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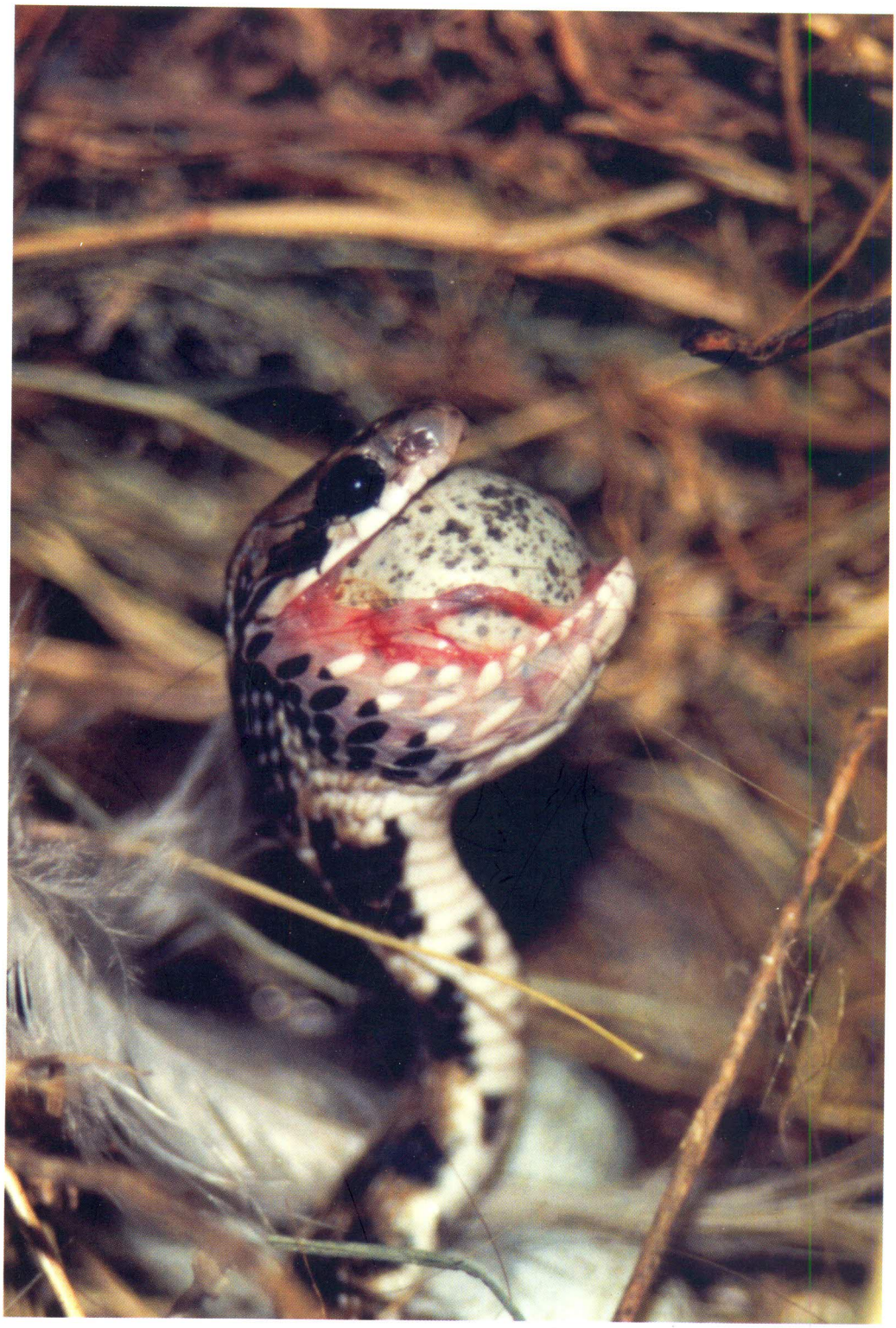

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THE VERNACULAR NAMES OF *MICRELAPS* IN WESTERN ASIA (REPTILIA: OPHIDIA: ATRACTASPIDIDAE)

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(with two text-figures)

ABSTRACT.– **Following brief reviews of the importance of vernacular names, and of the East African snake genus *Micrelaps* and its biology in western Asia (Israel and Jordan), the author discusses the Arabic and Hebrew vernacular names of the East-African snake genus *Micrelaps* in western Asia (Israel and Jordan) and proposes new English and Hebrew names for the two local species.**

KEY WORDS.– **Arabic, English, Hebrew, Levant, *Micrelaps*, vernacular names.**

SCIENTIFIC AND VERNACULAR NAMES

Vernacular names, especially if formally approved as standard and unanimously accepted, are potentially more stable than scientific names (Tyler, 1976; Werner, 2005). Formal approval occurs in some countries through a language academy (e.g., Werner, 2005); in some countries, this is substituted by zoological societies (e.g., Collins, 1990). Scientific names must occasionally change as a result of research: for example, a genus is split into two little-related genera, or an older synonym with priority is discovered. In contrast, vernacular names refer to the natural population, and normally should not change with the scientific taxonomy and nomenclature. This contrast is reflected in the title of Collins (1990). Here, it is worth mentioning that vernacular names are just nouns in the language and should not be capitalized, the ornithologists' habit notwithstanding.

Accordingly, some authors have been including a proposed vernacular name in their description of a new taxon. As a quite typical example, Babocsay (2003), in describing *Echis coloratus terraesanctae* from Israel, proposed the vernacular name Holy-land saw-scaled viper, and Babocsay (2004), in describing *Echis omanensis* from Oman and the United Arab Emirates, proposed the vernacular name Oman saw-scaled viper. Thus, English names were proposed for snakes occurring in countries where, in the first case, the national languages are Arabic and Hebrew, and in the second case, widely spoken, besides English, are Farsi and Urdu. The recent discovery and description of a new snake species in the Levant (Werner et al., 2006) prompts me to discuss the vernacular names of two striking snake species (the recently described species and its commoner congener), in view of a set of recommended guidelines for vernacular names (Werner, 1996, 2005).

INTRODUCING TWO SNAKES DESERVING VERNACULAR NAMES

Micrelaps Boettger, 1880 (Atractaspididae) is a small genus of small snakes, all rarely encountered because of their fossorial habits. Three of the five taxa (species or subspecies) are east African, together known from fewer than 60 specimens (Rasmussen, 2002, 2003). A fourth taxon, *M. muelleri* Boettger,1880 (Figure 1), inhabits the mesic part of the Levant: westernmost Syria, Lebanon, northern Israel and north-western Jordan (Werner, 1995; Bouskila and Amitai, 2001; Disi et al., 2001; Disi, 2002). In Israel, this species is known from several tens of specimens brought to the collections at the Hebrew University of Jerusalem and Tel Aviv University by numerous interested persons. The snake's usual colour pattern is striking, alternating black and

yellow rings, but two rare longitudinally striped morphs also occur (Werner et al., 2006). A fifth taxon, *Micrelaps tchernovi* Werner, 2006 (Figure 2), was recently described as new and is endemic to the semi-arid middle Jordan Valley of Israel and Jordan. It differs from *M. muelleri,* among other things, in being patterned with dark saddles instead of rings (Werner et al., 2006).

Micrelaps muelleri is believed to be primarily fossorial but is also active above ground, presumably especially at night, which generates DOR (dead on road) specimens (Bouskila and Amitai, 2001). Exceptional encounters with individuals active in daytime have been reported, for example one in Jerusalem on 17 November 2004 at 0830h and another on the Golan Plateau, on 8 December 1991 at 1400h (Werner et al., 2006). Of snakes with known month of collection (mostly under stones) or observation, the two months with the most finds were May–June and the two with least finds, January–February. This seasonality reflects ophidian activity rather than human activity, because the latter is great also in March–April when few snakes were recorded (Werner et al., 2006). In Jordan most specimens were found during March–November, always on humid substrates, sometimes in wheat fields or agricultural areas in the Jordan Valley.

There is some evidence that the food of *M. muelleri* includes, or even mainly comprises, snakes. Single cases of its having eaten a *Typhlops vermicularis*, a *Platyceps rhodorhachis* (or perhaps *P. saharicus*) and a young *Micrelaps muelleri* are listed by Bouskila and Amitai (2001), while *Typhlops* sp. and *Ablepharus* are listed as food by Disi (2002). Knowledge of its reproduction is limited to one observation of live birth in captivity of a 15 cm long juvenile in Tel Aviv University (Bouskila and Amitai, 2001).

NAMES UNDESERVED AND DESERVED

Of the two languages prevailing where these snakes occur, in Arabic *M. muelleri* has been called "hayet mular al-ardiya" (="Mueller's ground snake") by Amr and Al-Oran (1995), "hayeh mulari" (= "muelleri snake") by Tarawneh et al. (1999) or just "hayeh" (= "snake") by Disi et al. (2001). I am not competent to suggest a solution.

Figure 1. *Micrelaps muelleri* (live), normal Ringed (medium) morph: HUJ 20854 ♂, Zur Hadassa, Judean Hills. Note posture of tail pushing against the ground. (Scale bar = 10 mm.)

Figure 2. *Micrelaps tchernovi* holotype (live), HUJ 16864 ♀, Ubeidiyya Site, Jordan Valley, Israel. (Scale bar = 10 mm.)

For Hebrew, "ha-pitni" (= "the *Elaps*-like one") of Aharoni (1929) and "nehash ha-maharozet" (= "the snake of the chain or necklace") of Margolin (1947) and Barash and Hoofien (1956) were officially replaced with "maharozan", meaning "characterized by, or resembling, chain or necklace" or in one word reflecting the Hebrew single word, "chainling", by the Academy of the Hebrew Language (1965). Later "maharozan du-goni" (= "bi-coloured chainling") has been needlessly introduced by private initiative in an encyclopaedia of the Society for the Protection of Nature in Israel (Arbel, 1984), although *Micrelaps bicoloratus* exists in East Africa. In accordance with the principles explained elsewhere (Werner, 1996, 2005), I suggest "Maharozan taba'ot" (= "chainling with rings") for *M. muelleri,* and "Maharozan ukafim" (= "chainling with saddles") for *M. tchernovi* (because "muelleri" cannot be written or pronounced in Hebrew). These suggestions will also be proposed to the Academy of the Hebrew

Language, which has the legal authority to coin words and terms into the Hebrew language.

Although rarely mentioned in general snake books, *Micrelaps muelleri* has already been called in English "Mueller's snake" (Amr et al., 1997; Disi et al., 2001; Disi, 2002) and sometimes "Mueller's ground viper" (Gruber, 1989; Disi et al., 2001) and even "Mueller's two-headed snake" (Frank and Ramus, 1995; Bouskila and Amitai, 2001) and "false coral snake" (Lulav, 1978). All these names are uninformative, the last is outright misleading (Sokolov, 1988), and all but the last ignore the snake's contrasting colouration. To be more informative, I propose to translate the Hebrew genus name "maharozan" (= "characterized by, or resembling, chain or necklace") as "chainling" (same linguistic principle as duckling) for both local species – thus "Mueller's chainling" for *M. muelleri* and "Tchernov's chainling" for *M. tchernovi*.

According to Disi et al. (2001), *M. muelleri* has been called in German Müllers Erdviper and in French, Vipère à sol du Müller (both equalling Mueller's ground viper). I can make no proposals for these languages and I have no relevant information concerning other languages.

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A NEW SPECIES OF *AMOLOPS* (ANURA: RANIDAE) FROM ASSAM, NORTH-EASTERN INDIA

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(with one text-figure)

ABSTRACT.– **A new species of torrent-dwelling ranid frog of the genus *Amolops* from Assam north-east India is described. The new species differs from all other congeners of Eastern Himalaya in both adult and larval characteristics, and can be diagnosed from congeneric species in showing the following combination of characters: head wider than long; presence of a supratympanic fold; tympanum less than eye diameter; vomerine ridges angular to body axis; toe discs smaller than finger discs; toe webbing complete; both inner and outer metatarsal tubercles present; jaws in larva divided and keratodont formula: III:5–5/1–1:II.**

KEY WORDS.– ***Amolops*, new species, systematics, Assam State, north-eastern India.**

INTRODUCTION

The genus *Amolops* was established by Cope (1865) on the basis of the most conspicuous character- the presence of an abdominal sucker in the larva. This genus is restricted to the mountain brooks of south-east Asia and is represented by 34 nominal species (Yang, 1991; Liu and Yang, 2000; Frost, 2004). Seven species are now known from India (Ray, 1992; Chanda, 1994; Ao et al., 2003), and Pawar and Birand (2001) suspected the presence of additional species from north-eastern India. In an inventory of Kolaghat Reserve Forest (26°04–09'N; 90°24'–92°22'E; 61.65 sq km) and Mayeng Hill Reserve Forest (25°43'–25°55'N; 90°32'–91°21'E; 21 sq km), we collected a species of *Amolops* of Assam India, which is here described as a new species.

MATERIALS AND METHODS

Nine adult specimens (four males and five females) and five larvae comprise the type series. Specimens were preserved in 8% formalin and deposited in ZSIC and ZSIS. Measurements were taken with a dial vernier caliper to the nearest 0.1 mm within 1–8 months of collection. The following measurements of adult were taken: snout vent length (SVL: from tip of snout to vent); head length (HL: from angle of jaw to tip of snout); head width (HWN: width of head at level of nostrils. Additionally, HWAE is width of head at level of anterior corner of eye; HWPE is width of the head at the level of the posterior corner of eye; HWJ is width of head at level of angle of jaw; HDN is head depth at level of nostril; HDE is head depth at level of eyes; HDJ is head depth at angle of jaws; EN is eye to nostril distance, taken from anterior point of eye to nostril; NS is nostril to snout-tip distance; INS is internarial space; IFE is interspace between the anterior corner of eyes; IBE is interspace between posterior corner of eyes; IOS is minimum distance between upper eyelids, across interorbital area; UE is greatest transverse width of upper eyelid; ED is distance from posterior corner to anterior corner of eye; ET is distance between posterior corner of eye and anterior corner of

tympanum; HTYD is greatest tympanum diameter along horizontal plane; VTYD is greatest tympanum diameter along vertical plane; MN is distance between angle of jaw and nostril; MFE is distance between angle of jaw and anterior corner of eyes; MBE is distance between angle of jaws and posterior corner of eyes; AG is distance between posterior edge of forelimbs at its insertion to body to anterior edge of hind limb at its insertion to body; FL is distance from posterior edge of forelimbs at its insertion to tip of longest finger, with limb outstretched; and HAND is distance from base of palm to tip of longest finger). Finger lengths were taken from base to tip of each finger: F_1: First finger, F_2: Second finger, F_3: Third finger, and F_4: Fourth finger, greatest width of disc on 3rd finger (F_3D), length of palmer tubercle (PT: greatest length of palmer tubercle), hind limb length (HLL: distance from insertion to tip of longest toe of hind limb in stretched limb), tibia length (TBL: distance between surface of knee to surface of heel, with both tibia and tarsus flexed), tibia width (TBW: greatest width of tibia at any point of its length), toe length (from base of each phalange to tip; T_1: First toe, T_2: Second toe, T_3: Third toe, T_4: Fourth toe, T_5: Fifth toe), greatest width of disc on 4th toe (T_4D), inner metatarsal tubercle (IMT: greatest length of inner metatarsal tubercle), outer metatarsal tubercle (OMT: greatest width of the outer metatarsal tubercle).

Larval measurements taken include total length (TL: distance between snout tip to tail tip), snout vent length (SVL: from snout tip to vent), tail length (TAIL: from the vent to the tail tip), body width (BW: maximum width of the body), body depth (BD: maximum depth of the body), tail depth (TD: maximum depth of the tail), oral sucker length (OSL: maximum vertical distance of the oral sucker), oral sucker width (OSW: maximum horizontal distance of the oral sucker), eye to nostril distance (EN: distance between anterior point of eye and nostril) nostril to snout distance (NS: distance between nostril to tip of snout), internarial space (INS: distance between two nostrils), interorbital space (IOS: minimum distance between upper eyelids), eye diameter (ED: distance from posterior corner to anterior corner of eye), width of spiracle tube (WST), hind limb length (HLL: from insertion of limb to tip of longest toe).

Abbreviations used.– BMNH– The Natural History Museum, London; ZSIC – Zoological Survey of India, Kolkata and ZSIS – Zoological Survey of India, Shillong.

SYSTEMATICS

Amolops assamensis sp. nov.

(Fig. 1)

Holotype.– ZSIC A10272 adult male from Mayeng Hill Reserve Forest, Kamrup District, Assam, north-eastern India, collected 24 April 2004 by P. K. Choudhury.

Paratypes.– Three male (ZSIS V/A/ERS/606, ZSIS V/A/ERS/607, ZSIS V/A/ERS/608) and five females (ZSIC A10273, ZSIS V/A/ERS/609, ZSIS V/A/ERS/610, ZSIS V/A/ERS/611, ZSIS V/A/ERS/612), from Kolaghat Reserve Forest, Kamrup District, Assam, north-eastern India, collected by J. Gogoi and B. Hussain.

Diagnosis.– *Amolops assamensis* sp. nov., a large frog (♂ 52.80–61.50 mm; ♀ 82.50–94.40 mm) diagnosed from congeneric species in showing the following combination of characters: head wider than long, presence of a supratympanic fold, tympanum less than eye diameter, vomerine ridges angular to body axis, toe discs smaller than finger discs, toe web complete and both inner and outer metatarsal tubercles present.

