

## A COLLECTION OF AMPHIBIANS FROM WEST SUMATRA, WITH DESCRIPTION OF A NEW SPECIES OF *MEGOPHRYS* (AMPHIBIA: ANURA)

**Robert F. Inger**

*Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago IL 60605, USA*  
*Email: ringer@fieldmuseum.org*

**Djoko T. Iskandar**

*Institute of Technology, Bandung, Jl. Ganesha 10, Bandung 40132, Java, Indonesia*  
*Email: iskandar@bi.itb.ac.id*

**ABSTRACT.** – Sumatra's amphibian fauna is less well-known than that of any adjacent land mass. A recent collection of amphibians from West Sumatra expands our knowledge of the fauna of that region. The collection includes a new species, described below as *Megophrys parallela*, the second records of *Rana crassiovis* Boulenger and *Rhacophorus catamitus* Harvey, Pemberton & Smith, and two forms agreeing with the general description of *Rana chalconota* (Schlegel).

**KEY WORDS.** – West Sumatra, Anura, *Megophrys*, *Huia*, *Rana*, *Rhacophorus*.

---

### INTRODUCTION

The fauna of Sumatra is the least studied portion of the amphibian fauna of the Greater Sunda Islands (Inger & Voris, 2001). The most recent tabulation of the frogs of Sumatra lists 90 species (Iskandar & Setyanto, 1996). This number is smaller than the known anuran fauna of Borneo (148), with a much larger land area, and that of the Malay Peninsula (101) (Inger & Voris, 2001, list 97; plus 4 described since 2001), with a smaller land area. It is difficult at present to evaluate the relative size of the Sumatran anuran fauna for two reasons. Herpetological collecting in Sumatra within the last 50-60 years has been sporadic and infrequent. Both the Malay Peninsula and Borneo have experienced more thorough herpetological exploration than Sumatra during the previous 100-150 years. Furthermore, the known geologic history of Sumatra, with frequent, widespread volcanism (Verstappen, 1973) and subsidence of large portions of the island during the Tertiary (Hall, 1998), make it likely that its amphibian fauna has been subject to regional extinctions and, as a result, may be smaller and less spatially homogeneous than that of other areas within the Malaysian/Sundan region (Inger & Voris, 2001). We present the results of a recent sampling expedition to the Padang region of West Sumatra as a contribution to our understanding of the fauna of this poorly studied land mass.

### MATERIAL AND METHODS

This collection was made between July 2 and September 10, 2001 by Djong Hon-Tjong and David Gusman in West Sumatra near Padang at several localities that form a narrow triangular region with sides of 48, 46, and 15 km and apices at Padang, Payakumbuh, northeast of Padang, and Lubuk Selasih, southeast of Padang. The entire region is hilly, with elevations at collecting sites varying from 255 to 1390 m ASL. The localities are in three clusters: (1) 0°27'-0°28'S/100°27'-100°28'E, elevations 255-405 m ASL. This cluster includes the Research and Education Forest of Andalas University. Three of four actual sampling sites were along small, clear streams having beds of boulders and gravel lying within disturbed primary forest. The fourth site was along a clear stream flowing through a cleared area. (2) 0°04'-0°06'S/100°39'-100°40'E, elevations 523-566 m ASL, in and around Harau Nature Reserve, Payakumbuh. Three of the sampling sites lie on small tributaries of the Batang Harau and one on the river itself. The river is clear and has a bed of gravel with scattered boulders, whereas at least one of the tributaries had a bed of coarse sand and silt. Although the river flows through a protected forest, the forest cover is not continuous and varies in width from 50 to 200 m. The under storey of the forest is disturbed. (3) 0°59'-1°00'S/100°37'-100°38'E, elevations 1166-1390 m ASL, around Lubuk Selasih in Solok District. The sampling sites are on three streams, Batang Andaleh and Batang Sarasah which are tributaries of the third, Batang Tarusan. Batang Andaleh and Batang Sarasah flow through secondary forest, tea plantations, and vegetable and rice cultivation.

Table 1. List of species and distribution in altitudinal zones of collection from Padang area of West Sumatra.

Species	Elevation (m)		
	255-405	523-566	1166-1320
	Number of individuals		
<i>Megophrys parallela</i>			6
<i>Bufo asper</i>	72	71	77
<i>Bufo melanostictus</i>	2	10	
<i>Leptophryne borbonica</i>		9	
<i>Microhyla heymonsi</i>		12	
<i>Phrynella pulchra</i>	1		
<i>Fejervarya cancrivora</i>		11	
<i>Fejervarya limnocharis</i>	5	64	11
<i>Huia sumatrana</i>	145	1	1
<i>Limnonectes blythii</i>		12	
<i>Limnonectes kuhlii</i>	107	35	108
<i>Limnonectes shompenorum</i>	3		
<i>Limnonectes</i> sp. 1 <sup>a</sup>			23
<i>Limnonectes</i> sp. 2 <sup>b</sup>	68	72	5
<i>Limnonectes</i> sp. 3 <sup>c</sup>	21		2
<i>Rana</i> cf. <i>chalconota</i>	17		
<i>Rana chalconota</i>	27	117	
<i>Rana crassiovis</i>			226
<i>Rana erythraea</i>		21	
<i>Rana glandulosa</i>		5	
<i>Rana hosii</i>	138	19	18
<i>Rana nicobariensis</i>	2	21	2
<i>Rana picturata</i>	31	10	
<i>Nyctixalus pictus</i>	2		
<i>Polypedates leucomystax</i>	2	29	4
<i>Polypedates macrotis</i>		11	
<i>Rhacophorus poecilonotus</i>			1
<i>Rhacophorus catamitus</i>			21

<sup>a, c</sup> These forms are conspecific with new species being described by one of us (Iskandar, in ms).

