on belly.

In life dorsal ground color variable from rather uniformly tannish including the lateral surfaces or the lateral surfaces darker. Some specimens are more rusty brown or dark brown bordered by narrow or broad, pale dorsolateral lines on the dorsum. There is usually a very dark interorbital bar, and lips and limbs with alternating pale and dark transverse bands. Brown flecks on venter are mostly under head and throat.

REPRODUCTION. — Four clutches of eggs and embryos still in their capsules were collected at Mt. Banahao de Lucban from arboreal ferns and leaf axils of Pandanus at altitudes of 800–1,500 m on April 21 and September 17, 1996. These have been identified as *Platymantis* based on Alcala (1962), but the species identification is still unknown.

ADVERTISEMENT CALL. — The call of *luzonensis* sounds like "kwenk-kwenk-kwenk." Each note is in two parts. The first brief part is between 1,800 and 2,200 Khz; the second between 2,200 and 3,100 or 3,200 Khz. The duration of each note is about 0.1060 to 0.1156 seconds, and the time between notes ranges from 0.1437 to about 0.1563 seconds (see Fig. 1B and Table 4).

COMPARISONS. — *Platymantis luzonensis* differs from other species of the *guentheri* Group as indicated in the diagnoses and key.

ECOLOGICAL NOTE. — Twelve specimens from Mt. Maquiling were from various, arboreal sites (leaf axils of *Pandanus* and *Araceae*, leaves of shrubs and trees, tree trunks) 1–3 m above ground, in forest at 550–1200 m elevation. Six of the seven specimens from Mt. Banahao were found in sites 1–3 m above ground at elevations of 650–1,250 m in the upper lowland to montane forests on Mt. Banahao; 600–1,160 m on Mt. Maquiling.

RANGE. — Mt. Maquiling and Mt. Banahao, southern Luzon Island.

Platymantis banahao new species
(Fig. 5)

This species is known thus far only from forests on the upper slopes of the Mt. Banahao massif.

Holotype. — CAS 201208, an adult male, collected in original forest at 1100 m on the NE slope of Mt. Banahao at Lucban, Quezon Province, Luzon Island, by R. Quiver and R. Reso, April 20, 1996.

Paratypes. — CAS 201003–07, 201209–10, 201231, 201531–32, 201544 Mt. Banahao (same general locality as holotype); CAS 201015 Mt. San Cristobal, Quezon Province, Luzon Island.

Description of holotype. — An adult male (measurement in mm): SVL = 33.3, HL = 13.0, HW = 14.8, SnL = 4.8, ED = 3.9, TD = 2.0, TiL = 15.9, 3FL = 6.4, 3FD = 2.15; 3ToD = 1.1; dorsum free of tubercles or ridges; toe-webs reach basal tubercle except for fourth toe.

DIAGNOSIS. — *Platymantis banahao* differs from species of the *hazelae* and *dorsalis* Groups in those characters that diagnose these groups (see Introduction). It differs from other species of the *guentheri* Group in the following combination of characters: (1) webs of toes not reaching distal end of basal tubercle or beyond on any toe except fifth; (2) heavily pigmented venter; (3) smooth dorsum, except for *luzonensis*; (4) a distinctive advertisement call when compared with *negrosensis* and *luzonensis*.

DESCRIPTION. — SVL 27.8–39.4 mm for 11 males; HW 111–123% of HL and 40.44% of SVL; snout rounded; upper jaw only slightly protruding; SnL 36–44% of HL and 30–39% of HW; eye moderate, ED 73–92% of SnL, 26–30% of HW, and 10–14% of SVL; tympanum with thin skin; TD 44–54% of ED and 4–6% of SVL; canthus sharply rounded; lores moderately oblique, concave; fingers without webs; first finger much shorter than second reaching about midway between tubercle and disk of second; fingers (except first) with broad, truncate disks; proximal to disks not much broader than deep and with narrow dermal flanges; 3FD 29–44% of 3FL, 100–192% of TD, and 5–8% of SVL; 3FL 17–21% of SVL; subarticular tubercles moderately protruding, broadly oval; inner metacarpal tubercle moderate, oval; middle one large round and outer small, round; a row of moderate to prominent supernumary tubercles; hind limb moderately long, TiL 45–49% of SVL and HW 85–94% of TiL; toes with short webs: to tubercle on first and second toes, to proximal tubercle on third, not reaching proximal tubercle on fourth, and slightly beyond tubercle on fifth; disks of toes much smaller than those of fingers, 3ToD 41–60% of 3FD; subarticular tubercles like those of fingers; inner metatarsal tubercle elongate-oval; outer small round; plantar area smooth; dorsal surfaces smooth except for a tubercle posteriorly on the upper eyelid or occasionally a few scattered tubercles; upper lateral surfaces smooth or with a few, scattered, low tubercles; venter smooth; posterior thighs nearly smooth or with a few, vague tubercles.