Holotype.– A large frog (SVL to 61.50 mm); habitus stout; head long (HL : SVL= 0.31), wider than long (HL : HW= 0.85); snout flat (HL : HD = 2.21), granular, obtusely pointed, projecting beyond mandible; canthus rostralis round; loreal concave; nostril oval, slightly closer to the snout tip than eye (EN : ES = 0.60); eye large (ED : SL = 0.89), nearly half of the length of head (ED : HL = 0.43), and its diameter more than eye-nostril distance (ED : EN = 1.49); interorbital space smaller than width of upper eye lid (IOS : UE = 0.85) and internarial space (IOS : INS = 0.78); internarial space is smaller than IFE, IBE (INS : IFE = 0.55, INS : IBE = 0.37) and eye diameter (INS : ED = 0.81); tympanum flat, rounded (HTYD : VTYD = 0.98), small (HTYD : ED = 0.31), separated from eye by a distance slightly less than its diameter (HTYD : TE = 0.88); a distinct pineal body present; vomerine ridge oblique, present between the choanae and angular to body axis; tongue bifid, lingual papilla absent.

Table 1. Measurement (in mm) of the type series of *Amolops assamensis* sp. nov.

Measure-ments	ZSIC A10272 ♂	ZSIS V/A/ ERS/606 ♂	ZSIS V/A/ ERS/607 ♂	ZSIS V/A/ ERS/608 ♂	ZSI-CA10273 ♀	ZSIS V/A/ ERS/609 ♀	ZSIS V/A/ ERS/610 ♀	ZSIS V/A/ ERS/611 ♀	ZSIS V/A/ ERS/612 ♀
SVL	61.70	56.50	56.70	52.80	86.50	94.40	91.30	92.00	82.50
HL	21.15	20.05	20.00	18.75	29.30	33.15	30.65	28.80	27.55
HWN	10.30	9.50	10.10	9.65	14.20	15.00	15.75	14.50	12.65
HWAE	16.70	14.75	16.00	15.25	23.55	24.95	23.80	22.10	21.05
HWPE	22.00	18.95	20.70	19.60	30.45	33.95	32.20	28.45	28.15
HWJ	23.50	22.25	22.20	20.85	32.10	36.00	34.00	31.55	30.40
HDN	6.65	6.20	6.40	5.70	9.05	10.30	11.05	9.45	8.05
HDE	11.40	10.90	10.40	10.40	15.15	17.00	17.50	14.65	12.50
HDJ	9.50	8.90	9.60	8.60	13.05	14.80	14.80	14.00	12.00
SL	10.20	9.80	9.85	9.40	14.80	16.90	14.25	14.35	14.10
EN	4.50	4.10	4.85	4.40	6.70	7.95	7.00	6.10	6.15
NS	4.30	4.60	4.75	4.40	6.45	7.10	6.60	6.40	5.80
INS	6.65	6.15	6.55	5.85	9.15	9.95	9.20	8.90	8.30
IOS	5.55	5.10	5.20	5.10	7.45	7.60	7.10	7.15	6.75
UE	6.80	5.75	6.00	5.20	7.50	8.65	8.85	8.60	7.95
ED	8.35	7.35	8.10	7.30	9.65	10.90	10.15	9.60	9.40
ET	4.50	2.85	3.50	3.00	4.55	5.35	5.20	4.85	3.95
HTYD	3.50	2.35	2.95	2.35	3.30	3.70	3.05	3.85	3.50
VTYD	3.60	2.10	2.80	2.30	3.40	4.10	3.20	4.10	3.50
MN	17.05	14.95	15.40	14.60	22.80	26.10	23.90	22.30	21.05
MFE	12.75	11.75	11.80	11.45	16.00	18.80	17.75	16.65	18.65
MBE	5.95	5.85	5.80	5.80	8.30	10.95	9.15	8.00	8.40
IFE	11.80	11.00	11.80	10.85	16.10	17.90	16.90	16.05	16.95
IBE	19.05	17.00	18.20	16.35	23.80	27.10	25.70	23.25	24.25
AG	28.0	26.35	22.00	23.20	35.00	36.40	36.40	36.70	34.55
FL	40.05	34.65	34.70	34.60	50.05	54.50	50.65	52.05	53.35
F1	10.30	9.70	9.60	9.60	15.70	15.70	16.40	14.35	14.10
F2	13.85	11.90	12.15	11.75	17.75	19.55	19.00	18.45	17.10
F3	18.60	15.75	18.50	16.60	25.40	27.35	25.95	25.10	23.30
F4	15.40	14.50	15.00	14.00	22.00	22.00	22.00	23.60	19.45
F3D	4.35	4.10	4.15	3.85	5.10	6.20	6.70	6.30	6.20
PT	4.60	4.05	4.10	4.05	5.90	6.35	6.85	5.80	6.15
HLL	114.00	101.00	101.00	95.80	148.50	160.00	143.70	157.70	145.00
TBL	34.95	32.25	30.00	31.65	42.00	50.80	42.75	47.00	41.70
TBW	8.05	6.95	7.10	7.05	11.80	13.00	13.55	13.30	12.50
T1	12.60	10.80	12.30	111.60	17.80	19.80	19.65	19.45	18.25
T2	18.25	17.60	17.85	17.00	25.25	27.45	26.00	27.20	25.85
T3	25.90	23.00	24.45	22.50	34.50	38.50	34.90	30.80	34.15
T4	33.50	27.95	30.30	28.00	44.60	49.05	44.45	46.85	43.05
T5	28.55	24.55	26.90	23.95	37.45	41.05	38.10	39.25	35.50
T4D	3.70	3.55	3.60	3.25	4.50	5.40	5.75	5.50	6.00
IMT	4.05	3.45	3.55	3.55	5.50	5.55	6.05	6.50	5.65
OMT	1.60	1.40	1.45	1.55	2.30	2.00	2.05	2.20	2.20

Forelimb about twice the hand length (FLL : HAND = 2.15); fingers at tips bear large discs. with dorsal fold, terminal knuckle, circummarginal groove and basal groove, relative length of finger, $F_3 > F_4 > F_2 > F_1$.

Tibia long (TBL : SVL = 0.57) about four times its width (TBL : TBW = 4.34); hind limbs long (SVL : HLL= 0.54) about three times as long as tibia (HLL : TBL = 3.26); tip of toes dilated into discs that are smaller than finger discs;

Table 2. Measurements (in mm) and other data from tadpoles of *Amolops assamensis* sp. nov.

Measurements / character	Catalogue number				
	ZSIS V/A/ERS/601	ZSIS V/A/ERS/602	ZSIS V/A/ERS/603	ZSIS V/A/ERS/604	ZSIS V/A/ERS/605
TL	51.25	59.10	61.50	63.95	63.25
SVL	18.65	21.0	20.70	23.90	21.65
HLL	2.30	13.15	13.35	20.20	30.50
TAIL	32.60	38.10	40.80	40.05	41.60
BW	11.05	12.55	12.80	13.75	14.15
BD	7.00	8.25	8.75	9.55	8.40
TD	6.70	8.15	7.90	8.45	8.85
OSL	12.75	14.80	13.75	14.90	15.05
OSW	9.85	11.0	10.75	11.60	11.15
EN	2.65	2.90	3.00	3.15	3.05
NS	4.90	5.85	5.75	5.35	5.50
INS	2.35	2.85	3.0	3.55	3.30
IOS	2.95	3.75	3.95	4.55	4.70
ED	2.50	3.0	2.70	2.85	3.15
WST	2.0	1.85	1.70	1.25	1.80
Postorbital glands extend to fin base	-	-	-	-	+

pad of discs with dorsal fold, terminal knuckle, circummarginal groove and basal groove; a dermal fringe along toe V; toe webbing complete ($I_{0-0}II_{0-0}III_{0-0}IV_{0-0}V$); a large elongate innermetatarsal tubercle and a small oval outer metatarsal tubercle present; relative toe length, $T_4 > T_5 > T_3 > T_2 > T_1$; TTA reaches beyond snout.

Skin granular, with scattered tubercles on back and flank; subarticular tubercles large, distinct; dorsolateral rows of minute glands and rictal glands present; supratympanic fold distinct.

Dorsal ground colour olive green with rounded or irregular brown patches; sides of head olive green; tympanum-reddish brown; flanks olive green with large brown patches on the upper part; limbs dull yellow and barred with reddish brown.

Figure 1. Holotype of *Amolops assamensis* sp. nov. in life.

Tadpole.– Five specimens of tadpole belonging to Gosner (1960) stages 34, 36, 37, 39 and 40 were collected from Kolaghat Reserve Forest, Assam, India, were examined. Head-body rectangular, oval at snout, flat below; eye dorsolateral; nostril nearer to eye than snout tip; spiracle tube low on left side of body; width smaller than eye diameter, free from body; oral disc ventral, followed by a large abdominal sucker; upper lip without papillae except at corner; denticle formula III:5–5/1–1:II., two tadpoles (ZSIS V/A/ERS/604 – ZSIS V/A/ERS/605) with weak first upper (continuous) row of denticle; upper jaw divided; abdominal sucker with a narrow, marginal band of cornified epidermis and two isolated patches of similar tissue anteriorly; postorbital and ventral glands present; postorbital glands ca. 1.30–1.60 mm from posterior corner of eye, each with 108–128 glandulae; postorbital glands in the form of small patches of glandulae in a line on either side of mid-dorsal axis with development of larva; abdominal gland located at insertion of hind limbs, each abdominal gland with 166–215 clusters of glandulae

Variation in paratypes.– Measurements and variation in measurable characters are given in Table I. In general morphology, the variation is minimal except that some specimens have more granular dorsal skin. Sexual dimorphism observed include females being larger. Addi-

tionally, they have smaller eyes, smaller forelimbs and tibia, relative to males, which show enlarged nuptial pads.

Ecological notes.– Found in fast-flowing stream, and associated with the splash-zone of dark, moist rock crevices, with overhead canopy cover. At night they frequent open areas. The mating call is a low whistle, repeated at intervals. Amplexus was observed in May, during the day. Tadpoles frequently climb the vertical wall of rocks against stream flow and when threatened, drop into water and swim freely.

COMPARISONS

In the following list, the new species from Assam is compared with congeners, listing only opposing characters (characters of new species is in parentheses).

Amolops chakrataensis Ray, 1992 (distribution: Uttaranchal, northern India), mid-sized frog (vs. large size), nostril closer to anterior corner of eye than tip of snout (vs. nostril slightly closer to snout tip than to eye), eye tympanum distance almost equal to diameter of tympanum (vs. eye-tympanum distance greater than tympanum diameter) tympanum concealed below supratympanic fold (vs. tympanum small but distinct), interorbital distance greater than upper eyelid (vs. interorbital distance smaller than width of upper eyelid), tibiotarsal articulation reaches tympanum (vs. reaching beyond snout), outer metatarsal tubercle absent (vs. present); *Amolops chunganensis* (Pope,1929) (distribution: China), small size (vs. large), head length greater than width (vs. head wider than large), first finger almost equal to second (vs. first finger distinctly smaller than second), fourth toe webbed fully to distal subarticular tubercle (vs. fully webbed to disc), inner metatarsal tubercle small, oval (vs. large and elongated), no outer metatarsal tubercle (vs. present), tadpole denticle formula III:4–4(3–3)/1–1:II (vs. III:5–5/1–1:II); *Amolops formosus* (Günther, 1875) (distribution: Meghalaya, Sikkim, Uttar Pradesh and West Bengal in India and Nepal), medium size frog (vs. large size), circummarginal groove on first finger absent (vs. present), side of head devoid of granules (vs. granular), inner metatarsal tubercle oval (vs. elongated), outer metatarsal tubercle absent (vs. present), dorsolateral row of glands absent (vs. present), venter granular (vs. smooth); *Amolops gerbillus* (Annandale, 1912) (distribution: Meghalaya, Arunachal Pradesh, Assam, northeastern India, and China, Myanmar and Tibet), medium size frog (vs. large size), interorbital space equal to upper eyelid (vs. greater), disc of third finger as large as tympanum (vs. larger than tympanum), rudiment of web between 3rd and 4th finger (vs. absent), outer metatarsal tubercle absent (vs. present), dorsolateral row of glands absent (vs. present); *Amolops granulosus* (Liu and Hu, 1961) (distribution: China), small (vs. large) frog, head length slightly greater than width (vs. head wider than long), circummarginal groove absent on disc of first finger (vs. present), outer metatarsal tubercle absent (vs. present) tadpole denticle formula II:4–4/1–1:II (vs. III:5–5/1–1:II); *Amolops hainanensis* (Boulenger 1899), (distribution: China), head width equal to head length (vs. head wider than long), a pair of bony projections on front of mandible (vs. absent), pineal body invisible (vs. distinct), vomerine teeth absent (vs. present), first finger as long as second (vs. shorter), outer metatarsal tubercle absent (vs. present), male without vocal sac (vs. present), denticle formula of tadpole III:2–2/1–1:II (vs. III:5–5/1–1:II); *Amolops himalayanus* (Boulenger, 1888) (distribution: Darjeeling in eastern India, and Nepal), tympanum indistinct (vs. distinct), circummarginal groove on first finger absent (vs. present), supernumerary tubercles on three outer fingers (vs. supernumerary tubercles on finger absent), outer metatarsal tubercle absent (vs. present), dorsolateral row of glands absent (present); *Amolops hongkongensis* (Pope and Romer, 1951) (distribution: eastern China), moderate size (large), nostril midway between tip of snout and eye (vs. nostril slightly closer to snout tip than to eye), tympanum invisible (vs. distinct), vomerine teeth absent (vs. present), no outer metatarsal tubercle (vs. present), denticle formula of tadpole III:1–1/1–1:II (vs. III:5–5/1–1:II); *Amolops jaunsari* Ray, 1992 (distribution: Uttaranchal, northern India), small (vs. large) body size, nostril almost equidistant to tip of snout and anterior corner of eye (vs. nostril slightly closer to snout tip than to eye), internasal space almost equal to interorbital space (vs. distinctly larger), eye tympanum distance almost equal to diameter of tympanum (vs. eye-tympanum distance greater than tympanum di-

ameter), first finger almost equal to second (vs. first finger distinctly smaller than second), fourth finger smaller than first and second fingers (vs. distinctly larger); *Amolops jinjiangensis* (Su, Yang and Li, 1986) (distribution: China), mid-sized (vs. large), head longer than wide (vs. shorter), tympanum invisible (vs. distinct), first finger almost equal to second (vs. distinctly smaller), fourth toe webbed up to distal subarticular tubercle (vs. up to disc), outer metatarsal tubercle absent (vs. present), a pair of large tubercle at side of anus present (vs. absent), denticle formula of tadpole III:3–3(4–3)/1–1:II (vs. III:5–5/1–1:II); *Amolops kaulbacki* Smith, 1940) (distribution: Myanmar), nostril equidistant to tip of snout and anterior corner of eye (vs. nostril slightly closer to snout tip than to eye), tympanum feebly distinct (vs. distinct) and half eye diameter (vs. much less), inner metatarsal tubercle oval (vs. elongated), outer metatarsal tubercle present (vs. absent), skin smooth on dorsum (vs. granular with scattered tubercles); *Amolops larutensis* (Boulenger, 1899) (distribution: Thailand and Peninsular Malaysia), moderate size (vs. large) length of head slightly greater than width (vs. smaller), axillary gland present (vs. absent), denticle formula of tadpole III:5–5/1–1:IV (vs. III:5–5/1–1:II); *Amolops lifanensis* (Liu, 1945) (distribution: Sihuan Province, southern China), width of head equal to length (vs. width greater than length), tympanum invisible (vs. distinct), first finger equal to length of second (vs. first finger smaller than second), circummarginal groove on first finger absent (vs. present), outer metatarsal tubercle absent (vs. present), male without vocal sac (vs. present), keratodont formula of tadpole III:4–4/1–1:II (vs. III:5–5/1–1:II); *Amolops loloensis* (Liu, 1950) (distribution: China), head width equals length (vs. width greater than length), nostril closer to anterior corner of eye than tip of snout (vs. nostril slightly closer to snout tip than to eye), tympanum indistinct (vs. distinct), vomerine teeth absent (vs. present), circummarginal groove on first finger absent (vs. present), first finger equal to length of second (vs. first finger smaller than second), fourth toe webbed up to second subarticular tubercle and with a narrow fringe to disc (vs. fully webbed to disc), outer metatarsal tubercle absent (vs. present), male without vocal sac (vs. present), skin smooth on dorsum (vs. granular with scattered tubercles), keratodont formula of tadpole III:4–4/1–1:II (vs. III:5–5/1–1:II); *Amolops mantzorum* (David, 1871) (distribution: China), head width equals length (vs. width greater than length), nostril equidistant to tip of snout and anterior corner of eye (vs. nostril slightly closer to snout tip than to eye), first finger equal to length of second (vs. first finger smaller than second), circummarginal groove on first finger absent (vs. present), fourth toe webbed up to distal subarticular tubercle (vs. up to disc), outer metatarsal tubercle absent (vs. present), male without vocal sac (vs. present), *Amolops marmoratus* (Günther, 1858) (distribution: from the Eastern Himalayas of India and Nepal, to Thailand and China), mid-sized frog (vs. large size), vomerine ridge transverse (vs. angular), tympanum half of diameter of eye (vs. less than eye diameter), first and second fingers equal (vs. first finger shorter than second), supernumerary tubercles on three outer fingers (vs. supernumerary tubercles on finger absent), outer metatarsal tubercle absent (vs. present), dorsolateral row of glands absent (vs. present), venter tuberculate (vs. smooth); *Amolops monticola* (Anderson, 1871) (distribution: Darjeeling in eastern India and China), head length almost equal to head width (vs. head wider than long), toe web formula $I_{0-0}II_{0-1}III_{0-2}IV_{2-0}V$ (vs. $I_{0-0}II_{0-0}III_{0-0}IV_{0-0}V$), outer metatarsal tubercle absent (vs. present), keratodont formula III:4–4/1–1:II (vs. III:5–5/1–1:II); *Amolops nepalicus* Yang, 1991 (distribution: Nepal), mid-sized frog (vs. large size), head slightly longer than broad (vs. distinctly boarder than long), first and second fingers equal (vs. first finger shorter than second), supernumerary tubercles at bases of all fingers (vs. supernumerary tubercles absent), dorsolateral row of glands absent (vs. present); *Amolops ricketti* (Boulenger, 1899) (distribution: China and Vietnam), nostril closer to eye than tip of snout (vs. nostril slightly closer to snout tip than to eye), tympanum invisible (vs. clearly visible), inner metatarsal tubercle oval (vs. elongated), outer metatarsal tubercle absent (vs. present), male without (vs. with) vocal sac, keratodont formula of tadpole III:1–1/1–1:II (vs. III:5–5/1–1:II); *Amolops torrentis* (Smith, 1923) (distribution: Hainan Island, eastern China), small size (vs. large), width of head equal to length (vs. width greater than length), nostril