<sup>b</sup> This form is conspecific with a species being described by us in a separate manuscript discussing the *Limnonectes blythii* group

Specimens were preserved in the field in formalin and transferred to 70% ethanol after one to six weeks. They are now deposited in Field Museum of Natural History (FMNH) and Museum Zoologicum Bogoriense (MZB). We also examined comparative material from the Bernice P. Bishop Museum (BPBM), United States National Museum (USNM), and the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore.

The following measurements were made by use of dial calipers graduated in 0.05 mm: Snoutvent length (SVL); tibia length (T), made with the limb flexed; head width (HW), measured at the level of the jaw articulation; head length (HL), measured from the rear of the jaw to the tip of the snout; horizontal diameter of the tympanum (TYM), and, in some instances, horizontal diameter of the eye (Eye).

## RESULTS

The species included in this sampling and the altitudinal distribution of their individuals are shown in Table 1.

## TAXONOMIC ACCOUNTS

### *Megophrys parallela*, new species (Figs. 1, 2)

**Material examined.** – Holotype, MZB (field number D33), adult male from Batang Sarasah, Lubuk Selasih, near Solok, West Sumatra (0°59'S/100°38'E, 1289 m ASL), coll. Djong Hon-Tjong & David Gusman, 2-9 Sep.2001.

Paratypes – MZB (field numbers D48, K95), FMNH 264511-13, all males, same data as holotype.

**Diagnosis.** – A small *Megophrys*, males less than 50 mm SVL; tympanum visible as a half circle; vomerine teeth present; a single dorsolateral fold, parallel to contralateral fold throughout its length, the folds not diverging anteriorly; no V-shaped fold from behind the eye to the shoulder (the parietoscapular fold).

**Description.** – A small-sized species of *Megophrys*, known males 40-48 mm SVL; habitus stocky, robust, head wider than trunk; snout short, pointed at tip, projecting beyond lower jaw; no dermal rostral projection; canthus rostralis sharp, angular, slightly constricted; lores slightly sloping, concave; nostril about equidistant between eye and tip of snout;

diameter of eye subequal to length of snout; upper eyelid with short, narrow-based projection; eyelid with several low, conical tubercles; width of upper eyelid less than width of interorbital; tympanum small, posterior half obscured by skin; vomerine teeth present in short ridges between and slightly behind choanae; tongue notched at rear, no papilla.

Tips of digits rounded, not enlarged; first finger slightly longer than or equal to length of second; fourth subequal to second, third longest; subarticular tubercles of fingers indistinct; large palmar tubercle extending out from base of first finger. Hind limbs moderate, tibia less than 0.5 of SVL; toes with webbing at bases only, no fringes extending out towards tips; toe lengths  $4 > 3 > 5 > 2 > 1$ ; subarticular tubercles indistinct; inner metatarsal tubercle low, oval, as long as or longer than first toe; no outer metatarsal tubercle.

Dorsal skin smooth anteriorly, with low tubercles and short ridges posteriorly; a sharply angular supratympanic fold; a single dorsolateral fold parallel to contralateral fold, folds not diverging anteriorly and not reaching supratympanic fold; no V-shaped parietoscapular fold over rear of head and shoulders; sides with rounded tubercles; calf with narrow raised, transverse ridges; ventral surfaces granular.

Color in preservative dark gray or brown dorsally; a dark triangular interorbital marking, apex to rear; laterally tip of snout dark brown, a dark bar below eye; sides of trunk unmarked; chin, throat and chest dark brown; abdomen cream colored with varying amounts of brown mottling; forearm with dark crossbars; calf with narrow dark crossbars.

Males have velvety, dark brown nuptial pads on the first and second fingers on the dorsomedial surface from the base of the fingers to the beginning of the terminal joint.

Measurements (mm) of holotype: SVL 47.6, T 21.5, HW 22.8, HL 19.4, eye diameter 6.8, snout 6.7. Measurements and body proportions of type series given in Table 2

**Etymology.** – Specific name from *parallelus* (Latin) meaning parallel, referring to the condition of the longitudinal skin folds.

**Habitat notes.** – One frog was caught in primary forest, the remainder in secondary forest. All were found between 1289 and 1320 m ASL. Two were on dead leaves and one on a small log on the banks of a small (width 5 m) stream. We have no information on the perch position of the other three.