COLOR. — In preservative background color light to dark chocolate brown, with a few darker spots and small blotches; usually a paler band between the anterior half of the eyes; sometimes paler snout and upper lateral surfaces; lips nearly uniformly dark or with a couple of distinct, dark bars; hind limbs with vague, dark, transverse bars; venter heavily flecked with brown, slightly more dense on head and throat.

In life the dorsal background color is nearly uniformly light tan to lemon yellow including the head as well as the body. Even an interorbital dark bar is absent. For a few specimens there are some dark flecks. The lateral surfaces for these specimens are chocolate brown. Other specimens are rusty chocolate on both dorsal and lateral surfaces. The venter is densely covered with brown flecks and spots.

REPRODUCTION. — See note under *Platymantis luzonensis*.

ADVERTISEMENT CALL. — The call of *banahao* sounds like "tuk-tuk-tuk-tuk," usually repeated rapidly 6–20 or more times like a machine gun. Each note is between 1,100 or 1,200 and 2,100 to 2,400 Khz. The duration of each note is 0.0593 to 0.1125 seconds (usually less than 0.1 second), and the time between notes ranges from 0.1219 to 0.3562 seconds (see Fig. 1A and Table 4).

ETYMOLOGY. — The name is that of the mountain massif to which it appears to be endemic.

COMPARISONS. — *Platymantis banahao* differs from other species of the *guentheri* Group as indicated in the diagnoses and key.

ECOLOGICAL NOTE. — One specimen was found on the forest floor and four in leaf axils of *Pandanus*. Field notes for the other six simply state arboreal. The sites are in original montane forest at elevations of 800 to 1400 m on Mt. Banahao at Lucban and Mt. San Cristobal in the Banahao massif.

RANGE. — Mt. Banahao massif, southern Luzon Island.

SUMMARY

Factors Limiting Sample Size

In this revision of the *Platymantis guentheri* Group, we recognize five species: *P. guentheri*, *P. rabori*. *P. negrosensis*, *P. luzonensis*, and *P. banahao*. In the introduction we noted the distri-