midway between tip of snout and eye (vs. nostril slightly closer to snout tip than to eye), vomerine teeth absent (vs. present), first and second fingers equal (vs. first finger shorter than second), outer metatarsal tubercle absent (vs. present), keratodont formula of tadpole III:1–1/1–1:II (vs. III:5–5/1–1:II); *Amolops tuberodepressus* Liu and Yang, 2000 (distribution: China), head slightly longer than broad (vs. wider than long), nostril closer to anterior corner of eye than tip of snout (vs. nostril slightly closer to snout tip than to eye), finger lengths $F_3 > F_1 = F_4 > F_2$ (vs. $F_3 > F_4 > F_2 > F_1$), circummarginal groove on first finger absent (vs. present), relative toe length– $T_4 > T_5 = T_3 > T_2 > T_1$ (vs. $T_4 > T_5 > T_3 > T_2 > T_1$), Toe web $I_{1–2½}II_{1½–2}III_{1½–2½}IV_{2½–1½}V$ (vs. $I_{0–0}II_{0–0}III_{0–0}IV_{0–0}V$), outer metatarsal tubercle absent (vs. present); dorsolateral glandular fold absent (vs. present); *Amolops viridimaculatus* (Jiang, 1983) (distribution: China), nostril midway between tip of snout and eye (vs. nostril slightly closer to snout tip than to eye), circummarginal groove on first finger absent (vs. present), no outer metatarsal tubercle (vs. present), skin of dorsum smooth (vs. granulated and with tubercles), vocal sac in male absent (vs. present), keratodont formula of tadpole III:4–4/1–1:II (vs. III:5–5/1–1:II); *Amolops wuyiensis* (Liu and Hu, 1975) (distribution: China), small size (vs. large), tympanum invisible (vs. clearly visible), vomerine teeth absent (vs. present), outer metatarsal tubercle absent (vs. present), keratodont formula of tadpole III:1–1/1–1:II (vs. III:5–5/1–1:II).

Four species, *Amolops jaunsari, A. larutensis, A. nepalicus* and *A. assamensis* sp. nov. have an outer metatarsal tubercle. However, *A. assamensis* sp. nov. differs from these nominal species in being larger, from *A. larutensis* and *A. nepalicus* in having head width greater than head length. Additionally, *A. larutensis* possesses axillary gland and four undivided lower rows of keratodont in larva and *A. jaunsari* and *A. nepalicus* have first finger equal to second finger.

The larva shows divided jaws, a character supposedly unique to the genus *Meristogenys*. However, adults of the new species from Assam differs from the *Meristogenys* group in having second finger longer than the first and length of tibia < 0.6 SVL. The larva further has a ventral sucker. The presence of larval glands, including the postorbital gland and ventral gland, supports our opinion on this generic allocation.

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APPENDIX 1

Comparative Material

Amolops formosus (Günther, 1875) BMNH T.1947.2.4.18, ZSIS: V/A/ERS/494), ZSIC: A 15870; *Amolops marmoratus* (Günther, 1858) BMNH T.1947.2.27.93, ZSIS: V/A/ERS/494(a), ZSIS: V/A/ERS/494(b), ZSIC: A 888, A 20891, A 20892, A19247, A19248, A 9576; *Amolops himalayanus* BMNH 1880.11.10.121, BMNH 1880.11.10.120, ZSIC: A 19348; *Amolops gerbillus* (Annandale, 1912) ZSIC A9103, AVCM A0571–0578, ZSIC: A 16925, Index no. A XII; *Amolops monticola* (Anderson, 1871) A 10036.

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MISCELLANEA HERPETOLOGICA GABONICA I

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ABSTRACT.– **The lineated form of the colubrid genus *Bothrophthalmus*, namely *B. lineatus lineatus* auctorum, is deleted from the Gabon reptile list. The colubrid *Lamprophis fuliginosus* is confirmed for Gabon. New localities and/or ecological data are provided for *Agama agama* (Agamidae), *Hemidactylus mabouia* (Gekkonidae), *Gerrhosaurus nigrolineatus* (Gerrhosauridae), *Feylinia grandisquamis*, *Panaspis breviceps* (Scincidae), *Varanus ornatus* (Varanidae), *Calabaria reinhardtii* (Boidae), *Grayia ornata*, *Natriciteres fuliginoides*, *Philothamnus carinatus*, *Thrasops flavigularis* (Colubridae) and *Naja melanoleuca* (Elapidae).**

KEYWORDS.– **Reptilia, Agamidae, Gekkonidae, Gerrhosauridae, Scincidae, Varanidae, Boidae, Colubridae, Elapidae, *Bothrophthalmus*, *Lamprophis*, Gabon, Africa.**

INTRODUCTION

The herpetofauna of Gabon is one of the least known among tropical African countries. A preliminary national reptile list was first available only in 2004 (Frétey and Blanc, no date; see also Pauwels, 2004), but that list has to be seriously re-evaluated because of lack of material for documenting the presence of a number of species. For instance, Maran and Pauwels (2005) deleted three species and two genera of chelonians mentioned in that list for Gabon, pending available material. Distribution within the country and ecology are also poorly documented. Additional distributional and ecological data can thus be useful. For this reason, we decided to write a series of notes on unpublished miscellaneous observations that hardly fit into our current taxonomic works or regional inventories. This series will be published as "Miscellanea Herpetologica Gabonica".

MATERIAL AND METHODS

Families and taxa within families are presented in alphabetical order in the Results. New localities are as much as possible, substantiated by voucher specimens. Field observations in Gabon were made by OSGP (where field numbers are preceded by P). New locality records are marked with an asterisk*, new department (district) records by two**, new province records by three***. Body measurements were made to the nearest millimeter; scale measurements were made with a caliper to the nearest 0.05 mm. Paired meristic characters are given in the left/right order. Snake ventral scales were counted according to the Dowling (1951) method. The terminal tail scute is not included in the subcaudal count. The numbers of dorsal scale rows are given respectively at one head length posterior to head, at midbody (above the ventral corresponding to half of the total number of ventrals), and at one head length anterior to vent.

Abbreviations.– Institutions: DFC: Direction de la Faune et de la Chasse, Ministère de l'Economie forestière, Libreville; IRSNB: Institut Royal des Sciences naturelles de Belgique, Brussels; MNHN: Muséum national d'Histoire naturelle, Paris. Morphology: DSR: dorsal sca-

le row(s); IL: infralabial scale(s); Lor: loreal scale(s); PV: pre-ventral scale(s); SC: subcaudal scale(s); SL: supralabial scale(s); SVL: snout-vent length; TaL: tail length; TL: total length; VEN: ventral scale(s). Others: DOR: dead on road; Dpt.: Department; Prov.: Province.

RESULTS

Squamata

Agamidae

Agama agama (Linnaeus, 1758)

Distribution.– We observed this species in numerous localities, including Ayémé Agoula* (Komo Dpt., Estuaire Prov.) on 29/10/01, Bènguie* (Okano Dpt.**, Woleu-Ntem Prov.) on 29/10/01, Ékouk-Village* (Komo Dpt., Estuaire Prov.) on 30/10/01, Four-Place* (Komo Dpt., Estuaire Prov.) on 30/10/01, Kango* (Komo Dpt., Estuaire Prov.) on 29/9/01, Ntoum* (Komo-Mondah Dpt., Estuaire Prov.) on 29/9/01, and Oyan III* (Komo Dpt., Estuaire Prov.) on 29/9/01. Numerous citizens of the capital city Libreville (Komo-Mondah Dpt., Estuaire Prov.), explained to us that this species appeared in their city only at the end of the seventies, and that it has since progressively invaded the interior of the country, clandestinely embarking on motor vehicles. According to our informants, the species would have "arrived on boats coming from West Africa".

Diet.– Many specimens inhabiting the restaurant terraces in Libreville easily accept food like bread crumbs and other food reliefs. On the afternoon of 17 August, 2001 in the Quartier Charbonnages, Libreville, we observed an adult male eating a ripe papaya on a tree.

Predation.– On three occasions in 2005 at Yenzi Camp near Gamba, Ndougou Dpt., Ogooué-Maritime Prov., juveniles were seen in house gardens being killed and eaten by Common Bulbuls *Pycnonotus barbatus* (Aves: Pycnonotidae). In the same year and locality, we observed a case of predation on a juvenile by a Cattle Egret (Aves: Ardeidae: *Bubulcus ibis*), and three cases of predation by feral cats (Mammalia: Felidae: *Felis catus*), two on juveniles, one on an adult male in breeding colour. In 2004–2006 in Yenzi, we also examined two adult DOR *Psammophis* cf. *phillipsii* (Hallowell, 1844) (Colubridae), each with an adult female *Agama agama* in the stomach, ingested head first (voucher specimens for the local populations of these two species were presented by Pauwels et al., 2004).

Vernacular names.– The people of the Pounou ethnic group call it *dibambila* or *dibambilang*; its French-Gabonese name is *margouillat*, a general name actually applying locally to all four-legged lacertilians but the monitor *Varanus ornatus* (Daudin, 1803).

Gekkonidae

Hemidactylus mabouia (Moreau de Jonnès, 1818)

Distribution.– We observed this species at night hunting light-attracted insects near neon lights on house walls in the towns of Fougamou (Tsamba-Magotsi Dpt., Ngounié Prov.; 9/9/01), Lambaréné (Ogooué and Lacs Dpt., Moyen-Ogooué Prov.; 8/9/01), Mouila (Douya-Onoy Dpt., Ngounié Prov.; 24/7/01, 22/9/01), Ndendé* (Dola Dpt.**, Ngounié Prov.; 6/7/01), Ndjolé* (Abanga-Bigné Dpt.**, Moyen-Ogooué Prov.; 28/9/01) and Ntoum* (Komo-Mondah Dpt., Estuaire Prov.; 26/10/01).

Vernacular name.– The people belonging to the Fang ethnic group of Libreville and Ntoum call it *nchè*.

Gerrhosauridae

Gerrhosaurus nigrolineatus Hallowell, 1857

Diving.– On the morning of 25 October 2005 (rainy season), in Ivinga*, Gamba, after a continuous rain for 12 h, a subadult specimen was observed actively swimming in a heavily flooded bunchgrass prairie. When approached, it plunged and reappeared ca. 3 m further, and repeated it twice on shorter distances. This ability of swimming and diving is a necessity, since its natural environment in Gabon is sometimes flooded during the rainy season.

Scincidae

Feylinia grandisquamis Müller, 1910

Diet and behavior in captivity.– An adult specimen collected in October 2005 in Gamba was kept three months in a terrarium in the same town, and fed with locally collected prey. It

was later released. Range of prey items accepted included earthworms (Lumbricina), termite soldiers and workers (Isoptera), ant eggs (Hymenoptera Formicidae) and caterpillar-like beetle larvae (Coleoptera). Before being bitten, each prey item was touched 2–3 times with the snout, sometimes licked with the tongue, giving chance to any fast prey to escape. During its whole time in captivity, the main time of activity was 1730–1930 h. When the sky was cloudy, activity began around 1630 h and stopped earlier. Food was not given everyday, and was disposed only after foraging activity began. While handled, the specimen never attempted to bite, but frenetically moved its body. Several other specimens caught in the same locality had had recourse to caudal autotomy when first handled.

Panaspis breviceps (Peters, 1873)

New material.– IRSNB 17287: Itsila waterfall* on Ngounié River, on the border of Gabon with the Republic of Congo (Gabon side), ca 17 km E–SE of Lékindou, Boumi-Louétsi Dpt., Ngounié Prov., July 2004. This adult specimen was found in the afternoon under stones along the waterfall basin, in syntopy with a *Natriciteres fuliginoides* (see below). We visited the locality again on 17 August 2006 and lifted the very same rocks, under which we found another adult *P. breviceps*.

Varanidae

Varanus ornatus (Daudin, 1803)

Distribution.– We observed a juvenile crossing the road by day in secondary forest at Sam* (Okano Dpt.**, Woleu-Ntem Prov.) on 29 October 2001, another at Ébel Alèmbe* (Abanga-Bigné Dpt.**, Moyen-Ogooué Prov.) on the same day. Both showed five transversal dorsal rows of bright yellow ocellae between the fore and hind limbs.

Boidae

Calabaria reinhardtii (Schlegel, 1851)

New material.– IRSNB 16353 (field number P612) (male; 1 PV + 242 V; undivided anal; 27 undivided SC; 28–35–27 smooth DSR): Nkog-Mbon* (0°27'55"S, 10°17'10"E; alt. 35 m asl.) (also known as Nkoghe-Mboum), on the road Bifoun-Lambaréné (26 airline km from Lambaréné), Ogooué and Lacs Dpt., Moyen-Ogooué Prov., 4 August 2001. This specimen was found DOR along a secondary forest. In 2004, we examined a dead adult specimen on the road at Cap Esterias*, Komo-Mondah Dpt., Estuaire Prov. Its head and tail had been cut with a machete by a farmer working in a nearby field, who threw the rest of the body on the road, hoping that the next passing car would give it the *coup de grâce*. Because their blunt tail is not easily distinguishable from their tail, *Calabaria* and local typhlopids are believed to have two heads, and many locals also believe them to bite by their two extremities and be highly venomous. Special attention is thus always given to ensure they die whenever encountered.

Colubridae

Bothrophthalmus brunneus Günther, 1863

The genus *Bothrophthalmus* contains only two morphs (with and without three dorsal red longitudinal stripes) whose respective status is still unclear, since authors' opinions differ in the interpretation of this striking colour difference as being non-geographical intraspecific variation, subspecific or specific level variation. Knoepffler (1966:7) cited *Bothrophthalmus lineatus lineatus* from Gabon, and mentioned three specimens without describing their dorsal colouration. Waardenburg and Guicherit (1991:41) mentioned "*Botrophalmus* [sic] *lineatus*" from south-western Gabon (Ofoubou, also known as Moufoubou, Ndolou Dpt., Ngounié Prov.), but did not mention anything about the pattern. Pauwels et al. (2002:51, 55) recorded the non-striped morph under *B. l. brunneus* from south-central Gabon. Burger et al. (2004:153, 172) recorded the non-striped form from south-western Gabon under *B. lineatus*. Pauwels et al. (2006:93, 97; 2006:184) mentioned the non-striped form from south-western Gabon under *B. brunneus*. In order to verify the effective sympatry of both forms in Gabon, we re-evaluated the existing records. Waardenburg and Guicherit's record can not be verified since no preserved specimen was referred to. Knoepffler's "*lineatus*" specimens were deposited in the MNHN, and re-examined, as well as an older specimen (MNHN 1935.0407 from "Gabon" without more details

on locality). Knoepffler's MBG 0323 from "Lambaréné, route de Bakota" became MNHN 1967.0361; MBG 0332 and MBG 0737 from Makokou (Ivindo Dpt., Ogooué-Ivindo Prov.) are now MNHN 1967.0362 and MNHN 1967.0363 respectively (as also verified through the dates accompanying the specimens in the MNHN register and in Knoepffler's paper). None of them shows a lineated pattern. All four MNHN specimens have 23–23–21 DSR, a deep loreal depression, 7/7 SL of which only the 5th enters the orbit, 2+3 / 2+3 temporals, 3/3 preoculars, 2/2 postoculars, 8/8 IL, and a single anal scale. All DSR but the first are strongly keeled, and the first row is slightly keeled in all specimens except MNHN 1935.0407. In this latter specimen (the smallest), all DSR, including the first are strongly keeled. Additional data are presented in Table 1. It can be concluded that there is currently no evidence that the striped form *lineatus* occurs in Gabon, from where a number of unstriped *brunneus* are known. Pending a revision of the genus, we suggest both forms be treated as different species. Avoiding doing so may result in additional confusion to their respective records.

Grayia ornata (Barboza du Bocage, 1866)

New material.– DFC (P603), IRSNB 16352 (P604): Moukalaba River*, alt. 280 m., 2°46'S 11°9'E, along the road Tchibanga-Ndendé, near Ndènguilila, Doutsila Dpt.**, Nyanga Prov.***, 5/7/01; IRSNB 16324 (P605), IRSNB 16325 (P793): Moukalaba River*, alt. 36 m., 2°47'S 10°44'E, along the road Tchibanga-Digoudou, near the bac, Mougoutsi Dpt.**, Nyanga Prov.***, 23/7/01, 19/9/01.