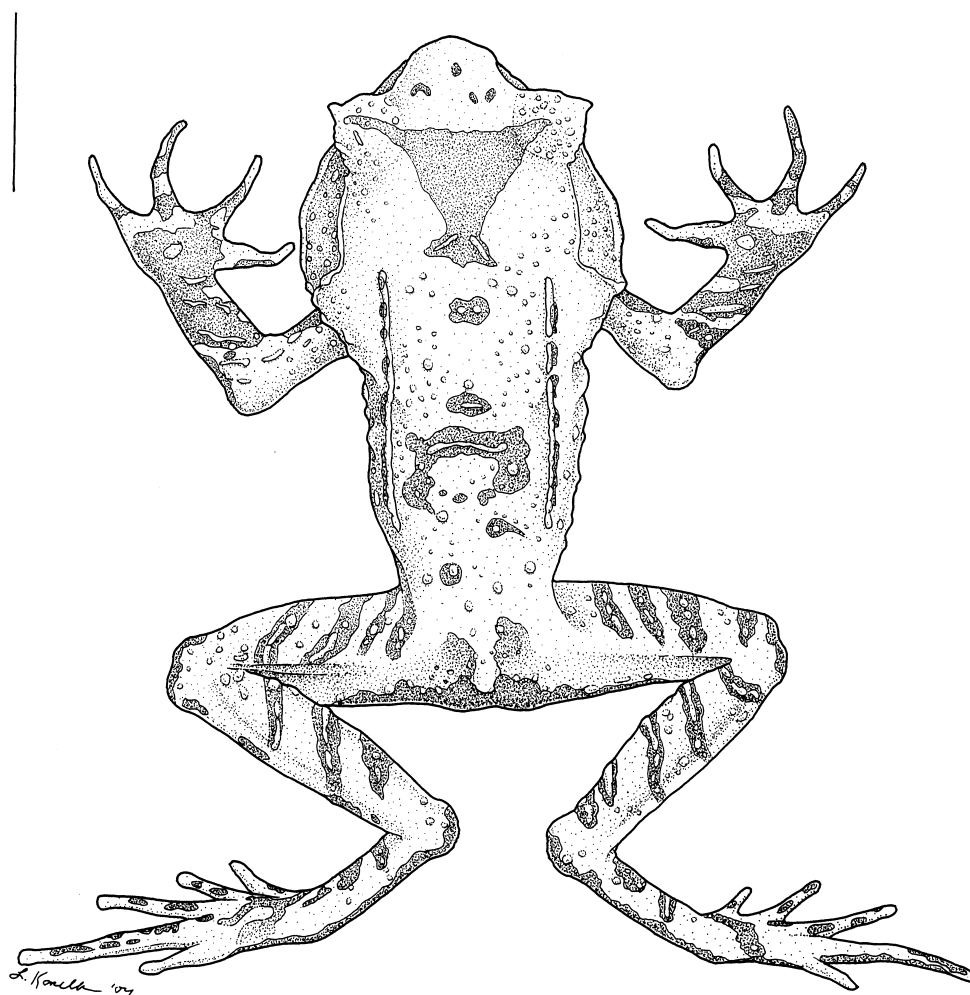


Fig. 1. Dorsal view of *Megophrys parallela*, new species (Paratype: FMNH 264512). Scale bar = 10 mm.

Table 2. Variation in size and body proportions of males in small species of *Megophrys*. Males of all species <65 mm SVL. All species occur in Indochina, Thailand, or Sundaland.

	N	SVL		T/SVL		HW/SVL		HL/SVL		TY/SVL	
		Range	Mean±SE	Range	Median	Range	Median	Range	Median	Range	Median
<i>parallela</i>	6	39.4-47.6	43.8±1.33	0.41-0.47	0.446	0.46-0.50	0.480	0.41-0.44	0.414	0.051-0.061	0.058
<i>aceras</i>	6	55.8-62.4	59.6±1.16	0.42-0.46	0.437	0.37-0.40	0.390	0.34-0.37	0.350	0.056-0.075	0.064
<i>dringi</i>	7	42.8-46.7	44.9±0.55	0.49-0.55	0.521	0.34-0.37	0.356				
<i>edwardinae</i>	4	38.8-42.0	40.7±0.69	0.45-0.50	0.488	0.41-0.48	0.452	0.39-0.43	0.390	0.036-0.057	0.048
<i>parva</i>	9	36.5-46.5	43.0±1.25	0.48-0.53	0.518	0.33-0.40	0.364	0.34-0.42	0.377	0.054-0.079	0.072
<i>longipes</i>	2	38.9-45.2	42.5	0.55-0.60		0.33-0.37		0.37		0.070	
<i>minor</i>	2	37.3-38.2	37.8	0.49-0.51		0.31-0.32		0.32-0.34		0.072-0.076	
<i>montana</i>	3	38.9-40.6	39.6±0.50	0.43-0.44	0.439	0.44-0.49	0.477	0.43-0.46	0.437		
<i>palpebral- espinosa</i>	3	38.4-40.8	39.8±0.73	0.44-0.48	0.462	0.33-0.34	0.333	0.30-0.33	0.317	0.043-0.065	0.052

**Comparisons.** – This Sumatran species appears to be most similar to *M. aceras* Boulenger, but is distinctly smaller than mainland *M. aceras* (Table 2). In *M. aceras* the dorsolateral folds diverge sharply anteriorly and usually reach the supratympanic folds, the pattern illustrated by Boulenger (1903); in *M. parallela* these folds do not diverge anteriorly and do not reach the supratympanic folds. The illustration of the type of *M. aceras* also shows a V-shaped ridge from the parietal region ending at the shoulders; this character is present in all the *M. aceras* we have seen, but is absent in *M. parallela*. The head of the Sumatran form is wider and longer and the tympanum smaller (Mann-Whitney test,  $P < 0.01$ ) than in *M. aceras* (Table 2).

Among the other small (males <65 mm) species of *Megophrys* from Indochina through Sundaland, *M. longipes* Boulenger and *M. parva* (Boulenger) differ from *M. parallela* in having

longer legs and smaller heads (Table 2), in having the dorsolateral folds diverging anteriorly, and in having distinct parietoscapular folds (Table 3). *Megophrys minor* Stejneger also differs from *M. parallela* in having a distinct parietoscapular fold and a smaller head and lacks vomerine teeth (Tables 2, 3). *Megophrys palpebralespinosa* Bourret differs from *parallela* in lacking vomerine teeth and in the orientation of the body folds (Table 3) and its smaller head (Table 2). *Megophrys dringi* Inger, Stuebing & Tan differs from *M. parallela* in lacking vomerine teeth and in having a distinct parietoscapular fold, relatively longer legs and narrower head (Table 2). *Megophrys edwardinae* Inger differs from *M. parallela* in lacking vomerine teeth, in having much rougher skin with scattered short ridges and prominent tubercles dorsally, and the snout distinctly shorter than the eye diameter. *Megophrys baluensis* (Boulenger) differs from *M. parallela* in having two longitudinal folds on the trunk,