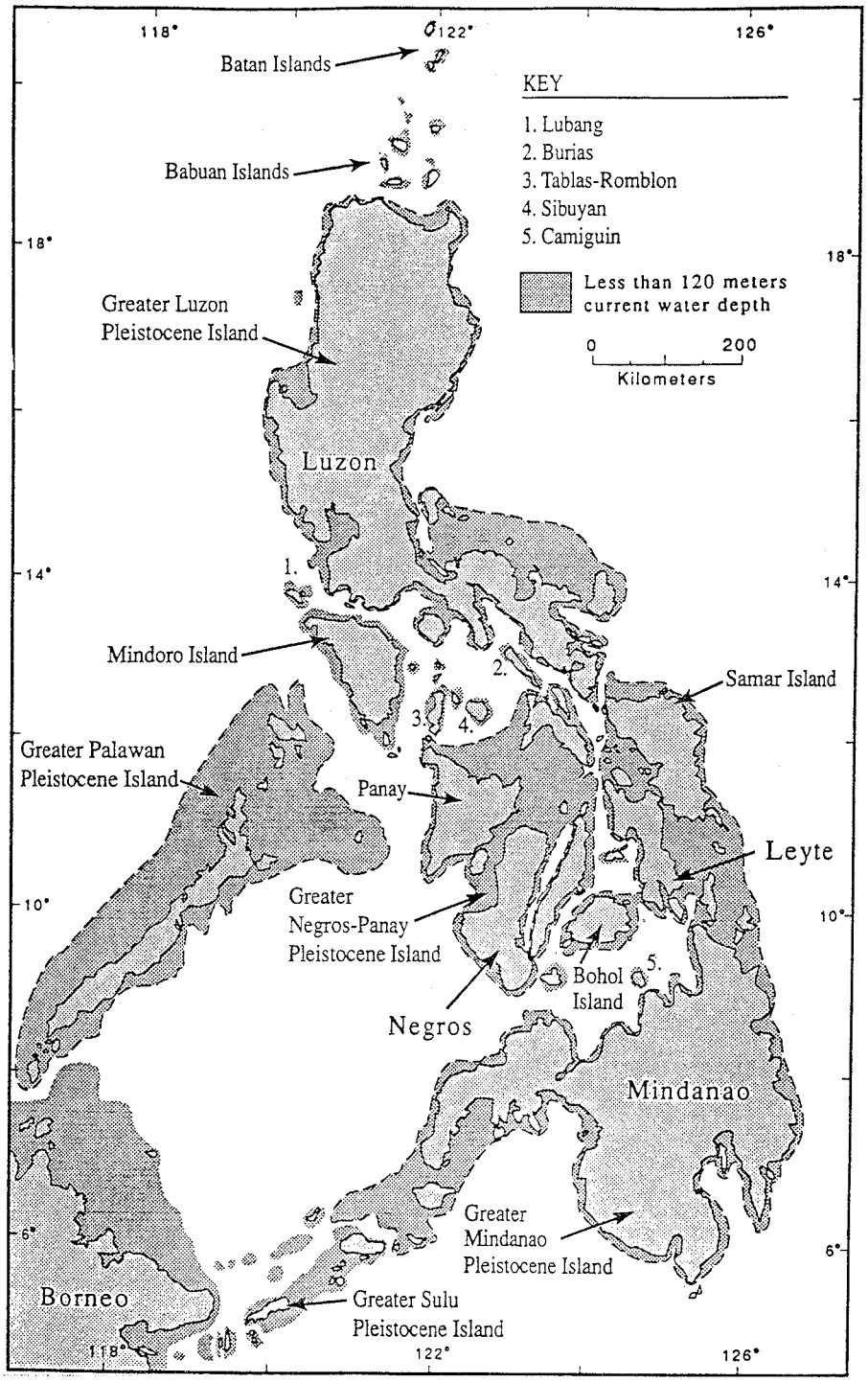


FIGURE 5. Map of the Philippines showing present islands (light stippled areas) and late Pleistocene islands (dark stippled areas).

bution patterns of the species, the reasons for the large samples from Bohol and Negros and relatively small samples from other localities, the recent reduction of suitable habitat for some populations, and the difficulties which limit further sampling in areas other than Cuernos de Negros (Negros Island) and Mt. Maquiling and Mt. Banahao (Luzon Island).

Factors Limiting Recording of Advertisement Calls

The advertisement calls reported here are the result of the recent aquisition of suitable recording equipment and the availability of bases at the University of the Philippines, Los Baños, Luzon Island and Silliman University, Negros Island. These bases made possible the numerous field trips necessary (1994–96) to secure suitable recordings of the voices of the species of *Platymantis* in those areas. We can continue this study in these localities when environmental conditions are suitable. The possibility of obtaining voice-recordings for the populations of *P. guentheri* and *P. rabori* on Bohol or northeastern Mindanao Islands are, however, subject to the same limitations as attempts to increase the size of the samples from those populations (see Introduction).

Voice Records of *Platymantis* on Mt. Maquiling and Mt. Banahao

Recent field work on Mt. Maquiling and Mt. Banahao has not only provided voice records reported here for *P. luzonensis* and *P. banahao*, but also records of the advertisement calls of other species of *Platymantis*. During some field trips, calls of three species (*P. dorsalis*, *P. mimulus*, and *P. luzonensis*) were heard and recorded on Mt. Maquiling and six species (*P. dorsalis*, *P. mimulus*, *P. banahao*, *P. luzonensis*, *P. montanus*, and *P.* undescribed [*dorsalis* Group]) on Mt. Banahao. Frequently all six species were calling at the same time.