P603–5 and P793 were caught in fishing nets. All specimens have smooth DSR, a divided anal scale and divided SC; additional characters are presented in Table 2. Although the possession of extralabials is typical for the species, P793 does not have any. We also saw a beheaded adult specimen on the road at Kougouleu*, Komo Dpt., Estuaire Prov. on 23 August 2001, at midday; an interview with Kougouleu villagers revealed that it had been locally killed in a field along the road. Ethnozoological data were already gathered on *G. ornata* from Nyanga Prov. (see Pauwels et al., 2002:137, 139), but the above mentioned specimens are the first documented record of the species for that province.

Lamprophis fuliginosus (Boie, 1827)

The species was not mentioned for Gabon by Hughes (1983), and no Gabonese locality appears on the dotted map provided by Chippaux (2006:65). Mocquard (1887:63, 79–80) listed *Boedon unicolor* from Franceville, Passa Dpt., Haut-Ogooué Prov. This record was based on three specimens, deposited in the Paris Museum: MNHN 1886.0224–0226, that we re-examined, and positively identified as *Lamprophis fuliginosus*. All three are females. Their dorsal colouration is uniformly dark brown. The dorsal surface of their head is also dark brown, except in MNHN 1886.0226, which shows a discrete postocular stripe. Their ventral colouration is uniform yellowish-brown. All three have 8/8 SL, 2/2 preoculars, no suboculars, 2/2 postoculars, 1+2/1+2 temporals, the 4th and 5th SL in contact with the eye, 10/10 IL (except on right side of MNHN 1886.0224, where there are nine), a single anal scale and divided SC. Additional characters are provided in Tables 3–4.

The MNHN registers indicate that these three specimens, collected during the Brazza's expedition, were entered in the collections in 1886. The registers interestingly also mention that three other specimens also identified as *Boaedon unicolor*, collected in Franceville during an expedition by the French explorer Thollon, and

Table 1. Morphometric and meristic data for non-striped Gabonese *Bothrophthalmus* specimens in the MNHN collections.

Collection Number	Sex	SVL (mm)	TaL (mm)	TaL /TL	VEN	SC
MNHN 1935.0407	M	228	60	0.21	192	79
MNHN 1967.0361	F	524	114	0.18	191	70
MNHN 1967.0362	M	309	78	0.20	191	80
MNHN 1967.0363	F	956	195	0.17	198	68

Table 2. Meristic data for *Grayia ornata* from Nyanga Prov., Gabon.

Collection Number	Sex	PV + VEN	SC	DSR
DFC (P603)	M	3 + 145	88	19–19–16
IRSNB 16324	F	2 + 148	82	19–17–15
IRSNB 16325	M	1 + 145	> 81	18–16–15
IRSNB 16352	M	2 + 147	> 46	19–17–15

Table 3. Morphometrical data for *Lamprophis fuliginosus* from Franceville, Gabon.

Collection Number	SVL (mm)	TaL (mm)	TaL/TL	Length of frontal	Width of frontal	L/W frontal
MNHN 1886.0224	890	129	0.13	7.85	6.20	1.27
MNHN 1886.0225	767	102	0.12	6.95	5.10	1.36
MNHN 1886.0226	615	93	0.13	6.40	4.45	1.44

Table 4. Meristical data for *Lamprophis fuliginosus* from Franceville, Gabon.

Collection Number	VEN	SC	DSR	Lor	Teeth
MNHN 1886.0224	230	52	29–31–21	1/1	6+15
MNHN 1886.0225	223	50	29–29–21	2/2	6+14
MNHN 1886.0226	225	51	27–27–19	1/1	6+14

entered in the MNHN collections in 1887, were later destroyed due to their bad state of preservation. If they were indeed of the same species, it would thus seem locally common, although Franceville is the only known locality in Gabon for the species. Two other *Lamprophis* species are known from the country: *L. olivaceus* and *L. virgatus* (see a.o. Mocquard, 1897:13, Pauwels et al., 2002a:53).

Natriciteres fuliginoides (Günther, 1858)

An adult specimen was found at Itsila waterfall* on Ngounié River, on the border of Gabon with the Republic of Congo (Gabon side), ca 17 km E–SE of Lékindou, Boumi-Louétsi Dpt., Ngounié Prov., July 2004. It was found in the afternoon under stones along the waterfall basin. It was released after the examination of diagnostic characters: round pupil, 2 internasals, 1/1 loreal, 2/2 preoculars, 3/3 postoculars, 17–17–15 smooth DSR, vertebral row not enlarged, divided SC and a single anal scale. It did not make any attempt to bite when caught.

Philothamnus carinatus (Andersson, 1901)

New material.– IRSNB 16362 (P714) (female; PV+VEN: 1+150; single anal; SC: 83, divided; DSR: 13–13–11, smooth): Koumameyong*, Mvoung Dpt.**, Ogooué-Ivindo Prov., 6/10/01. This specimen was crossing a road in secondary forest in the afternoon.

Thrasops flavigularis (Hallowell, 1852)

New material.– IRSNB 16354 (P611) (only head preserved; PV+VEN: 1+208; SC: 144, divided; anal divided; DSR: 14–15–11, keeled): Moukouma II*, on the road Libreville-Lambaréné, Komo Dpt.**, Estuaire Prov.***, 4/8/01. This specimen was found DOR along secondary forest.

Elapidae

Naja melanoleuca Hallowell, 1857

New material.– IRSNB 16397 (P610) (only head and tail preserved; female; PV+VEN: 1+?; anal single; SC: 63, divided; DSR: 26–?–13, smooth): Agricole I*, on the road Libreville-Lambaréné, Komo Dpt., Estuaire Prov., 4/8/01. P610 was found in the morning on the road where it had just been thrown after being killed by a farmer in a garden near the road. We examined an adult headless specimen sold as food at Oyan I*, Komo Dpt., Estuaire Prov., on 4/7/01; the snake had been caught by snare in a nearby secondary forest. We saw an adult specimen crossing the road at Andem*, Komo Dpt., Estuaire Prov. in the sunny afternoon of 29/9/01. Vernacular names: The Fang villagers of Agricole I call it *évin-a-nyo* (*évin* = black; *nyo* = snake); the Pounou inhabitants of Oyan I call it *moudouma*.

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MISCELLANEA HERPETOLOGICA GABONICA II

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ABSTRACT.– ***Leptotyphlops perreti* and the family Leptotyphlopidae are confirmed for Gabon. The colubrid *Dispholidus typus*, the elapids *Dendroaspis polylepis* and *D. viridis* and the viperid genus *Echis* are deleted from the Gabon reptile list. New localities and/or ecological data are provided for *Agama agama* (Agamidae), *Hemidactylus mabouia*, *Lygodactylus fischeri* (Gekkonidae), *Dipsadoboa duchesnii*, *Hapsidophrys smaragdinus*, *Rhamnophis a. aethiopissa* (Colubridae), *Aparallactus modestus*, *Lamprophis olivaceus*, *Mehelya poensis*, *Psammophis* cf. *phillipsii* (Lamprophiidae) and *Natriciteres fuliginoides* (Natricidae). A new size record for *Hapsidophrys smaragdinus* is provided. Two species are added to the reptile fauna of Cristal Mounts National Park.**

KEYWORDS.– **Reptilia, Agamidae, Gekkonidae, Colubridae, Elapidae, Lamprophiidae, Leptotyphlopidae, Natricidae, Viperidae, Cristal Mounts, Gabon.**

INTRODUCTION

Due to the scarcity of data on the distribution and ecology of the herpetofauna of Gabon, we decided to make relevant new observations available through a series of publications entitled *Miscellanea Herpetologica Gabonica* (see Pauwels and David, 2007), of which the present article is the second part. One of the main objectives of the series is to evaluate literature and museum records to help establish a documented list of the reptiles of the country.

MATERIAL AND METHODS

Taxa within families are presented in alphabetical order in the Results. Field observations in Gabon were made by OSGP. New locality records are marked with an asterisk*, new department (district) records by two**, new province records by three***. Body measurements were taken to the nearest millimeter; scale measurements were taken with a caliper to the nearest 0.05 mm. Paired meristic characters are given in the left/right order. Snake ventral scales were counted according to Dowling's (1951) method. The terminal tail scute is not included in the subcaudal count. The numbers of dorsal scale rows are given respectively at one head length behind head, at midbody (above the ventral corresponding to half of the total number of ventrals), and at one head length before vent. Numbers of supralabials are followed between brackets by the indication of which among them border the eye. Numbers of infralabials are followed between brackets by the number among them bordering the first pair of sublinguals.

Abbreviations: Institutions: IRSNB: Institut Royal des Sciences naturelles de Belgique, Brussels; MNHN: Muséum National d'Histoire naturelle, Paris; USNM: National Museum of Natural History, Washington D.C. Morphology: DSR: dorsal scale row(s); IL: infralabial scale(s); Lor: loreal scale(s); PoO: postocular scale(s); PreO: preocular scale(s); PV: preventral scale(s); SC: subcaudal scale(s); SL: supralabial scale(s); SVL: snout-vent length; TaL: tail length; Tem: temporal scale(s); TL: total length;

VEN: ventral scale(s). Others: DOR: dead on road; Dept.: Department; Prov.: Province.

RESULTS

Agamidae

Agama agama (Linnaeus, 1758)

Predation. On the 30th of April, 2007, at 9h50 a.m., a group of four adult *Corvus albus* (Corvidae) was seen chasing an adult male *Agama agama* in the garden of the first author in Yenzi, Gamba, Ogooué-Maritime Prov. The *Agama* took refuge in an electric box, where it could not hide completely, part of its tail, and that of another specimen, an adult female, were visible. The four pied crows were joined by five more, and all were pulling the *Agama* tails with their beaks. The female first went out, and was chased and caught in the grass. A few minutes later, the male was also extracted from its retreat. Both birds which got an *Agama* went to eat it on a palm tree.

Gekkonidae

Hemidactylus mabouia (Moreau de Jonnès, 1818)

Predation. See under *Hapsidophrys smaragdinus*.

Lygodactylus fischeri Boulenger, 1890

Province record. An adult specimen (USNM 565025) was caught on a sunny afternoon on a pipeline along a path in a mature secondary forest at Totou 9, Gamba*, Ndougou Dept.**, Ogooué-Maritime Province***, 20 May 2005. It ran surprisingly fast and made several big leaps while trying to escape. This specimen represents the first record of the species for the Gamba area, and the first record for Ogooué-Maritime Prov. (Pauwels et al., 2006a).

Leptotyphlopidae

Leptotyphlops perreti Roux-Estève, 1979

Country record. The specimen MNHN 1977.1651 (sex unknown) originates from "Mounana, près de Moanda" ("Mounana, near Moanda"), Mounana*, Lébombi-Léyou Dept.**, Haut-Ogooué Prov.*** Its SVL is 199 mm; its TaL 42 mm. The body diameter is 3.00 mm. Nostril situated between nasal and 1st supralabial (= "infranasal" of Roux-Estève, 1979), rounder than as shown in the original description by Roux-Estève; eye large; rostral large, narrowing posteriorly, its apex reaching beyond the anterior limit of the eyes (just reaches it according to Roux-Estève, 1979). The ocular scale large, reaching lip. One SL between the "infranasal" and the ocular, another SL beyond the ocular, i.e., in total four scales border the upper lip. Prefrontal triangle-shaped. Frontal wider but shorter than prefrontal. Length of frontal + prefrontal longer than rostral length. Supraoculars oblique; interparietal wide; occipitals entire and wide. Other meristical and morphometrical characters include (data are followed in brackets by those provided in the original description, if they differ): DSR 14-14-14; 248 scales along body (291, 302, 297); 55 SC (54, 49, 51); TaL/TL 0.174 (0.143, 0.119, 0.126); SVL/body diameter 66.3 (54.1, 69.7, 56.6). The color in alcohol is uniformly beige. The species had already been cited from Gabon, although without any precise locality, by Trape and Roux-Estève (1995), and the present record thus confirms the presence of the species and the family Leptotyphlopidae in Gabon.

Colubridae

Dipsadoboa duchesnii (Boulenger, 1901)

Diet in captivity. A subadult specimen was caught by day in Yenzi, Gamba, Ndougou Dept., Ogooué-Maritime Province, in early April 2007, while it was resting on a metallic fence a meter above the ground. It was locally kept in a terrarium for a week, then released. During that week it ate a live adult *Hyperolius cinnamomeoventris* Barboza du Bocage, 1866, a live adult *H. nasutus* Günther, 1865 (Anura: Hyperoliidae) and a live juvenile *Hemidactylus mabouia*, all collected at the site of capture. It never made any attempt to bite when first caught or any time it was handled. Its activity was strictly nocturnal.

Dispholidus typus (Smith, 1828)

Deleted from Gabon reptile list. See below under *Rhamnophis a. aethiopissa*.

Hapsidophrys smaragdinus (Schlegel, 1837)

Diet and maximal size. Three specimens were collected in the Botanical Garden of Tch-

imbélé, Haut-Komo Dept., Woleu-Ntem Prov. in January (IRSNB 17375) and May 2002 (IRSNB 17376–17377). Their sizes are, respectively: SVL 473, 745, 251 mm; TaL 297, 450, 152 mm. They show, respectively (characters are not repeated if they do not differ): round pupil; keeled DSR, VEN and SC; 9(5–6)/9(5–6), 9(5–6)/9(5–6), 10(6–7)/9(5–6) SL; 10(5)/10(5), 10(5)/11(5), 10(5)/10(5) IL; 1/1 Lor; 1/1 PreO; 2/2 PoO; Tem 1+2/1+2, 1+2/1+2 with on each side a small scale in the anterior upper corner of the first Tem, 1+2/1+1+2. The TL of IRSNB 17376, 1195 mm, is higher than the maximal TL (1191 mm) cited by Chippaux (2006). The stomach of IRSNB 17375 contained an adult *Hemidactylus mabouia* whose SVL is 65 mm (tail mostly missing), ingested head first, the left arm along the head. The stomach of IRSNB 17377 contained a juvenile *Hemidactylus mabouia* (SVL 37 mm, TaL 45 mm) ingested head first. In both cases, the SVL ratio between the predator and the prey is close to 7 (7.3 and 6.8, respectively). Pauwels et al. (2002:63) had already reported a case of predation involving these two species, but did not mention their respective SVL; in which case, the snake (IRSNB 16317) had an SVL of 434 mm and the gecko (IRSNB 15692) an SVL of 51 mm, thus a predator-prey SVL ratio of 8.5.

Rhamnophis aethiopissa aethiopissa Günther, 1862

Distribution and nomenclatural note. Knoepffler (1966: 15) mentioned a male specimen of *Dispholidus typus* from Makokou (Ivindo Dept., Ogooué-Ivindo Prov.), and gave some of its meristic characteristics: 17 mid-dorsal scale rows, 166 VEN, 143 SC, 1/1 PreO, 2/2 PoO, 7/7 SL, and 1+2/1+2 Tem. This unique and zoogeographically unexpected Gabonese record for the genus was repeated by Chippaux (2006: 159) and Frétey and Blanc (no date: 40), although Hughes (1983: 317) had attributed the record to *Thrasops flavigularis* (Hallowell, 1852). In order to solve the question, we (PD) re-examined Knoepffler's specimen. It is deposited in the Paris collections as MNHN 1967.0443. It has 17-17-11 DSR, slightly keeled on lower flanks, smooth on higher flanks, except the vertebral row which is much enlarged and keeled. It has 1 PV + 166 VEN, 146 divided SC and a divided anal. Its internasals are longer than its prefrontals. It has 16 + 3 enlarged maxillary teeth. As Knoepffler noted, it has 7/7 SL, 1/1 PreO, 2/2 PoO, but 1+0/1+0 Tem. These characters allow to positively identify it as a *Rhamnophis aethiopissa aethiopissa* (see a.o. key in Chippaux, 2001:103). Another record of *Dispholidus typus* exists for Gabon (at Ofoubou, also known as Moufoubou, Ndolou Dept., Ngounié Prov.), in the unpublished report by Waardenburg and Guicherit (1991:41, 108 [figs]), but the two photographs they presented undoubtedly illustrate a *Rhamnophis a. aethiopissa*. *Dispholidus typus* can thus be deleted from the Gabon reptile list. According to several dictionaries of classical Latin that we consulted, the specific nomen *aethiopissa* is not an adjective (which should be *aethiopicus*, *-a*, *-um*), but a noun that means "an Ethiopian [woman]". It is hence a feminine noun in apposition, and should not be grammatically accorded with the masculine gender *Rhamnophis*.

Elapidae

Dendroaspis viridis (Hallowell, 1844) and *Dendroaspis polylepis* Günther, 1864

Deleted from Gabon reptile list. In a superficial study dedicated to the snake envenomations in Gabon in a medical journal, Tchoua et al. (2002) presented three species of medical importance in the country: *Bitis gabonica* (Duméril, Bibron and Duméril, 1854), *Dendroaspis viridis* and *Dendroaspis polylepis*. They gave as common name for the first "mamba vert" (green mamba) and for the second "mamba noir" (black mamba). In Gabonese French, these names refer to any elongate, (semi-) arboreal, green/greenish (*Dipsadoboa* spp., *Hapsidophrys* spp., *Philothamnus* spp., *Rhamnophis* spp., *Dendroaspis j. jamesoni* (Traill, 1843)) or black/blackish (dark *Boiga blandingii* (Hallowell, 1844), *Thrasops flavigularis*, *Naja melanoleuca* Hallowell, 1857, *Pseudohaje goldii* (Boulenger, 1895)) snakes, respectively. Their mention of these two species are thus based on misinterpretations of local common names, and throw doubt on the efficiency of medical treatments applied. From a zoogeographical point of view, the presence of these two mamba species in Gabon would be surprising and is not supported by a voucher,

and they can be provisionally deleted from the Gabon snake list. It is to be noted that the same authors also erroneously mentioned the genus *Echis* Merrem, 1820 as being present in Gabon, without supportive evidence.