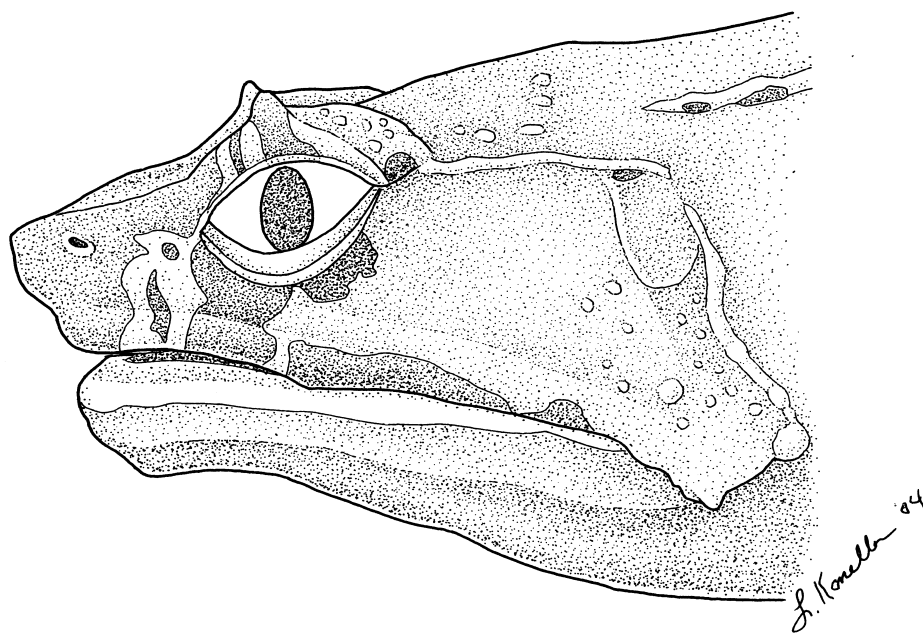


Fig. 2. Lateral view of head of *Megophrys parallela*, new species (Paratype FMNH 264512). Scale bar = 5 mm.

Table 3. Variation among small species of *Megophrys*. Males of all species less than 65 mm SVL.

Species	Parietoscapular ridge <sup>1</sup>		DL folds diverge <sup>2</sup>		Palpebral horn		Vomerine teeth	
	present	absent	yes	no	present	absent	present	absent
<i>parallela</i>	0	6	0	6	6	0	6	0
<i>aceras</i>	11	0	10	0	11	0	11	0
<i>dringi</i>	7	0	7	0	7	0	0	7
<i>edwardinae</i>	2	2	0	4 <sup>3</sup>	4	0	0	4
<i>longipes</i>	3	0	3	0	5	0	3	0
<i>parva</i>	7	0	7	0	4	11	15	0
<i>minor</i>	4	0	2	2 <sup>3</sup>	1	3	0	4
<i>palpebralespinosa</i>	2	2	4	0	3	0	0	3
<i>montana</i>	0	4			4	0	4	0

<sup>1</sup>V-shaped ridge, apex at rear, beginning at parietal or rear of supraocular region and ending over shoulders.

<sup>2</sup>Longitudinal dorsolateral body folds diverge anteriorly.

<sup>3</sup>No longitudinal body folds present.

the snout not projecting beyond the mandible, and related to the last, a shorter head.

In other species of *Megophrys* from Southeast Asia, males usually exceed 65 mm SVL and differ from the Sumatran form in other ways, e.g., presence of a rostral projection [*M. nasuta* (Schlegel)], broad-based palpebral projection (*M. nasuta*, *M. kobayashii* Malkmus & Matsui), a dark stripe on side of head (*M. lateralis* Anderson), toes with dermal fringes and no vomerine teeth (*M. auralensis* Ohler, Swan & Daltry).

**Comparative material.** – *Megophrys aceras*: Peninsular Malaysia: ZRC 1.6052 (Perlis State); FMNH 185897-98 (Selangor State). Thailand: FMNH 135344 (Nakhon Si Thammarat Prov.), FMNH 216092-95, USNM 94795-96 (Trang Prov.). *Megophrys boettgeri*: China: FMNH 24397, 24399, 24400, 24402 (Fujian Prov.). *Megophrys brachykolos*: Hong Kong: FMNH 69064-65, 109979, 109981, 256939-40. *Megophrys longipes*: Peninsular Malaysia: FMNH 185899 (Selangor State), BPBM 17248, FMNH 216240, ZRC 1.3460a, 1.8377 (Pahang State). *Megophrys montana*: Java: ZRC 1.6411, 1.6414, 1.6422, 1.6425 (West Java, Sukabumi). *Megophrys minor*: China: FMNH 49523, 167973 (Sichuan Prov.). *Megophrys omeimontis*: China: FMNH 232870, 232874-75, 232877 (Sichuan Prov.). *Megophrys palpebralespinosa*: Laos: FMNH 258098-258100 (Phongsaly Prov.). Vietnam: FMNH 254036 (Vinh Phy Prov.). *Megophrys parva*: Laos: FMNH 255543 (Huaphahn Prov.). Thailand: FMNH 175915-16, 175918-20 (Chiang Mai Prov.); FMNH 216096 (Surathani Prov.); ZRC 1.8489-92 (Phuket Prov.).

### *Huia sumatrana* Yang

This series agrees very closely with the holotype (FMNH 209922) and adult paratype (FMNH 209912). The fully webbed toes, the extreme sexual dimorphism in size (see Table 4), and the distinctive, dark, diagonal markings in the temporal region noted in the original description (Yang, 1991) are particularly diagnostic. The original description has

confused the sexual dimorphism in tympanum diameter. At one point the description attributes a smaller tympanum in males: "...disk of third finger 0.61 times the tympanum, 0.44-0.53 in females," then ascribes a larger tympanum to males: "...tympanum 0.53 eye diameter in females, 0.62-0.74 in males" (Yang, 1991). The tympanum of males is visibly larger than that of females (see also Table 4). Males have slightly longer heads (HL/SVL; Mann-Whitney test  $U=23$ ,  $P<0.002$ ). SVL and body proportions are given in Table 4. All the females measured had enlarged, non-pigmented ova.

Coloration (in preservative) is medium to dark brown above. The throat varies from immaculate whitish to heavily marked with irregular brown spots, some of which often appear also on the chest. The diagonal dark bars in front of and behind the tympanum are consistent features of the pattern. The bar behind the tympanum is continued forward above the tympanum to the rear of the eye. The bar at the shoulder mentioned by Yang (1991) is sometimes marked only by a row of small spots. The weak dorsolateral fold is usually marked by several small black spots.