The advertisement calls reported here for *P. luzonensis* and *P. banahao* are very different (to the human ear), as were the calls for *P. dorsalis* and *P. mimulus* reported earlier (Brown et al. 1997). The analysis of their voice records contributed to more complete diagnoses of *P. negrosensis*, *P. luzonensis*, and *P. banahao*. We hope that similar voice records can be obtained for *P. guentheri* and *P. rabori* when conditions permit. The voice of *P. luzonensis* sounds like "kwenk-kwenk-kwenk". The notes are repeated three to five or six times in one or two seconds, or the notes may be more isolated and widely spaced. The voice of *P. banahao* sounds like "tuk-tuk-tuk-tuk" repeated six to 20 or more times at a rate of four to five times a second. It can be described as the sound of a machine gun. The voice of *P. negrosensis* is more like that of *P. luzonensis* but differs in dominant frequency and other characteristics (see Fig. 1A–C and Table 4). Advertisement calls such as those recorded for *P. luzonensis* and *P. banahao* are generally accepted as probably the primary means of species identification (see Blackwell and Passmore 1991).

Voice Records of Other Species of *Platymantis*

The only other voice record for a Philippine population of *Platymantis* is that of *P. dorsalis* from Cuernos de Negros, Negros Island (Kuramoto 1997). Our voice record for this population of *P. dorsalis* differs in the lower kilohertz, closer to 3,000 than 4,000, and time intervals separating calls (or notes?). Our records have not yet been published.

Records of voices for several non-Philippine species were reported much earlier: that of *P. papuensis* from New Guinea (Zweifel 1969) and those of *P. schmidti*, *P. solomonis*, *P. magnus*, and *P. neckeri* from the Bismarcks and Solomons (Menzies 1982). These reports provide varying amounts of information in terms of sonograms, their analyses, and interpretations. Certainly establishment of uniform terminology as well as reanalysis of these published sonograms which would permit direct comparisons of both Philippine and non-Philippine species are desirable projects, but are not the purpose of this study.

DISCUSSION

The five species of the *P. guentheri* Group recognized at this time are based on large samples (over 100 specimens each for *P. guentheri*, *P. rabori*, and *P. negrosensis*) and smaller samples of 12–20 specimens for *P. banahao* and *P. luzonensis*. Differences in their advertisement calls were important clues to our diagnosing the latter two species. Other populations from isolated mountains such as Mt. Isarog on Luzon, or

islands such as Cataduanes, may be recognized as additional species of the *P. guentheri* Group when larger samples and audiosterograms of their advertisement calls become available.

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APPENDIX A
Specimens Examined

Platymantis guentheri. — Dinagat I., Philippines: BMNH 1947.2.31.34 (holotype), Esperanza: DMNH 151-153, Mt. Magkono: DMNH 135; Mindanao I., Davao Prov.: FMNH 50571, 50573; Zamboanga Prov., Dapitan Peak: CAS-SU 19987, 20121, 20125; Agusan del Norte Prov.: CM 3424-29, Mt. Hilong-hilong: CAS 133148-49, 133287, 133307, 133313, 133332-33, 133531, 133540, 133548, 133651-53, 133780-81, 186066-67, 186124-26, 196378-79; Biliran I.: FMNH 318381-83; Bohol I., Sierra Bullones area (within radius of 15 km): CAS-SU 21214 (holotype of *Cornufer ingeri*), CAS-SU 21196-210, 21212, 21216-17, 21219, 21709-16, 21719-20, 21724-32, 21734, 21736, 21740, 21745, 21747, 21749-55, 21757, MCZ 38097-98, FMNH 134985-86 (paratypes of *Cornufer ingeri*).

Platymantis rabori. — See list of holotype and paratypes for that species.

Platymantis negrosensis. — See list of holotype and paratypes for that species.

Platymantis luzonensis. — See list of holotype and paratypes for that species.

Platymantis banahao. — See list of holotype and paratypes for that species.

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