Lamprophiidae

Aparallactus modestus (Günther, 1859)

Locality record. An adult individual (IRSNB 17374; SVL 442 mm; TaL 73 mm) was collected in the Botanical Garden of Tchimbélé*, Haut-Komo Dept., Woleu-Ntem Prov. in January 2002. It shows unkeeled DSR, VEN and SC; 7(3–4)/7(3–4) SL (6th contacting the parietal); 7(4)/7(4) IL; 0/0 Lor; 1/1 PreO; 2/2 PoO; 0+1+1/0+1 Tem. Other characters are shown in Table 1. In preservative, its dorsal surface is uniformly blackish. Ventral surface of head and belly yellow, except in last 3rd of belly, which is speckled with black; underside of tail blackish, contrasting with belly colour. Pupil round. This specimen represents the second known locality for the species in the Cristal Mounts (Pauwels et al., 2002).

Lamprophis olivaceus (Duméril, 1856)

Locality/national park record. Two specimens were collected in the Botanical Garden of Tchimbélé*, Haut-Komo Dept.**, Woleu-Ntem Prov. in January 2002. The largest one (IRSNB 17378), besides its characters appearing in Table 1, shows a vertical pupil; 8(3–5)/9(4–6) SL; 9(4)/9(4) IL; 1/1 PreO; 2/2 PoO; 1/1 Lor not in contact with the eye; 1+3/1+3 Tem; unkeeled DSR, VEN and SC. Its 29th and 36th VEN are forked on their right and left side, respectively. The vertebral row is not enlarged. In preservative, its dorsal surface is blackish; belly uniformly yellowish in the first fifth, becoming more spotted with black posteriorly. The adult female (SVL 680 mm; TaL 96 mm) contained five eggs of ca. 27 x 13 mm. The second specimen (IRSNB 17379), a juvenile (SVL 213 mm; TaL 36 mm) in poor preservation condition, also shows a vertical pupil and unkeeled DSR, VEN and SC; see Table 1. These specimens represent the first record of this genus for the Cristal Mounts and Cristal Mounts National Park (Pauwels et al., 2002, 2006b).

Mehelya poensis (Smith, 1847)

Locality/national park record. An adult specimen (IRSNB 17380; SVL 770 mm; TaL 201mm) was collected in Tchimbélé*, Haut-Komo Dept., Woleu-Ntem Prov. in May 2002. It has keeled DSR (with a double keel on an enlarged vertebral row), VEN and SC; 7(3–4)/7(3–4) SL; 8(5)/8(5) IL; 1/1 Lor, not in contact with the eye; 1/1 PreO; 2/2 PoO; 0+1+2/0+1+2 Tem (5th SL in contact with the parietal on each side). Additional characters are shown in Table 1. This record represents the second locality for the species in the Cristal Mounts and the first for the genus for Cristal Mounts National Park (Pauwels et al., 2002, 2006b).

Psammophis cf. *phillipsii* (Hallowell, 1844)

Diet in captivity. A newborn specimen collected in a school garden in Yenzi, Gamba, Ogooué-Maritime Prov., in late October 2005, which was at the beginning of the rainy season. It was kept for a month in captivity in Gamba, during which it ate two adult *Hyperolius nasu-*

Table 1. Meristic characters for some Gabon snakes. Taxa are arranged in alphabetical order.

Species	Collection number	Sex	DSR	PV+VEN	An	SC
Aparallactus modestus	IRSNB 17374	F	15-15-15	1 + 160	Single	45 undiv.
Hapsidophrys smaragdinus	IRSNB 17375	F	15-15-11	2 + 157	Divided	151 div.
H. smaragdinus	IRSNB 17376	F	15-15-11	2 + 157	Divided	143 div.
H. smaragdinus	IRSNB 17377	Juv.	15-15-11	2 + 155	Divided	150 div.
Lamprophis olivaceus	IRSNB 17378	F	28-29-23	1 + 211	Single	1 div. + 42 undiv.
L. olivaceus	IRSNB 17379	Juv.	?	1 + ca. 205	Single	41 undiv.
Mehelya poensis	IRSNB 17380	F	17-15-15	3 + 257	Single	99 div.
Natriciteres fuliginoides	IRSNB 17381	M	17-17-15	2 + 123	Single	92 div.
N. fuliginoides	IRSNB 17382	M	17-17-15	2 + 123	Single	>24 div.
N. fuliginoides	IRSNB 17383	M	17-17-15	2 + 119	Single	>33 div.

tus, collected at the same locality. The snake was later released.

Natricidae

Natriciteres fuliginoides (Günther, 1858)

Locality/national park record. Three specimens (IRSNB 17381–17383) were collected in the Botanical Garden of Tchimbélé*, Haut-Komo Dept., Woleu-Ntem Prov. in January 2002. Their sizes are SVL 163, 249, 231 mm; TaL 100, >43, >59 mm, respectively. Respectively, they show (characters are not repeated if they do not differ): rounded pupils; unkeeled DSR, VEN and SC; 8(4–5)/8(4–5) SL; 8(4)/8(4), 8(4)/8(4), 9(4)/10(5) IL; 1/1 Lor; 2/2, 2/2, 1/1 PreO; 3/3 PoO; 1+2/1+2, 1+2/1+1+2, 1+2/1+2 Tem. Additional characters are shown in Table 1. The stomach of IRSNB 17381 contains a partly digested frog (SVL ca. 29 mm, TL ca. 60 mm) ingested legs first. These specimens represent the first record of the genus for Cristal Mounts National Park (Pauwels et al., 2006b).

Viperidae

Echis Merrem, 1820

Deleted from the Gabon reptile list. See above under Elapidae.

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A NEW ROCK-DWELLING *HEMIDACTYLUS* (SQUAMATA: GEKKONIDAE) FROM MAHARASHTRA, INDIA

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(with seven text-figures)

ABSTRACT.- **A distinctive new species of rock dwelling gecko of the genus *Hemidactylus* is described from the forests of the northern Western Ghats of Maharashtra, India. It is most similar in morphology to *Hemidactylus giganteus* Stoliczka, 1871, but can be distinguished by its large size, dorsum with small granules, intermixed with 18–20 rows of irregularly arranged enlarged tubercles; 11–13 lamellae under fourth toe and 15–19 pairs of femoral pores in males.**

KEY WORDS.- ***Hemidactylus aaronbaueri,* new species, Gekkonidae, Maharashtra, Western Ghats, India.**

INTRODUCTION

With > 85 species inhabiting warm continental land masses and hundreds of intervening continental and oceanic islands, *Hemidactylus* Gray, 1845 is one of the most species-rich and widely distributed of all reptile genera (Carranza and Arnold, 2006). Although the genus is widely distributed throughout much of the Old and New World tropics and sub-tropics, it achieves its greatest species richness in the Horn of Africa and adjacent regions (Bauer and Pauwels, 2002). A great majority of *Hemidactylus* species have relatively small distributions, confined to southern Asia and Africa, and just eight species are responsible for most of the huge geographical area covered by the genus, namely, *H. mabouia*, *H. turcicus*, *H. brookii*, *H. frenatus*, *H. garnotii*, *H. persicus*, *H. flaviviridis* and *H. bowringii*. The first five of these are especially widespread and are present in both the Old and New Worlds, with *H. mabouia* also occurring on islands in the Atlantic and Indian Oceans and *H. frenatus* and *H. garnotii* being widespread in the Pacific (Carranza and Arnold, 2006). In India, this genus is represented by 19 species. Smith (1935) listed 14 species of *Hemidactylus* (*H. maculatus* (in part) Duméril and Bibron, 1836; *H. triedrus* Daudin, 1802; *H. subtriedrus* Jerdon, 1853; *H. brookii* Gray, 1845; *H. prashadi* Smith, 1935; *H. gracilis* Blanford, 1870; *H. reticulatus* Beddome, 1870; *H. frenatus* Duméril and Bibron, 1836; *H. leschenaultii* Duméril and Bibron, 1836; *H. flaviviridis* Rüppel, 1835; *H. giganteus* Stoliczka, 1871; *H. bowringii* (Gray, 1845); *H. garnotii* Duméril and Bibron, 1836; *H. karenorum* (Theobald, 1868). Loveridge (1947) considered *Lophopholis* a synonym of *Hemidactylus* and thus added one more species to this genus, *H. scabriceps* Annandale, 1906. Later, Sharma (1981) described *H. porbandarensis* from Porbandar, Gujarat. This species is known only from the type locality. In 1983, Shukla described *H. mahendrai* from Kanpur, Uttar Pradesh. Based on the similarity in the digit morphology, the monotypic Indian genus *Dravidogecko* was synonomised with *Hemidactylus* by Bauer and Russell (1995). There is one more addition to this genus: Vyas et al. (2006) reported *H. persicus* from the Indian Republic. Grandison and Soman, 1963 described *H. albofasciatus* from Maharashtra. This species is now listed as *Teratolepis albofasciatus* by Kluge (2001) and Das (2003), but its generic allocation is under re-evaluation (Bauer et al., in prep.).

The Western Ghats of India is a global biodiversity hotspot, and is also known for its rich

and endemic diversity of reptiles and amphibians. With its varied topography and geography, the northern Western Ghats, which mainly comprises of Maharashtra and parts of Goa and Gujarat, is also the home to some unique species of reptiles and amphibians. Apart from its diversity and endemicity, the region is not thoroughly studied and there are reasons to believe that the species diversity may be greater than currently recognized. A rapid explosion in the number of newly recognised species of amphibians in the Western Ghats despite previous research (Biju, 2001; Gower et al., 2004), suggests that new species of the less-studied lizards also await description. As one of the contributions towards the documentation of the herpetofauna of Maharashtra State, south-western India, I am describing a distinctive new species of *Hemidactylus*.

MATERIALS AND METHODS

The following measurements were taken with Bruder Mannesmann Werkzeuge Digit-cal Plus digital calipers (to the nearest 0.1 mm): snout-vent length (SVL; from tip of snout to vent), trunk length (TRL; distance from axilla to groin measured from posterior edge of forelimb insertion to anterior edge of hindlimb insertion), body width (BW; maximum width of body), crus length (CL; from base of heel to knee); tail length (TL; from vent to tip of tail), tail width (TW; measured at widest point of tail); head length (HL; distance between retroarticular process of jaw and snout-tip), head width (HW; maximum width of head), head height (HH; maximum height of head, from occiput to underside of jaws), ar length (EL; longest dimension of ear); forearm length (FL; from base of palm to elbow); orbital diameter (OD; greatest diameter of orbit), nares to eye distance (NE; distance between anteriormost point of eye and nostril), snout to eye distance (SE; distance between anteriormost point of eye and tip of snout), eye to ear distance (EE; distance from anterior edge of ear opening to posterior corner of eye), internarial distance (IN; distance between nares), interorbital distance (IO; shortest distance between left and right supraciliary scale rows). Scale counts and external observations of morphology were made using a Wild M5 dissecting microscope. Mensual data is given in Table 1. Nine derived variables were used to compare *Hemidactylus giganteus* (HG) and the new species of *Hemidactylus* being described herein (HN). Considering the fact that no two individuals of a species of gecko are necessarily of the same size, use of proportions to explain and compare a species with other species is a widely accepted methodology. Table 1 explains these variables individually. Principal Component Analysis (PCA) was used to investigate the cumulative effect of these variables.

SYSTEMATICS

Hemidactylus aaronbaueri sp. nov.

Figs. 1–5

Holotype.– Bombay Natural History Society (BNHS) 1739, adult male; on the rock cliffs near Ghatghar, Taluka Junnar, District Pune, Maharashtra, India (19°17'28 N, 73°40'36 E; 248 m asl), 22 November 2006. Collected by Ashok Captain and Varad Giri.

Paratypes.– BNHS 1737, 1738, 1740 and 1741, same data as holotype.

Diagnosis.– A large *Hemidactylus*, snout-vent length at least 128 mm; 18–20 rows of irregularly arranged, enlarged, rounded and feebly keeled dorsal tubercles; first labial touching nasal; two well developed pairs of postmentals, the inner pair elongate and larger than outer; ventrolateral folds not clearly visible; ca. 41–43 scale rows across venter between lowest rows of tubercles; 12–13 enlarged scansors beneath fourth toe of pes; digits with indistinct basal webs; ca. 19 femoral pores on each side separated by at least six scales in adult males; original tail tuberculate, with median subcaudal scales forming broad transverse plates; dorsal pattern comprising a series of dark, transverse undulating crossbars bordered anteriorly and posteriorly with pale cream, first on nape followed by four more, all bands inconspicuous on flanks; and tail alternately banded with pale and dark brown.

Hemidactylus aaronbaueri sp. nov. may be distinguished from all other mainland Indian congeners on the basis of (sympatric taxa with differing or non-overlapping character states indicated parenthetically): 18–20 rows of enlarged, rounded, feebly keeled dorsal tubercles (usually few in number, sometimes absent in *H. leschenaultii*, with fewer enlarged tubercles, more often absent altogether in *H. flaviviridis*, no enlarged tubercles in *H. giganteus*, large trihedral tuber-

cles arranged in 20 fairly regular longitudinal rows in *H. maculatus*, conical, keeled, or subtrihedral tubercles arranged in from 16–20 more of less regular longitudinal series in *H. brookii*), femoral pores in male 15–19 on each side separated by six scales (10–17 in *H. leschenaultii*, 5–7 in *H. flaviviridis*, 16–22 femoral pores separated by eight scales in *H. giganteus*, 19–25 femoral pores on each side in *H. maculatus*, from 7–12 (16) preano-femoral pores on each side, usually interrupted mesially in *H. brookii* (Smith, 1935, Giri et al., 2003, pers. obs.)

The new species is most similar in general appearance to *Hemidactylus giganteus*, but differ with respect to (*H. giganteus* vs. *H. aaronbaueri* sp. nov.): maximum size (115 vs. 128 mm SVL), dorsal pholidosis (uniform smooth granules without enlarged tubercles vs. 18–20 rows of enlarged, rounded tubercles), tail (covered above with uniform small scales versus small scales and a series of eight rows of enlarged dorsal tubercles), scansors beneath the fourth toe (13–15 vs. 11–13).

Description of holotype.– Some morphometric and meristic data are given in Table 1. The holotype is in good condition generally. Body shape dorsoventrally flattened throughout most of body (a little more so in preservative); head short (HL/SVL ratio 0.27), wide (HW/HL ratio 0.81), not strongly depressed (HH/HL ratio 0.50), and not markedly distinct from neck; loreal region slightly rounded, canthus rostralis not prominent.

Snout short (SE/HL ratio 0.42); longer than eye diameter (OD/SE ratio 0.43); scales on snout and forehead minute, granular; hinder part of the head with small granular ones, intermixed with larger tubercles; scales on canthus rostralis are slightly larger than those on occipital region; eye small (OD/HL ratio 0.18); pupil vertical with crenelated margins; supraciliaries large, mucronate; posterior scales of outer row forming short, stout, projecting spines; ear opening oval, vertically oriented and small (EL/HL ratio 0.05); eye to ear distance much greater than diameter of eyes (EE/OD ratio 1.65); rostral wider (4.5 mm) than deep (2.8 mm), incompletely divided dorsally by weakly developed rostral groove; two enlarged supranasals separated by a longitudinal series of two rounded internasals; rostral in contact with supralabial I, supranasals, and anterior internasal; nostrils circular and large (width of nostril 0.8 mm); each surrounded by supranasal, rostral, first labial and four postnasals, of which the posterior is larger than the remaining three; 2–3 rows of scales separate orbit from supralabials; mental subtriangular, slightly deeper (4.8 mm) than wide (4.5 mm); two pairs of enlarged postmentals, inner pair longer (3.2 mm) than outer (2.5 mm) and in contact (1.0 mm) behind mental, the outer postmental is medially divided in two, both inner and outer postmentals are in touch with first infralabial; infralabials bordered by a row of enlarged scales, decreasing in size posteriorly; supralabials (to midorbital position) 11 (right)- 11 (left); supralabials to angle of jaws 13 (right)- 13 (left); infralabials 9 (right)- 9 (left). Body relatively stout, not so elongate (TRL/SVL ratio 0.42) with weakly developed ventrolateral folds with scattered denticulate scales; dorsal scales heterogeneous, granular; regularly arranged intermixed with small, flattened to weakly conical tubercles extending from posterior interorbital and temporal regions to tail; tubercles more or less uniform across dorsum, somewhat more prominent on flanks enlarged; tubercles surrounded by rosettes of smaller scales of varying sizes, 2–5 smaller scales between two adjacent enlarged tubercles; tubercles in approximately 19–20 rows at midbody; ventral scales larger than dorsal, weakly subimbricate; a bit larger on abdomen than on chest, gular region with still smaller and granular scales; midbody scale rows across belly to denticulate edge of ventrolateral fold 43; femoral pores 18 on left thigh and 19 on right thigh, with left and right series separated by a median gap of six scales.

Scales on palm and sole smooth, rounded; scales on dorsal aspect of limbs heterogeneous, larger than those on the back, intermixed with larger domed to conical tubercles, scales on dorsal aspects limbs heterogeneous- granular, intermixed with conical to moderately keeled tubercles, more pronounced than those of body dorsum, enlarged tubercles on forelimbs are relatively smaller than those on the hind limbs, particularly on knees and shanks, moreover scales on shoulder are comparatively larger than those on the back and thighs.