The white velvety nuptial pad of males covers the medial surface of the first metacarpal and the medial and dorsal surfaces of the basal phalanx of the first finger. The distal edge of the pad is opposite the center of the subarticular tubercle of the first finger. The nuptial pad is usually constricted and in a small percentage of males the constriction divides the pad into two parts.

This species differs from the recently described *Amolops (Huia) modiglianii*, as noted by Doria et al. (1999), in having more extensive webbing, in the presence of an outer metatarsal tubercle, and in having the first finger longer than the second.

All but two of this large series were collected along clear, rocky streams flowing through forests at 255-405 m ASL near Padang. One frog was obtained from the rocky stream flowing through the Harau Valley (536-566 m), and one from the Batang Tarusan (1166-1170 m), near Lubuk Selasih.

Table 4. Size and body proportions of *Huia sumatrana* Yang.

	Males	Females
<b>SVL (mm)</b>		
Range	30.8-34.4	56.8-65.4
Mean±SE	32.34±0.29	61.60±0.68
N	15	15
<b>T/SVL</b>		
Range	0.67-0.74	0.68-0.74
Median	0.721	0.711
N	15	15
<b>HW/SVL</b>		
Range	0.30-0.38	0.31-0.35
Median	0.334	0.327
N	15	15
<b>HL/SVL</b>		
Range	0.39-0.43	0.36-0.41
Median	0.402	0.382
N	15	15
<b>TY/SVL</b>		
Range	0.110-0.132	0.065-0.079
Median	0.125	0.071
N	10	10

### *Limnonectes shompenorum* Das

Male 83.9 mm SVL, with enlarged odontoids; female 87.5 mm, with enlarged, pigmented ova. These frogs agree closely with the original description (Das, 1996). The webbing is very slightly more extensive than figured by Das (1996) and the throat lacks dark pigment noted in the original description.

### *Rana chalconota* (Schlegel)

Males with nuptial pads, SVL 28.1-38.1 mm (Table 5); mature females, SVL 37.8-43.2 mm (Table 5); juveniles, SVL 23.5-28.6 mm (n=7). Round dark spots on back (except in two); heavy dusting of melanophores on the ventral surface of the legs; throat whitish, with dark mottling. The webbing is blackish. Vomerine teeth in patches equidistant from each other and the choanae. Toes three and five fully webbed to base of discs, toe four fully webbed to distal subarticular tubercle; outer metatarsal tubercle elevated. Males with velvety, whitish nuptial pads on the first finger; vocal sac openings at the corners of the floor of the mouth; whitish spinules on the granules of the dorsum. A weak humeral gland present in 10/16 males. Males have a larger tympanum than females (Table 5).

We have compared these to a sample from Bohorok, North Sumatra. The two samples are similar in most characters, including the color of the webbing, in the presence of a weak humeral gland in the males, and in body proportions (Table 5). However, they differ in size (Table 5).

Geographic variation in this species is known to involve secondary sex characters of males. Males from Peninsular Malaysia and Borneo usually have the nuptial pad constricted,

but those from Java do not (Inger, 1966). The nuptial pads in males from the Padang-Payakumbuh-Lubuk Serasih area are not constricted, though they are in about half of those from Bohorok. The spinules of the dorsum appear on the upper eyelids of Bornean males but only in a portion of those from Java (Inger, 1966). All but one of the males from Sumatra have spinules on the upper eyelid. Males in the present sample from Sumatra are about the same size as those from Java (30-40 mm; Iskandar, 1998), but the females are much smaller than those from Java (45-65 mm; Iskandar, 1998), which is the type locality of the species.

### *Rana cf. chalconota*

Seven adult males, SVL 43.6-49.0 mm (Table 5); seven adult females, SVL 46.3-65.6 mm (Table 5); three immature females, SVL 34.8-41.1 mm. All except two with strong reddish tinge to webbing (in preservative). All but four with dark dorsal spots. Ventral surface of legs with heavy dusting of melanophores; throat whitish, immaculate or with faint mottling. Vomerine teeth present. Toe four with full webbing to distal edge of distal subarticular tubercle, toes three and five with full webbing to base of discs. Males with velvety, whitish nuptial pad on first finger, not constricted; vocal sac openings on floor of mouth; spinules on granules of dorsum; no humeral glands. Males have larger tympanum (Table 5). Females approximate the size of those from Java (see above).

These frogs are very similar to those we have identified above as *R. chalconota*. However, they differ greatly in size, in smaller relative tympanum diameter in males, in relative head length (Table 5), in absence of humeral glands in the males, and in the reddish webbing.

Table 5. Comparison of size and body proportions of *Rana chalconota* and *R. cf. chalconota* from areas of Sumatra. "Padang" = Padang-Payakumbuh-Lubuk Selasih area. "Bohorok" = Bohorok, North Sumatra. See text for definition of taxa.

Taxa Area	<i>cf. chalconota</i> Padang	<i>chalconota</i> Padang	<i>chalconota</i> Bohorok	<i>cf. chalconota</i> Padang	<i>chalconota</i> Padang	<i>chalconota</i> Bohorok
		SVL males			SVL females	
Range	43.6-49.0	28.1-38.1	32.4-39.6	46.3-65.6	37.8-43.2	44.5-51.9
Mean±SE	45.73±0.65	31.63±0.30	35.80±0.65	57.60±3.07	40.52±0.56	47.75±0.93
N	7	43	10	7	9	8
		T/SVL males			T/SVL females	
Range	0.53-0.59	0.52-0.61	0.54-0.59	0.52-0.58	0.53-0.58	0.56-0.60
Median	0.552	0.564	0.572	0.555	0.572	0.583
N	7	15	10	7	9	8
		HW/SVL males			HW/SVL females	
Range	0.28-0.31	0.27-0.33	0.28-0.31	0.28-0.30	0.27-0.31	0.28-0.31
Median	0.294	0.296	0.298	0.291	0.292	0.299
N	7	15	10	7	9	8
		HL/SVL males			HL/SVL females	
Range	0.35-0.39	0.38-0.45	0.38-0.41	0.34-0.39	0.34-0.41	0.38-0.41
Median	0.361	0.398	0.397	0.366	0.379	0.388
N	7	15	10	7	9	8
		TYM/SVL males			TYM/SVL females	
Range	0.10-0.12	0.10-0.13	0.10-0.12	0.07-0.08	0.08-0.10	0.07-0.09
Median	0.103	0.115	0.114	0.073	0.085	0.082
N	7	15	10	7	9	8