Fore- and hind limbs relatively short, stout; forearm short (FL/SVL ratio 0.13); tibia short

Table 1. Mensural data for holotype and paratypes of *Hemidactylus aaronbaueri* sp. nov. Abbreviations in Materials and Methods; all measurements in mm. Asterisks refer to damaged/missing tails.

BNHS	SVL	TRL	BW	CL	TL	TW	HL	HW	HH	EL	FL	OD	NE	SE	EE	IN	IO
1737	115.77	49.53	40.58	14.63	110.67	17.88	29.53	27.49	14.26	1.81	16.45	5.90	10.68	12.68	9.87	2.50	9.43
1738	77.06	31.83	22.27	12.43	82.00	9.00	21.58	22.48	10.22	0.48	9.75	4.40	7.68	9.50	7.27	2.16	8.27
1739	123.28	51.67	37.06	20.32	115.67*	16.34	33.67	27.35	17.10	1.78	16.80	6.29	12.03	14.33	10.39	3.38	10.80
1740	122.74	57.03	39.74	17.67	111.95*	16.76	32.85	26.77	16.75	1.85	15.77	5.84	11.92	14.32	11.53	3.25	12.20
1741	128.30	57.46	42.10	20.50	99.65*	17.80	33.46	27.92	16.20	1.80	16.91	6.57	11.71	14.10	11.19	3..30	10.52

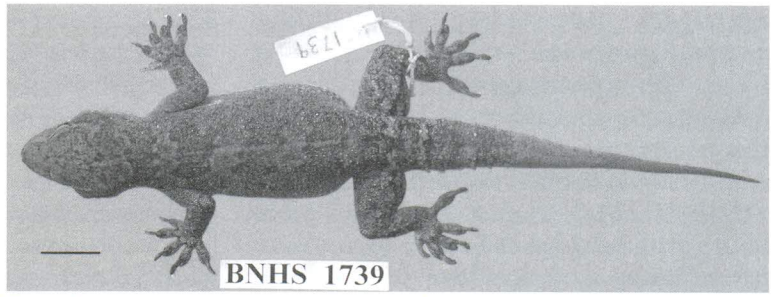

Figure 1. Dorsal view of the holotype of *Hemidactylus aaronbaueri*, sp. nov. (BNHS 1739). Scale bar = 20 mm.

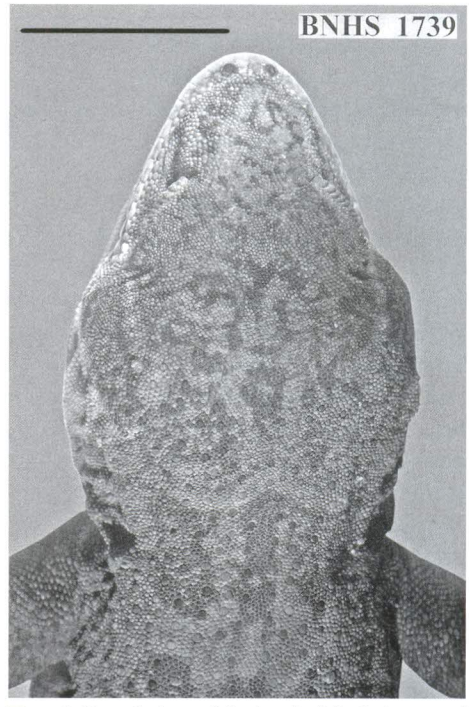

Figure 2. Dorsal view of the head of the holotype of *Hemidactylus aaronbaueri*, sp. nov. (BNHS 1739) showing the head scalation. Scale bar = 20 mm.

(CL/SVL ratio 0.16); digits moderately short, strongly clawed; all digits of manus and digits I–IV of pes indistinctly webbed; distal portions of digits curved, arising from distal portion of expanded subdigital pad; scansors beneath each toe divided except distalmost and few basal scansors are single, there are more number (7) of undivided or notched scansors on first toe: 1 3 – 1 2 – 1 2 – 1 2 – 1 3 (right manus), 11–13–13–13–13 (right pes). Relative length of digits (measurements in mm in parentheses): V (12.50) > II (11.88) > III (11.58) > IV (11.47) > I (11.20) (right manus); IV (14.60) > III (13.64) > II (13.55) > V (13.30) > I (11.37) (right pes).

Original portion of tail (34.8 mm) slightly depressed, flat beneath, verticillate; regenerated portion (80.9 mm) also slightly depressed and slender; length of partly regenerated tail slightly less than snout-vent length (TL/SVL ratio 0.93); original part of tail covered above with small (larger than those on dorsum), posteriorly-pointed, subimbricate to imbricate scales and a series of eight enlarged tubercles, continuing from body dorsum; ventral scales much larger, imbricate, ca. 3–4 scales in a median row near base of tail which greatly enlarged into subcaudal plates extending nearly across width of tail distally; 3–5 enlarged postcaudal spurs on either side of tail base; regenerated portion of tail covered above with small, pointed, keeled scales, below with enlarged subcaudal plates.

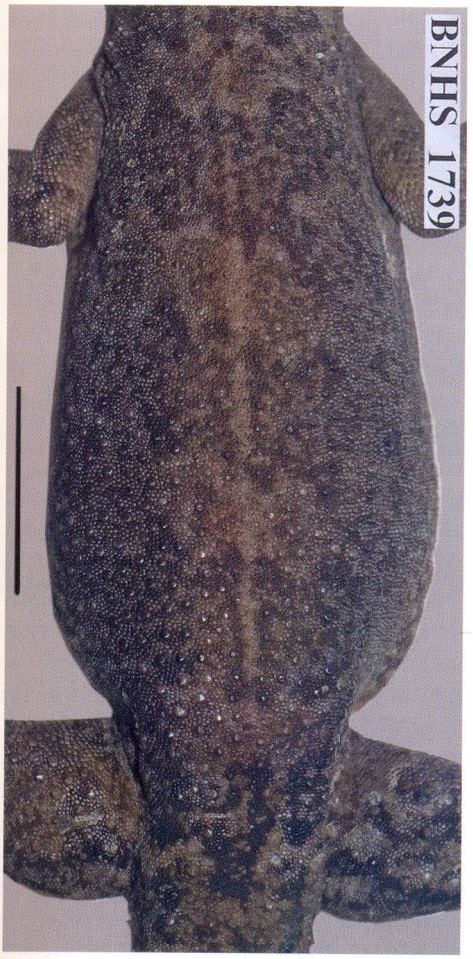

Figure 3. Dorsal view of the midbody of the holotype of *Hemidactylus aaronbaueri*, sp. nov. (BNHS 1739) showing the dorsal pholidosis. Scale bar = 20 mm.

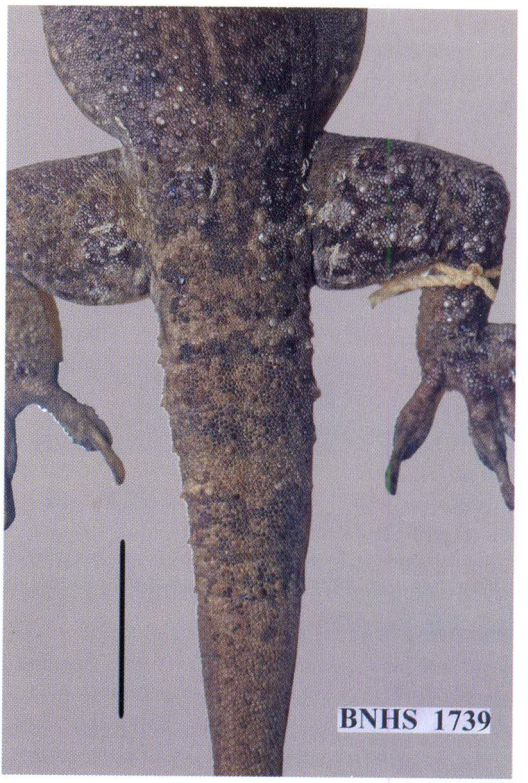

Figure 4. Dorsal view of the tail and hindlimb of holotype of *Hemidactylus aaronbaueri*, sp. nov. (BNHS 1739) showing the enlarged dorsal tubercles. Scale bar = 20 mm.

Colouration (in life).– Dorsum, ground colour of head, body and tail, greyish-brown. Upper surface and sides of head, especially posterior to eyes has vermiform dark brown and pale cream markings; a diffuse dark brown streak on can-

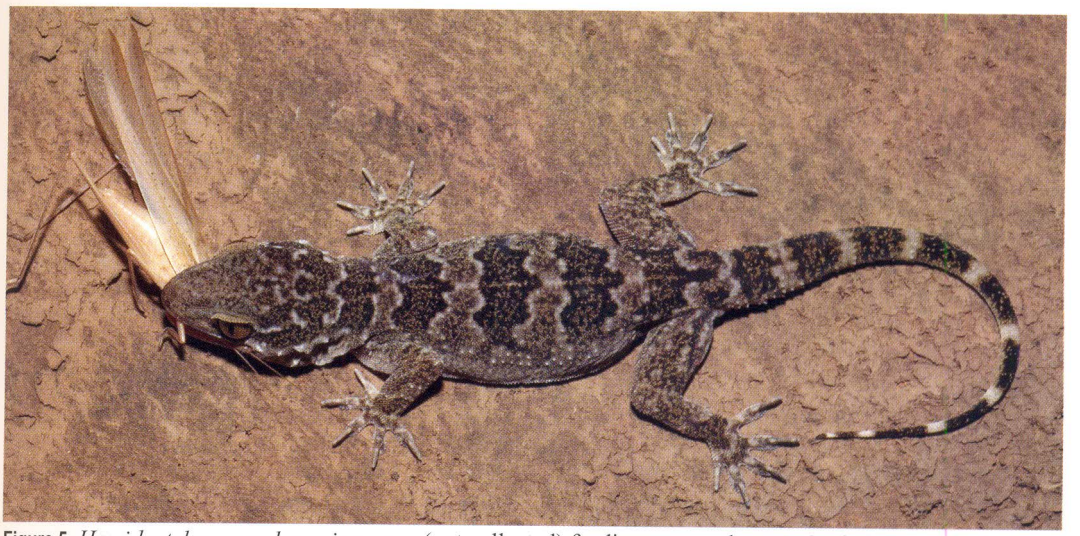

Figure 5. *Hemidactylus aaronbaueri* sp. nov. (not collected) feeding on grasshopper. Scale bar = 20 mm.

Table 2. Statistically significant differences between morphometric variables in *Hemidactylus aaronbaueri* sp. nov. and *H. giganteus*, using Student's *t*-test. Head length = HL/SVL; Head width HW/HL; Head depression = HH/HL; Snout = SE/HL; Eye diameter = OD/SE; Eye-ear length = EE/OD; Elongation = TRL/SVL; Hind limb length = CR/SVL; Fore limb length = FL/SVL; Tail width = TW/SVL. * = not significantly different.

	Hemidactylus aaronbaueri sp. nov. (n = 5)		*Hemidactylus giganteus* (n = 5)		t-test	p
	Mean	± SD	Mean	± SD		
Variable						
Head length	0.267	0.010	0.294	0.009	-4.51	0.002
Head width	0.887	0.099	0.750	0.042	2.84	0.022
Head depression	0.492	0.016	0.428	0.019	5.74	0.000
Snout length	0.431	0.008	0.425	0.041	0.28	0.784*
Eye diameter	0.448	0.025	0.505	0.037	-2.84	0.022
Eye-ear length	1.731	0.138	1.387	0.047	5.27	0.001
Trunk length	0.435	0.021	0.412	0.013	1.99	0.082*
Hind limb length	0.151	0.016	0.173	0.005	-2.93	0.019
Fore limb length	0.133	0.006	0.150	0.003	5.52	0.001
Tail width	0.136	0.013	0.153	0.005	-2.63	0.047

thus rostralis usually present; all specimens with a narrow pale cream postocular streak, bordered above, below and posteriorly by a wide brown and black mottled region; anterior supralabials whitish, mottled with pale brown, which gives them a brownish appearance; posterior supralabials cream; back of head, body and tail with a regular series of dark brown bands, the anterior and posterior margins of which are undulating; these bands have an anterior and posterior pale cream margin; bands confined to upper back and not produced onto flanks; usually an indistinct band on occiput, followed by a series of distinct bands– one on nape, four on body and 10–11 on tail; venter, enamel white.

Coloration (in preservative).– In preservative, colouration similar to that in life, except bands on dorsum and tail inconspicuous and visible when specimens are in preservative.

Etymology.– The species name is a patronym, applied in the genitive singular case, honouring Dr. Aaron M. Bauer of Villanova University for

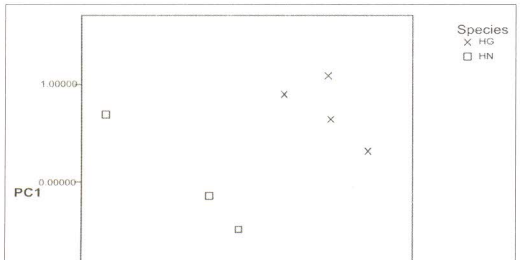

Figure 6. Scatter plot of *Hemidactylus aaronbaueri* (squares) and *Hemidactylus giganteus* (crosses) in ordination space of Principal Components. PC1→ Positively correlated with hind limb length and head length and negatively correlated with head depression and eye-ear length. PC2→ Positively correlated with tail width, fore limb length and eye diameter, and negatively correlated with head width.

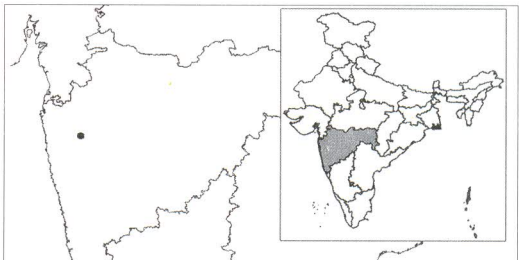

Figure 7. Map of India (right). showing Maharashtra State. The type locality of Hemidactylus aaronbaueri sp. nov. is indicated with a black dot on the map of Maharashtra (left).

his major contribution towards work on systematics and morphology of the lizards, especially geckos.

Variation shown by paratypes.– Mensural data for type series are given in Table 1. Specimens range in size from 77–128 mm. This table provides a restricted understanding of variation about this species. All paratypes resemble holotype in most respects except as follows: outer pair of postmentals is single (BNHS 1738, 1741, 1740); in BNHS 1737 second pair of postmental is divided and first postmental on right side is also divided. Apart from the holotype (BNHS 1739) one paratype is appears to be a subadult male (BNHS 1788). This specimen differs from holotype in having a lower number of femoral pores, 15 on either side with a gap of six scales. In BNHS 1737 and 1740 supralabials (to midorbital position) 10 (right)- 10 (left); supralabials to angle of jaw 12 (right)- 12 (left). In BNHS 1741 supralabials (to midorbital position) 9 (left)- 11 (right); supralabials to angle of jaw 10 (right)- 12 (left). A adult female paratype (BNHS 1741) subdigital scansors 10–10–11–10–11 (right manus), 9–11–12–12–11 (right pes).

Distribution.– At present this species is only known from the type locality which is in the northern parts of the Western Ghats region of Maharashtra (Fig. 7). The northern Western Ghats, which pass through Goa, Maharashtra and part of the Gujarat state, lie roughly between 72° 50'E to 74°40'E and 15°00'N to 20°15'N. The forest in the Western Ghats south of Goa (20°N latitude) is of wet-evergreen type and changes as one moves northwards. In the northern Western Ghats the forest is of semi-evergreen and deciduous type. Along with the forest types the ecological conditions also changes. The northern areas have a longer dry season with moderate rainfall (ca. 2,500 mm annually). A number of peaks in the Maharashtran part of the Western Ghats rise over 1,200 m asl, the tallest being Kalsubai (1,640 m). Unlike southern parts of the Western Ghats of Maharashtra, the type locality is mainly composed of flat-topped hills with steep high basalt cliffs with forest at their base. This is a common feature of the northern part of the Western Ghats in Maharashtra, especially in the Pune and Nasik districts.

Natural history.– The holotype and paratypes were caught late at night (0120 h) on rocky cliffs (Fig. 1). We had also seen about 10 additional specimens in the same area. *Hemidactylus aaronbaueri* sp. nov. seems to be the commonest species at the type locality. All specimens were seen on rock cliffs, ca. 1–7 m above ground. They are nocturnal and actively move on rocky cliffs, and were seen feeding on grasshoppers at 2430 h. Juveniles were observed in syntopy with the adults, and the types were found sympatrically with *H.* cf. *brookii.* Red coloured ectoparasites were observed on all live individuals.

DISCUSSIONS

The Indian *Hemidactylus* is one of the least studied groups of squamates and their relationships remain largely uncertain. Though Carranza and Arnold (2006) have established patterns of relationships among several major groups within the genus, but their study did not sample heavily from tropical Africa (Bauer et al., 2006). This is also true for the Indian species. The type specimens range in size from 77–128 mm and this indicates that this is one of the largest *Hemidactylus* in mainland India. Based on its superficial resemblance, large size, overlapping numbers of digital scansors, supralabials and femoral pores *H. aaronbaueri* sp. nov. may be allied to *H. giganteus*.