Statistically significant differences between samples; P values of test results; Student's t-test for SVL, Mann-Whitney U test for body proportions:

	SVL male	SVL female	HL/SVL male	TYM/SVL male	HL/SVL female
<i>cf. chalconota</i> X <i>chalconota</i> Padang	<0.01	<0.01	<0.01	0.02	
<i>cf. chalconota</i> X <i>chalconota</i> Bohorok	<0.01	<0.01	<0.01	0.02	<0.01
<i>chalconota</i> Padang X <i>chalconota</i> Bohorok	<0.01	<0.01			

All 17 frogs were caught between 255 and 405 m ASL along clear, rocky streams in the disturbed forests controlled by Andalas University, Padang. Five of the *Rana chalconota* were collected at the same times and places as seven of the *R. cf. chalconota*.

### *Rana crassiovis* Boulenger

Seventy two males, 13 females. As this represents the first sample of this species reported since the original description (Boulenger, 1920b), we provide a full description:

**Description.** – Habitus moderately slender, head length slightly greater than head width; SVL of males with nuptial pads 29-35 mm, females with mature oviducts 58-70 mm (see Table 6). Snout obtusely pointed, weakly projecting; nostril slightly closer to tip of snout than to eye; canthi sharp, constricted behind nostrils; lores oblique, deeply concave; diameter of eye usually greater than length of snout; interorbital about equal to width of upper eyelid; tympanum distinct, 0.5-0.7 of eye diameter; vomerine teeth in oblique groups between the choanae.

Finger discs large, with circummarginal grooves, width of disc of third finger  $1/2$  to  $3/4$  diameter of tympanum; first finger equal to or slightly longer than second, third finger the longest;

second and third fingers with narrow, movable flaps of skin on outer phalanges; subarticular tubercles distinct. Discs of toes smaller than those of fingers; fourth toe longest, fifth extending slightly farther than third; toes 1-3 and 5 fully webbed to base of discs, fourth toe with one phalange free; an oval inner but no outer metatarsal tubercle; no tarsal fold.

No dorsolateral fold; skin above finely granular; usually with large, rounded tubercles scattered over back, not evident in rare individuals; sides coarsely granular; venter smooth except rugose or granular posteriorly.

Color in preservative brown with many large black or dark brown spots, the lighter areas forming an irregular network; sides becoming lighter ventrad, many large dark spots; venter whitish, throat and chest with brown speckling, or mottling, very dark in about half of individuals; abdomen with speckling or mottling but lighter than throat; legs with heavy cross bars dorsally; ventrally legs dusted with dark pigment; rear of thigh with dark vertical bars and spots separated by narrow whitish areas.

Body proportions shown in Table 6.

**Secondary sex characters.** – Females are much larger than males and have smaller tympana (Table 6). Gravid females have non-pigmented ova. Males have grayish, velvety nuptial

Table 6. Snoutvent length and body proportions of *Rana crassiovis* Boulenger.

	Range	M a l e s		N	F e m a l e s		
		Median <sup>2</sup>			Median	N	
SVL <sup>1</sup>	29.6-35.6	32.76±0.29		27	58.5-70.3	63.43±1.12	13
T/SVL	0.58-0.66	0.625		11	0.58-0.67	0.645	13
HW/SVL	0.30-0.37	0.323		11	0.32-0.37	0.340	13
HW/HL	0.70-0.90	0.812		11	0.84-0.93	0.905	13
Tym/SVL	0.100-0.108	0.103		11	0.063-0.073	0.070	13
E/Sn	0.87-1.33	1.124		11	0.79-1.11	1.071	6

<sup>1</sup>SVL = snoutvent length; T = tibia length; HW = head width; HL = head length; Tym = tympanum diameter; E = eye diameter; Sn = length of snout.

<sup>2</sup>Mean±SE for SVL.

pads on the dorsomedial surface of the inner finger and paired subgular vocal sacs with openings near the rear lateral corners of the floor of the mouth. Males lack gular pouches and humeral glands.

**Comparisons.** – This sample matches the original description (Boulenger, 1920a) in almost every detail of form and coloration. Boulenger said head length equalled head width; in the present series head length was slightly but consistently greater than head width. The types were smooth or finely granulate dorsally, but in the present series large tubercles are present dorsally save in three individuals. This sample was obtained approximately 140 km north of the type locality of *R. crassiovis*, which was given by Boulenger (1920a) as “Barong Bharu ... West Sumatra 2°8’S”, within the same mountain range of western Sumatra.

Boulenger (1920b) provided a new name, *Rana kampeni*, for *R. pantherina* (non Fitzinger) van Kampen (1910), type locality Bandar Bahru, Sumatra (3° 16’N), about 550 km north of the type locality of *R. crassiovis*. The descriptions of these nominate species presented by Boulenger (1920b) are very similar and Boulenger noted only the following differences: *R. kampeni* with a larger tympanum, a narrower interorbital relative to the upper eyelid, the first finger shorter than the second, and the belly granulate. As the type of *R. kampeni* is probably a male, judging by its size, 36.5 mm (van Kampen, 1910), and the types of *R. crassiovis* females (Boulenger, 1920a), the presumed difference between taxa in size of tympanum is merely a matter of sex dimorphism (Table 6). The relative length of the first finger varies slightly in the present series from slightly shorter to slightly longer than the second. In our sample the belly is smooth except posteriorly where it is granulate. Van Kampen (1910) said the skin of *R. pantherina* (*kampeni* Boulenger) was smooth, but later van Kampen (1923) said the skin was “smooth, or finely granulate, or with a few tubercles on the back.” Most of the specimens in our sample have large, rounded tubercles on the back. We conclude that *R. kampeni* Boulenger and *R. crassiovis* may be conspecific and that clear separation of these taxa requires examination of additional specimens from northern Sumatra. We apply the name *R. crassiovis* to this sample because of proximity to the type locality.