Ten morphometric variables were compared between type series of *H. aaronbaueri* sp. nov. and *H. giganteus* (two males and three females) to test the null hypothesis that the two species are morphometrically indistinguishable. Using a Student's *t*-test, snout-vent length and trunk length were not significantly different, but the eight remaining variables were (Table 2) thus supporting the alternate hypothesis that the two species are morphometrically dissimilar. Principal Component Analysis (PCA) was also performed on the eight variables found to differ between the species. The first two Principal Components explained 83% of the total variance in the data. On plotting the PC scores of each of the specimens on these Principal Axes, a clear difference between the morphometrics of the two species could be observed (Fig. 6).

Hemidactylus aaronbaueri sp. nov. is currently known only from the type locality in the northern Western Ghats of Maharashtra. *H. giganteus* is reportedly a widely distributed species and has been recorded from Andhra Pradesh,

Karnataka, Maharashtra, Kerala, Chhattisgarh and Tamil Nadu (Giri et al. 2003). In Maharashtra, *H. giganteus* has been reported from Pandava Caves, Kolaba District (Soman, 1966) and Ozar, Nasik District (Chopra, 1968). The related specimens are not traceable. Fresh material from these two localities needs to be examined to determine if indeed the geckos found here are *H. giganteus*, or actually *H. aaronbaueri* sp. nov. Apart from this, there are four *H. giganteus* specimens (BNHS 1259/1–4) in the collection of the BNHS which were from Siraucha, West Chanda, Maharashtra (Giri et al., 2003). There is one more specimen from Yawal Wildlife Sanctuary in Jalgaon district (BNHS 1590). Both these localities are in the Satpura Range, which is separated from the Western Ghats by ca. 200 km. The present known distributional range of these species in Maharashtra do not overlap. More surveys need to be undertaken to determine if the two species are sympatric.

The herpetofauna of northern Western Ghats, especially the parts in Maharashtra, is poorly known (Giri et al., 2003). With its varied habitat features this region supports unique, though not rich diversity of amphibians and reptiles. In the recent past three new species of caecilians have been discovered from this region with little effort (Giri et al., 2003; Ravichandran et al., 2003, Giri et al., 2004). Thus with intensive and systematic surveys it is possible to enhance knowledge of reptiles of the northern Western Ghats. In Maharashtra, there are excellent examples of the northern extremity of the richer forests of the Western Ghats, but here the forest is more fragmented and is increasingly degraded by human exploitation (Rodgers and Panwar, 1988). The discovery of a new, large rock-dwelling species of *Hemidactylus* adds to the body of knowledge on the region's diversity of herpetofauna. Although the new species is being reported from a single locality, its habitat preference suggests that it may be present in other regions of the northern Western Ghats, and therefore highlights the need for more intensive surveys to document the region's biodiversity.

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A HERPETOFAUNAL COLLECTION FROM THE CHITTAGONG HILL TRACTS, BANGLADESH, WITH TWO NEW SPECIES RECORDS FOR THE COUNTRY

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(with 20 text-figures)

ABSTRACT.- **A herpetofaunal survey was conducted at a relatively disturbed area in Milonchari, central Chittagong Hill Tracts. A total of 24 species (11 frog, nine lizard and four snake species) from 21 different genera, were documented. Of these, at least two lizard species are new records for Bangladesh. One of these, *Lygosoma lineolatum*, was previously considered a Myanmar endemic. The second species, *Hemidactylus garnotii*, is widely distributed in south-east Asia and north-east India. Of the remaining species, three (*Calotes* cf. *versicolor*, *Microhyla* cf. *berdmorei* and *Xenophrys* cf. *parva*) have been tentatively assigned to their closest described relatives which themselves are species complexes. Most species found during this study are of south-east Asian affinities, and all but two- *Microhyla* cf. *berdmorei* and *Cyrtodactylus* sp.- are considered primarily associated with anthropogenically modified habitats.**

KEY WORDS.- **Reptile, amphibian, Chittagong Hill Tracts, Bangladesh, *Lygosoma, Xenophrys, Microhyla, Cyrtodactylus, Hemidactylus, Boiga, Kaloula.***

INTRODUCTION

The Chittagong Hill Tracts are situated in south-eastern Bangladesh and is the only true mountainous region in the country. These mountains run in a north to south direction forming parallel ridges with deep narrow valleys. This hill range continues north to form the hill ranges of Tripura and extend south to the coast in the western Rakhine District of Myanmar. In the east it is directly connected to the Mizo Hills of Mizoram, India and the Chin Hills of Myanmar. The highest elevation in Bangladesh occurs in the Chittagong Hill Tracts, Tahjindong (also referred to as Bijoy or Mowdok Mualat) at 1,003 m asl. The habitat of this area, until fairly recently, consisted of mixed semi-evergreen and bamboo forests. Most of this habitat has now been cleared by anthropogenic activities such as logging and jhum (slash and burn) farming. However, small isolated patches of natural forests still remain.

To date, little published material exists on the herpetology of Bangladesh. Most of these consist of anecdotal reports in non-peer reviewed journals. For most of the remaining publications, specimen numbers are rarely supplied and locality, or even photograph voucher are not mentioned in the papers.

Without such basic reference material, it becomes virtually impossible to assess which species are actually present and what is their distributional range. In a small country such as Bangladesh, with a growing population approaching 150 million people, it becomes obvious that any species that is generally not found in anthropogenically modified habitats should be considered to be confined to relatively small and most likely isolated populations. For this reason, the need for detailed information on such localities becomes far more significant than a checklist for an entire political division,

for which many of the species listed would certainly not be considered widespread. Adding to this, many of these localities are under increasing stress from encroachment and are themselves rapidly being cleared of original habitat thus strengthening the need for accurate locality details to establish whether previously known populations of less adaptable species still exist.

With regards to more recent publications on herpetofauna in the Chittagong Division, Khan (2004) provided a checklist of herpetofauna of Bangladesh, which includes species reported present in the Chittagong Division. However, this paper did not refer to Asmat et al. (2003), therefore excluding several amphibian species previously reported in their checklist of amphibians of Chittagong and Chittagong Hill Tracts. Neither paper provided actual localities, specimen numbers or even photographs, thus allowing external verification of specimen identities virtually impossible. The most recently published paper (Khan, 2007) described two new country records of skinks found in Chittagong, namely *Scincella reevesii* and *Sphenomorphus indicus*, based on photographs and general descriptions. Unfortunately, the photograph referred to as *Scincella reevesi* is applicable to the species here referred to as a male *Sphenomorphus maculatus* (Fig. 15). Several specimens collected during this survey show no morphological differentiation from Thailand specimens described by Taylor (1963). The most notable difference of these Bangladesh specimens from true *S. reevesi* is the lack of transparent disc on the lower eyelid and the widely separated prefrontals, as opposed to presence of transparent disc and prefrontals in contact or narrowly separated. The second species mentioned in this paper is *Sphenomorphus indicus*. Unfortunately the photo depicting this specimen is obviously that of a juvenile *Eutropis macularia*. Although both *Scincella reevesi* and *Sphenomorphus indicus* are likely to be present in Bangladesh, we propose that both species be removed from the countries checklist until specimens of verified identity are found.

MATERIALS AND METHODS

From 14–16 July 2006, a three member team consisting of the two authors and a field assistant surveyed at Milonchari, ca. 8 km from Bandarban district city in the central foothills of the Chittagong Hill Tracts. The first author continued the survey until 20 July 2006. Due to a shortage of time and manpower, only three sites were selected for a visual encounter survey. Site 1 was the Hillside Resort compound. Site 2 was a stream directly down hill from the Hillside Resort, which extends as far as the Sangu River. Site 3 is a medium sized, primarily monoculture teak plantation situated 200 m uphill from the Hillside Resort compound. All three sites were surveyed during daylight and night surveys were carried out only at sites 1 and 3.

Site 1 (22°10N, 92°13E; 150 m asl): This area primarily consists of mature semi deciduous tree growth. Most areas of dense "weed" growth between trees are regularly cut. At ground level, a varying degree of disturbance occurs such as lawn areas, ornamental planting and a small vegetable patch. At the southern boarder lies a small, narrow, fast flowing stream, which at one point is used to fill two small concrete reservoirs. The banks of this stream have the only remaining patch of original vegetation, and form a closed canopy. Directly opposite (but not connected) to the stream is a medium sized, mostly stagnant pond surrounded by grasses and thick bushy vegetation.

Site 2 (ca. 500 m from Site 1): At this site runs a second, small, slower stream lower in the Sangu River valley. Both sides of the upper portion are bordered by rice paddies, with a small isolated patch of mature semi-evergreen forest at the high water mark where it meets the Sangu River. The river was still quite low at the time of sampling, exposing wide mud banks at either side. The upper portions of these mud banks were utilized for agriculture.

Site 3 (ca. 200 m from Site 1): This site was primarily a monoculture teak plantation on relatively steep hill slopes. The hilltop has a small forest clearing containing mostly dry twigs and branches and some log piles. This site also contains another slightly larger fast flowing stream under a closed canopy. As with Site 1, this stream is bordered by mostly original forest vegetation.

Specimens collected were photographed live before euthanasia, fixed for ca. 24 h in 10% formalin and preserved in 70% ethanol. These specimens are deposited at Department of Zo-

ology, Jahangirnagar University, Savar, Dhaka Division, Bangladesh. Specimen numbers mentioned in the following text are in brackets (e.g., JU 0042). Digital images of new country records were also deposited at Zoological Reference Collection (collection of images), Raffles Museum of Biodiversity Research (ZRC [IMG]), for external verification.

Equipment used during this survey include Sony DSC H1 digital camera, Olympus W10 digital sound recorder, dual in/out digital thermometer/hydrometer (accurate to 0.1°C and 0.1% humidity) and slide calipers (accurate to 0.02 mm) for measurements. All measurements, where mentioned are in millimeters, abbreviations are; SVL – snout to vent length, ToL – total length, N = total number of specimens measured. Anuran nomenclature follows Frost et al. (2006).

SPECIES ACCOUNTS

Duttaphrynus melanostictus (Schneider, 1799)

Bufo melanostictus J. G. Schneider. 1799. Hist. Nat. Amph.:216.

Site 1: This was the most common frog species at this site. All sizes were found from newly metamorphosed juveniles to adults (largest female SVL 110 mm). Every evening from 1900 h until after 2300 h (23–27°C, 92–99% humidity) males could be found calling sporadically from around the pond and both reservoirs, however, at least at the pond, males were gathered in large numbers to ca. 6 m from the edge. Males stopped calling immediately under torchlight. Spawn was found on only one occasion in a slower flowing pool of the stream. Tadpoles of mostly earlier stages of development (Gosner 24–25) were found in both reservoirs. Two metamorphs were also found close to the reservoirs. During observation, one was predated by red ants. Females, sub-adults and juveniles were found after sunset, mostly around human habitations and artificially lit paths. All males had distinctly yellow colouration on their gular region with no other obvious dorsal colour differences related to breeding condition (e.g., males of southern India have golden dorsal colouration during breeding season).

Euphlyctis cyanophlyctis (Schneider, 1799)

Rana cyanophlyctis J. G. Schneider. 1799. Hist. Nat. Amph.:137.

Site 1: Adults of this species were found only at the pond during both day and night surveys. Males would call sporadically during the day and in chorus from dusk onwards. Call recordings correspond well to those recorded from other localities in Bangladesh and India.

Fejervarya sp. (large; SVL 41.0 mm, n = 1)

Site 2: Juveniles to adults were found to be abundant along the edges of rice paddies. Tadpoles were also found in such areas, and were up to midstages of development (Gosner's Stages 24–36). No night survey was carried out in this area to assess whether breeding activity was occurring.

Fejervarya sp. (small; SVL 28.5 mm, n = 1)

Site 1: Three adult males were found, all within 1 m from the pond edge between 1830–2100 h (23°C, 99% humidity) during light rain. All three males were sporadically calling and were the only individuals calling that evening. These specimens differed from the above *Fejervarya* sp. (large) in size, dorsal fold shape and arrangement.

Note: *Fejervarya limnocharis* was considered possibly restricted to Indonesia (Dubois, 1984) pending taxonomic revision of the genus. Therefore, all *Fejervarya* assigned to the species *limnocharis* from mainland Asia should be considered a complex of cryptic species. In Bangladesh, the *limnocharis* complex represents 3–5 similar species that will be discussed in detail elsewhere (Mahony, in prep.)

Hoplobatrachus tigerinus (Daudin, 1803)

Rana tigerina F.-M. Daudin. 1803. Hist. Nat.:64; Pl. XX.

Site 1: One juvenile was found at 1950 h (27°C, 88% humidity) crossing a narrow path. The path was bordered by freshly cut grass/weeds in an otherwise mostly closed canopy patch of trees. One adult was also observed on the tarmac road outside the compound. No males were heard calling during this survey.

Sylvirana sp.

Site 3: One individual was seen briefly at 1815 h, on an inaccessible area of the stream bank, for which reason it could not be caught or photographed for accurate identification. It su-

perficially resembled a sub-adult *S. leptoglossa*. No other specimen could be collected despite intensive searching of the surrounding area, to confirm its identity.

Kaloula pulchra Gray, 1831

Kaloula pulchra J. E. Gray. 1831. Zool. Misc., Part 1:38.

Site 1: One adult and two juveniles were found on paths next to artificial light sources between 2000–2200 h (25ºC, 99% humidity), immediately after light rain showers. All were actively foraging.

Site 3: One juvenile was found at 2215 h, ca. 70 cm up a 20 cm (breast height) diameter, vertical tree trunk. The tree was situated on the edge of a trail within the teak plantation.

Microhyla cf. *berdmorei* (Blyth, 1856)

Engystoma (?) *berdmorei* E. Blyth. 1856 "1855". Proc. Asiatic Soc. Bengal 24:720.

(JU 0051, SVL 25.4; JU 0052, SVL 23.0).

Site 1: A group of three adult females were found at 2130 h in a seldom-disturbed area of the compound. This small area consists of closed canopy trees under which lie some low vegetation patches on an open leaf litter floor. These three females were all found within < 4 m from each other in the open, on leaf litter. No other individuals were found throughout the remaining area of this apparently homogenous leaf litter floor. The authors have also observed this grouping behavior in females of this species from other sites in Bangladesh. No water bodies for breeding or obvious localized feeding benefits were found near such groups.

Site 3: One male was found on leaf litter high on the bank of the stream at 1800 h. No calling males were heard at this site.

Note: The identification of this species remains tentative as it does not conform morphometrically to true *M. berdmorei* from south-east Asia. This species is most similar to one currently being described from north-east India (M. Firoz Ahmed, in prep.)

Microhyla ornata (Duméril and Bibron, 1841)

Engystoma ornatum A.-M.-C. Duméril & G. Bibron. 1841. Erp. Gen. 8:745.

Site 1: Many males were found calling in chorus within 4 m from the edges of the pond between 1900–2200 h (25ºC, 92–99% humidity), during light rain. All males called from concealed positions in the grass, each spaced ca. 50 cm from the next. Only one female was found at this site at the edge of the pond. All adults have a dark reddish-brown colouration, which changes to greyish-brown during the day. Call structure and frequency matches all other populations of *M. ornata* recorded in Bangladesh and northeast India.

Site 2: Tadpoles of a *Microhyla* sp. were found in large numbers in the rice paddies. These tadpoles superficially resemble and behave like *M. ornata* tadpoles found at several other locations in Bangladesh and India. No adults were found at this site.

Polypedates leucomystax (Gravenhorst, 1829)

Hyla leucomystax J. L. C. Gravenhorst. 1829. Delic. Mus. Zool. Vratislav. 1:26.

Site 1: Calling males were found around the pond in dense bushy vegetation at 1–4 m from the edge. All were calling from concealed positions. The recorded call matches those from populations of this species from Bangladesh and other areas of north-east India. Calling began from 1850 h until after 2300 h (23–27ºC, 92–99% humidity), regardless of the occurrence of rain during the evening or daytime. No calls were heard from the adjacent stream.

Xenophrys cf. *parva* (Boulenger, 1893)

Leptobrachium parvum G. A. Boulenger. 1893. Ann. Mus. Civ. Stor. Nat. Genova, Ser. 2, 13:344.

Site 1: A female (JU 0042) and a male (JU 0043) were found during the daytime concealed within clumps of dead vegetation on the banks of the stream. One additional male (JU 0044) was collected at night from the same stream. Males could be heard every night, regardless of whether it rained or not during the day or evening. Individual males call from along the stream spaced ca. 10 m from the next, perched on vegetation at a height of < 1 m. Many tadpoles were observed in groups in slower, shallow (1–5 cm deep) parts of the stream, at various stages of early development (Gosner stages 24–25). Tadpoles were identified by their large funnel shaped mouthparts and surface feeding habits, a unique characteristic shared among

members of *Xenophrys* and several other closely related Megophryidae genera. When disturbed, tadpoles regularly leap from the water onto wet rock surfaces where they cling for several minutes. No mating behavior or spawn was found despite rigorous searching.

Note: These specimens also differ morphometrically from those published from Thailand (Taylor, 1962), Assam, and Meghalaya (Chanda, 1994). After the examination of several literature sources, most containing considerable morphometric variation with minor variations of colour, pattern and morphological features, it seems that *X. parva* most likely represents a complex of several species. Further work is currently in progress regarding the taxonomy of this Bangladesh population (Mahony, in prep.). *Xenophrys parva* has been previously reported to occur in Bangladesh (Asmat et al., 2003). As is typical, no specimens, photographs or specific localities were described in the text to allow comparison, therefore it is assumed likely that such reports refer to the species found during this survey.

Cosymbotus platyurus (Schneider, 1792)

Stellio platyurus J. G. Schneider. 1792. Amphib. Physiol. Spec. Hist:30.