The other species similar to *R. crassiovis* in many ways is *R.*

*hosii* Boulenger. Both have moderately slender habitus, enlarged discs on the fingers having circummarginal grooves, fully webbed toes, no outer metatarsal tubercle, males without humeral glands or gular pouches, and large non-pigmented ova. In life, these *R. crassiovis* had a strong, unpleasant odor just as does *R. hosii*. They differ, however, in the following ways: *R. hosii* has a weak, though distinct dorsolateral fold, *R. crassiovis* has none; *R. hosii* has granular dorsal skin but no dorsal tubercles, most *R. crassiovis* have conspicuous, round tubercles scattered over the back; *R. hosii* is larger [males 42-66, females 86-98 mm (Inger, 1966)], than *R. crassiovis* (males 29-35, females 58-70 mm).

Three species of *Rana* recorded from Sumatra differ from *R. crassiovis* in having dorsolateral folds, in having an outer metatarsal tubercle, toes 3 and 5 not webbed to base of discs, and males with a humeral gland: *R. baramica*, *R. nicobariensis*, and *R. persimilis*. Other species recorded from Sumatra differing from *R. crassiovis* in having an outer metatarsal tubercle and males with humeral glands include *R. chalconota*, *R. erythraea*, *R. glandulosa*, *R. luctuosa*, *R. nigrovittata*, *R. picturata*, and *R. siberu*. *Rana debussyi* van Kampen, known only from the type specimen collected at Bandar Baru, central Sumatra, differs markedly from *R. crassiovis* in having reduced webbing (only as far as the distal subarticular tubercle of the third and fifth toes) and in having a light stripe extending from the lip to the rear of the body (van Kampen, 1910). In lacking conspicuous light lines, stripes, or spots, *R. crassiovis* differs markedly from *R. erythraea*, *R. luctuosa*, *R. picturata*, and *R. siberu*.

The entire present sample was obtained along the banks of Batang Tarusan and two of its tributaries at elevations between 1166 and 1320 m AMSL.

#### ***Rhacophorus catamitus* Harvey, Pemberton, & Smith**

Twenty-one adult males. SVL 27.0-33.9 mm (mean±SE 31.49±0.38). T/SVL 0.50-0.58 (median 0.524); HW/SVL 0.32-0.38 (median 0.346); HL/SVL 0.35-0.39 (median 0.373); TYM/eye 0.27-0.37 (median .0320). Nuptial pad whitish, finely granular, on mediadorsal surface of first finger. First finger with vestige of web at base; second finger web reaching subarticular tubercle or not so far laterally; third finger web



laterally not reaching distal subarticular tubercle; fourth finger web to distal subarticular tubercle. Web of foot moderate, first toe webbed between subarticular tubercle and disc; second toe webbed laterally almost to base of disc, third toe laterally to base of disc; fourth toe laterally to distal subarticular tubercle, fifth toe medially to base of disc or between distal tubercle and base of disc. A low interrupted fold of skin on outer edge of forearm and a similar ridge on outer edge of tarsus. A conical tubercle at tibiotarsal joint. No dermal ridge or row of tubercles above or below the vent. Color in preservative tan to dark purplish brown with obscure darker cross bands, one between eyes, a second behind eyelids, and a third at sacrum. Dorsal coloration extends half way down sides. Venter cream-colored with or without brown speckling; light coloration extends part way up sides.

These frogs agree in most details with the original description of *Rhacophorus catamitus* (type locality Mt. Dempo, Sumatera Selatan, Sumatra) (Harvey et al., 2002). The distinctive characters shared with that species include the reduced webbing of fingers and toes, the weak crenulated ridge on the forearm and tarsus, the conical tubercle at the tibiotarsal joint, and the coloration. However, males in the type series are slightly larger (31.0-35.2 mm), have head width greater than head length, and the tympanum slightly larger relative to the eye diameter (0.38-0.58).

All of the present sample came from 1166-1320 m ASL in forest near Lubuk Selasih, about 440 km N of the type locality.

## DISCUSSION

Collecting amphibians had been carried out in 1991-1995 in the Anai River basin (0°50'S/100°17'E), approximately 50 km N of Padang, West Sumatra at 200-1150 m, where 35 species of frogs were found (Iskandar & Setyanto, 1996). We remove from this discussion the species that are essentially commensals of man and, therefore, tell us little of biogeographic significance: *Microhyla ornata*, *M. heymonsi*, *Bufo melanostictus*, *Fejervarya cancrivora*, *F. limnocharis*, *Rana erythraea*, *R. nicobariensis*, and *Polypedates leucomystax*. All were included in the Anai basin sample and all but the first in the present sample (which we refer to as "Sumatra PPL," for Padang, Payakumbuh, Lubuk Selasih). Five of the species in the Sumatra PPL sample (Table 1) not in the Anai basin list are species of *Limnonectes*. The specimens identified by Iskandar & Setyanto (1996) as "*Limnonectes cf. blythi* (smooth form)" are conspecific with the species described by Das (1996) as *L. shompenorum*. The Anai specimens named as "*Limnonectes cf. blythi* (rough form)" in the 1996 paper are conspecific with *Limnonectes* sp.2 of the present paper. The Anai specimens treated as "*Limnonectes cf. lateiceps*" are probably identical to *Limnonectes* sp.3 in Table 1. The species we have designated *L. kuhlii* (Table 1) may be conspecific with the Anai basin specimens listed as "*Limnonectes cf. kuhli* (wide head)" (Iskandar & Setyanto, 1996). *Rana picturata* is included only in the Sumatra PPL sample; its absence from the Anai basin sample is probably an identification problem. Although

*Rana signata* is listed from the Anai basin (Iskandar & Setyanto, 1996), the distinction between *signata* and *picturata* has not always been recognized. We treat *R. picturata* and *R. signata* as identical for the purposes of this analysis.

If the preceding adjustments in identification are accepted, 14 of the 20 non-commensal species in the Sumatra PPL sample were found in the Anai basin. Of the six not found in the Anai basin, four—*Megophrys parallela*, *Limnonectes* sp. 1, *Rana crassiovis*, and *Rhacophorus catamitus*—occurred only at 1166-1320 m ASL in the present sample. Only a small amount of time was spent above 900 m in the Anai basin because forests had been cleared there, and only two species were found at the highest elevation (1150 m) searched in the Anai basin—*Bufo asper* and *Rana erythraea*. *Limnonectes blythii* (seven specimens from 536-566 m) and the form we have called *Rana cf. chalconota* (all 17 collected below 400 m) appear not to have been found in the Anai basin survey. The 12 species included in the Anai sample but missing from our Sumatra sample are all relatively widely spread, lowland species that probably do occur in the Sumatra PPL area.

Iskandar & Setyanto (1996) listed 87 species of anurans from Sumatra, of which 55 (including ten commensals of man) were listed as occurring in West Sumatra and/or Riau provinces. Twenty two of the 27 species in the Sumatra PPL sample are in this large list of West Sumatra frogs. The five not in the West Sumatra list are: *Megophrys parallela*, described here for the first time; *Limnonectes* sp. 1, a manuscript species (Iskandar, in ms); *Limnonectes* sp. 2, a manuscript species (Inger & Iskandar, in prep.); *Rana cf. chalconota*, a form described but not named in this report; and *Rhacophorus catamitus* Harvey et al., a recently described species. With these five, the total anuran fauna known from West Sumatra equals 61.

Several hypotheses regarding the biogeographic relations of the frogs of Sumatra have been proposed (Inger & Voris, 2001). However, it is not certain that they can be properly tested because of the extensive modification of forests in Sumatra. Although in the 1930's more than two-thirds of Sumatra was covered by pristine forest, more than half of that had been cleared or logged by 1980 (Collins et al., 1991, fig. 19.1). As logging and clearing of forests has continued in the following 25 years, it is likely that we will never learn the geographical patterns of this fauna.

## ACKNOWLEDGMENTS

The collection on which this account is based was made by Messrs. Djong Hon-Tjong and David Gusman, who at the time were students at the Institute of Technology, Bandung, Java. We are grateful to them for their diligence and care in the field. We also are grateful to Ms. Lisa Kanellos for the illustrations and to two reviewers whose helpful comments have improved this paper. Field work was supported by the Marshall Field III Fund, Field Museum of Natural History.

**LITERATURE CITED**

- Boulenger, G. A., 1903. Report on the batrachians and reptiles. *Fasciculi Malayenses, Zoology*, **1**:131-176.
- Boulenger, G. A., 1920a. Reptiles and batrachians collected in Korinchi, West Sumatra by Messrs. H. C. Robinson and C. Boden-Kloss. *Journal of the Federated Malay States Museum*, **8**: 287-306.
- Boulenger, G. A., 1920b. A monograph of the South Asian, Papuan, Melanesian and Australian frogs of the genus *Rana*. *Records of the Indian Museum*, **20**: 1-226.
- Collins, N. M., J. A. Sayer, & T. C. Whitmore, 1991. *The conservation atlas of tropical forests. Asia and the Pacific*. Simon & Schuster, New York. 256 pp.
- Das, I., 1996. *Limnectes shompenorum*, a new frog of the *Rana macrodon* (Anura: Ranidae) complex from Great Nicobar, India. *Journal of South Asian Natural History*, **2**: 60-67.
- Doria, G., S. Sallvidio, & M. L. Tavano, 1999. Description of *Amolops (Huia) modiglianii*, new species from Sumatra (Amphibia, Anura, Ranidae). *Doriana*, **7**(317): 1-9.
- Hall, R., 1998. The plate tectonics of Cenozoic SE Asia and the distribution of land and sea. In: Hall, R. & J. D. Holloway (eds.), *Biogeography and geological evolution of Southeast Asia*. Backhuys Publishers, Leiden. Pp. 99-131.
- Harvey, M. B., A. J. Pemberton, & E. N. Smith, 2002. New and poorly known parachuting frogs (Rhacophoridae: *Rhacophorus*) from Sumatra and Java. *Herpetological Monographs*, **16**: 46-92.
- Inger, R. F., 1966. The systematics and zoogeography of the Amphibia of Borneo. *Fieldiana: Zoology*, **52**: 1-402.
- Inger, R. F. & H. K. Voris, 2001. The biogeographical relations of the frogs and snakes of Sundaland. *Journal of Biogeography*, **28**: 863-891.
- Iskandar, D. T., 1998. *The amphibians of Java and Bali*. Research and Development Centre for Biology, Jakarta. 117 pp.
- Iskandar, D. T. & D. Y. Setyanto, 1996. The amphibians and reptiles of Anai Valley, West Sumatra. *Annual Report Field Biology Research and Training Project (Bandung)*, **2**: 74-91.
- van Kampen, P. N., 1910. Eine neue Nectophryne-Art und andere Amphibien von Deli (Sumatra). *Natuurkundig Tijdschrift voor Nederlandsch-Indie*, **69**: 18-24.
- van Kampen, P. N., 1923. *The Amphibia of the Indo-Australian Archipelago*. E. J. Brill, Leiden. 304 pp.
- Verstappen, H. Th., 1973. *A geomorphological reconnaissance of Sumatra and adjacent Islands (Indonesia)*. Verhandelingen of the Royal Dutch Geographical Society (K.N.A.G.), Groningen, Wolters-Noordhoff. 182 pp.
- Yang, D.-T., 1991. Phylogenetic systematics of the *Amolops* group of ranid frogs of southeastern Asia and the Greater Sunda Islands. *Fieldiana: Zoology* (n.s.), no. **63**: 1-42.