Site 1: This species was found to be most common on trees and wooden lamp posts close to artificial light sources, within the resort compound. Some individuals were also found on inside walls of buildings. External wall surfaces were mostly dominated by *H. frenatus*. Only adults and sub-adults were found.

Cyrtodactylus sp.

Site 3: One adult male (SVL 54 mm) was found active at 1850 h, at the edge of the forest clearing bordered by primary forest growth. The specimen was found at ground level on dried vegetation. Unfortunately, by morning, the specimen was found killed and mutilated by ants (Fig. 9). No other individual was found during this survey.

Note: The specific identification of this specimen cannot be determined as many distinguishing characters (head scalation and pore number and structure) were destroyed by ants. Otherwise, it fits the description of *C. ayeyarwadyensis* Bauer (2003) in general pattern and morphology (e.g., slender bodied, short digits, etc.). However, typical adult male *C. ayeyarwadyensis* are considerably larger than this specimen (SVL 62.1–67.6 mm). Previously only *Cyrtodactylus khasiensis* has been reported for Bangladesh (Ahsan, 1998). This specimen differs from typical *C. khasiensis* observed in Assam and Tripura, north-eastern India, in both size and pattern. A larger sample size of this population is required to obtain distinguishing morphological details thus allowing identification to specific level.

Gekko gecko (Linnaeus, 1758)

Lacerta gecko C. Linnaeus. 1758. Syst. Nat. 10th edn. 1:205.

Site 1: Adults were commonly found in all buildings of the resort compound. Some individuals were also observed and heard calling from trees during both day and night. Found to be preying on *Cosymbotus platyurus* in one building as all had missing tails and one was observed with bite marks on the body, corresponding in jaw size and shape with the resident adult *Gekko gecko*.

Site 3: Individuals were only heard calling from high in the trees of the primary forest patch, next to the stream.

Hemidactylus frenatus Duméril & Bibron, 1836

Hemidactylus frenatus A.-M.-C. Duméril & G. Bibron. 1836. Erp. Gén. 3:366.

Site 1: Sub-adults to adults were abundant on and in many buildings. Territorial vocalizations were heard day and night. Dominant males were observed chasing off intruders of *Hemidactylus frenatus* and *Cosymbotus platyurus* from prime feeding locations around lights. Also found sympatric with *H. garnotii* and *G. gecko* on the same walls.

Site 3: One sub-adult was found in the forest clearing among dry twigs and vegetation. Sympatric species at this locality were *Calotes* cf. *versicolor, Cyrtodactylus* sp., *Eutropis macularia* and *Lygosoma lineolatum*.

Hemidactylus garnotii Duméril & Bibron, 1836

Hemidactylus Garnotii A.-M.-C. Duméril & G. Bibron. 1836. Erp. Gén. 3:368. (ZRC [IMG].2.3)

Site 1: This species appears to be rare in this area, as only one female was found on the wall

of a bungalow. As can be seen from Fig. 11, it was carrying a pair of eggs. This species is considered parthenogenetic as females reproduce without mating. No males of this species have been found throughout its geographic range. *H. garnotii* was previously unrecorded for Bangladesh. Its closest known population is in neighboring Mizoram (Pawar and Birand, 2001) and has been reported from Sikkim, West Bengal (Darjeeling), and Assam (Sibsagar) in India, Myanmar, south-east Asia and southern China (Smith, 1935).

Eutropis macularia (Blyth, 1853)

Euprepes macularius E. Blyth. 1853. J. Asiatic Soc. Bengal 22:652.

(female JU 0045; male JU 0046)

Site 1: Juveniles and adults were commonly found on and around a patch of dried cut vegetation next to a small vegetable garden.

Site 2: Some adults were found around a patch of dense bush between the stream and a rice paddy.

Site 3: Many individuals, juveniles and adults, were found in the forest clearing amongst dead branches and other dry vegetation.

This species was easiest to catch after sunset, using torchlight, when they were found fleeing from disturbed refuges. All mature males had vivid orange/red areas on the lower lips and lower flanks indicative of breeding colouration.

Lygosoma lineolatum (Stoliczka, 1870)

Riopa lineolata F. Stoliczka. 1870. Proc. Asiatic Soc. Bengal 1870(4):105. (ZRC [IMG].2.4)

Site 1: One sub-adult found during the day at the same location as *E. macularia* mentioned above. Sub-adults have pinkish/red tail colouration.

Site 3: One sub-adult and one adult were found after sunset at the same location as *E. macularia* mentioned above. The adult tail colouration matches that of the rest of the body. When threatened, it moves in a serpentine motion through leaf litter. *Lygosoma lineolatum* is previously only known from Myanmar (including Pegu, Moulmein, Martaban, Rangoon, Prome, Pyinmana, North Chin Hills, Dawna Hills, Minhla) (Smith, 1935) and previously not recorded for Bangladesh.

Sphenomorphus maculatus (Blyth, 1853)

Lissonota maculata E. Blyth. 1853. J. Asiatic Soc. Bengal 22:653.

Site 1: An adult male and a female were found crossing a path next to a bungalow within a closed canopy portion of the compound. Substrate surrounding the path consists primarily of leaf-litter with some patches of ornamental plants.

Site 3: One juvenile was caught active on leaf-litter at 1820 h (just after sunset), in the patch of a primary forest 1.5 m from the stream.

Males all showed orange colouration from the superlabials to the insertion of the forelimb, indicative of breeding condition. This orange colouration was absent in females.

Calotes cf. *versicolor* (Daudin, 1802)

Agama versicolor F.-M. Daudin. 1802. Hist. nat. Rept. 3:395; Pl. XLIV.

(JU 0047)

Sites 1 and 2: This species could be found in all disturbed areas receiving direct sunlight. Juveniles and adults were found from ground level to 2 m height on grass and bushes. At night, an adult was found sleeping on a tree branch at 4 m height.

Site 3: Only juveniles and sub-adults were found in the forest clearing on piles of dried twigs and branches, just above ground level. These were most easily caught at night when they would be found sleeping on the extremities of small twigs. No individuals were found in any of the original or primary habitats at any of the three sites.

Note: This population of *C.* "*versicolor*" is morphologically different from the *C. versicolor* examined from Pondicherry and Chennai, southern India. *C. versicolor* has been considered a species complex (Zug et al., 2006).

Boiga ochracea cf. *walli* Smith, 1943

Boiga ochracea walli M. A. Smith. 1943. Fauna British India 3:349.

Site 1: One juvenile was found at 2220 h actively foraging at the base of a banana tree at the same habitat shared by the *Lygosoma lineolatum* and *Eutropis macularia* (see above). This individual was moving through the grass and leaf litter at ground level. This this specimen was kept in captivity for several weeks,

Figure 1. *Duttaphrynus melanosticus*. Female.

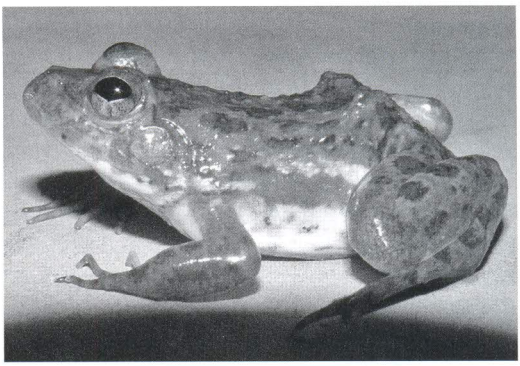

Figure 2. *Euphlyctis cyanophlyctis*. Male.

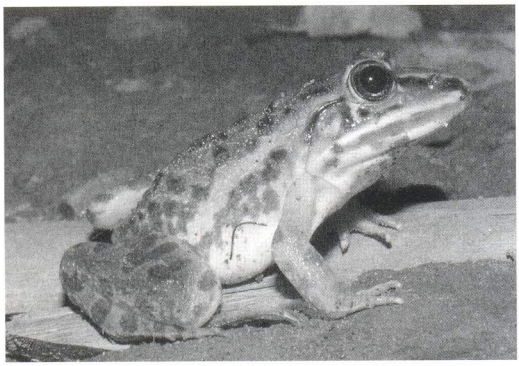

Figure 3. *Hoplobatrachus tigerinus*. Juvenile.

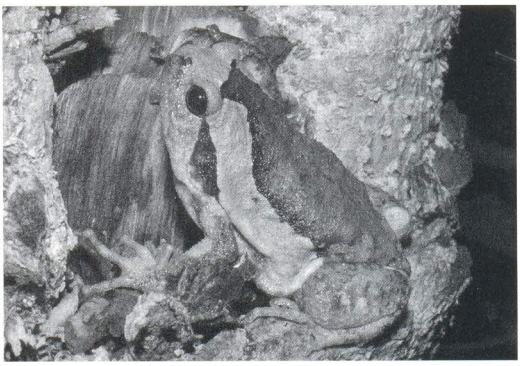

Figure 4. *Kaloula pulchra*. Subadult.

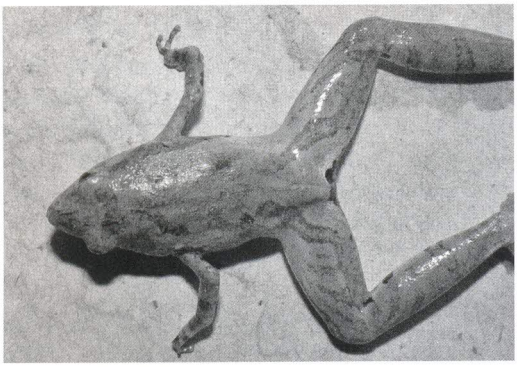

Figure 5. *Microhyly* cf *berdmorei*. Male.

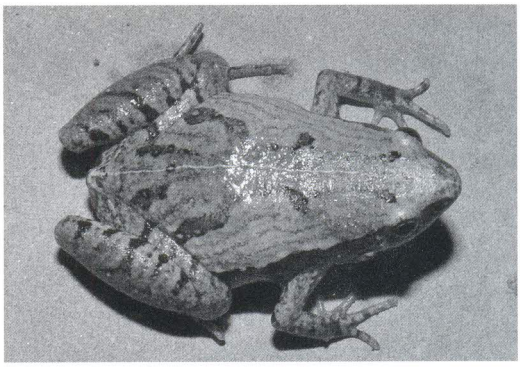

Figure 6. *Microhyla ornata*. Male.

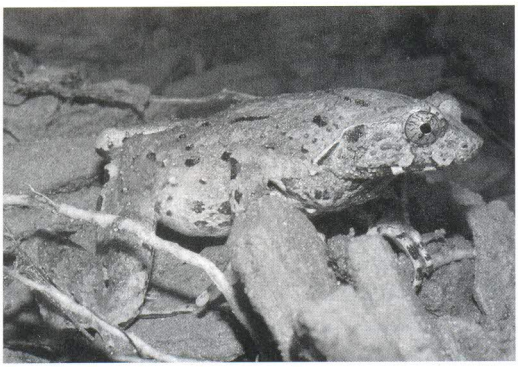

Figure 7. *Xenophrys* cf. *parva*. Female.

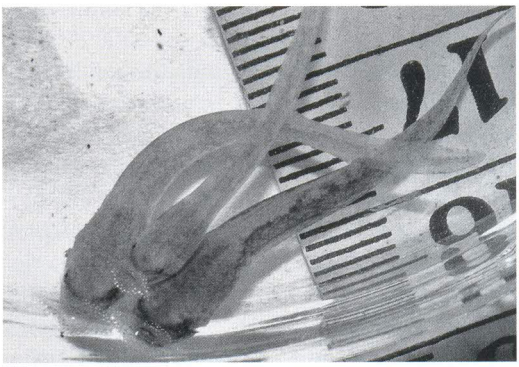

Figure 8. *Xenophrys* cf. *parva*. Tadpoles.

Figure 9. *Cyrtodactylus* sp. Male.

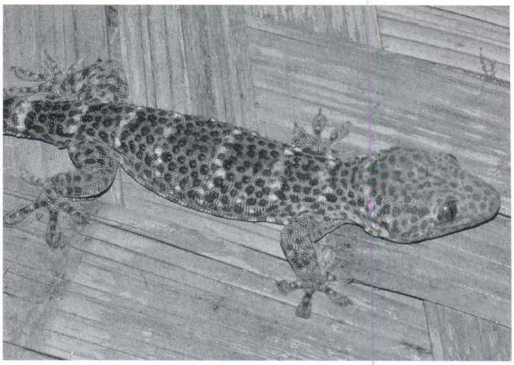

Figure 10. *Gekko gecko.* Adult.

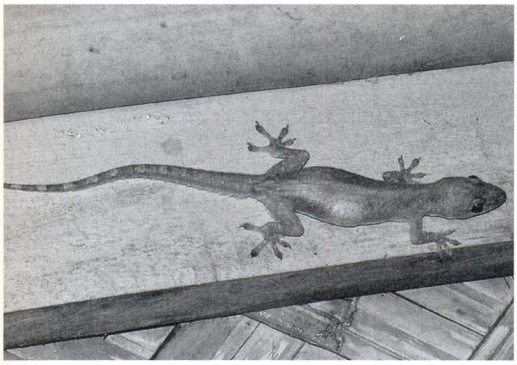

Figure 11. *Hemidactylus garnotii.* Female.

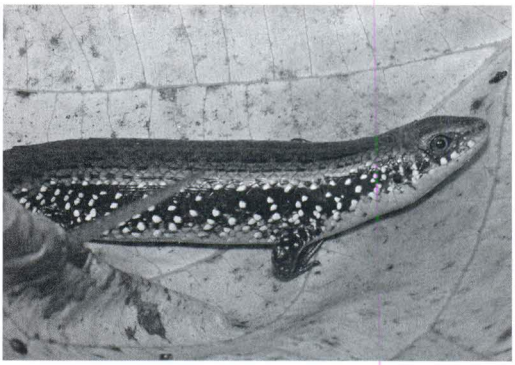

Figure 12. *Eutropis macularia.* Male.

Figure 13. *Lygosoma lineolatum.* Adult.

Figure 14. *Sphenomorphus maculatus. Female.*

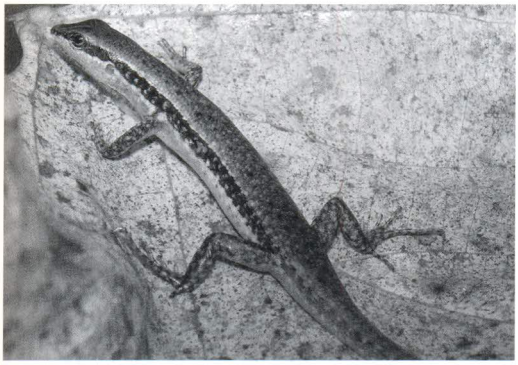

Figure 15. *Sphenomorphus maculatus.* Male.

Figure 16. *Calotes* cf. *versicolor.* Adult.

Figure 17. *Boiga ochracea* cf. *walli.* Juvenile.

Figure 18. *Coelognathus radiatus.* Adult.

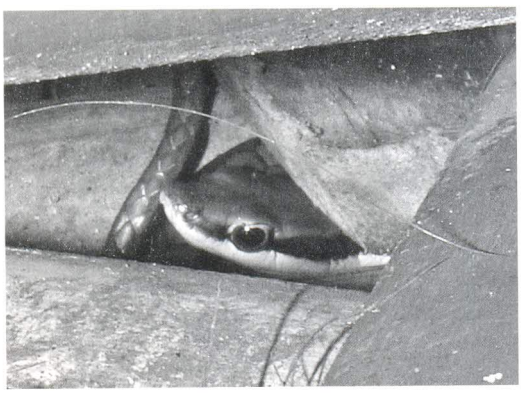

Figure 19. *Dendrelaphis pictus*. Adult.

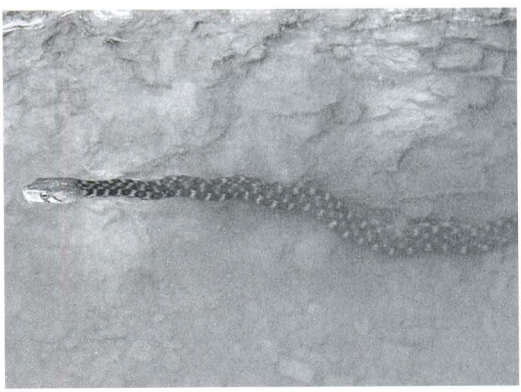

Figure 20. *Xenochrophis piscator.* Subadult.

and fed on two juvenile or one sub-adult *Hemidactylus frenatus* every second night. When caught, the gecko was held in the back of the mouth and chewed. Even the largest food item would be completely immobilized within 40 sec of capture. No constriction was observed during feeding. The genus members of *Boiga* are rear fanged and this species is considered mildly venomous to humans.

Currently, 2–3 subspecies are considered valid. Smith (1943) described the subspecies *Boiga ochracea walli* ("Burma" = Myanmar) as having 19 midbody scale rows, as opposed to the 21 scale rows of the subspecies *B. o. ochracea* (north-east India). The specimen collected from Bandarban better fits the description of *walli* with 19 midbody scale rows.

Coelognathus radiatus (Reinwardt in: Boie, 1827)

Coluber radiatus J. T. Reinwardt in: F. Boie. 1827b. Isis (von Oken) 20(6): column 536.

Site 1: An adult was found between the horizontal corrugated metal sheets forming the roof of a small maintenance shed within the compound. Next to it were two recently killed (presumably the snake), mid-sized rats. Upon attempt to capture, it fled quickly at ground level for ca. 100 m before escaping through an area of dense vegetation. The following day, the snake was observed in the process of swallowing a freshly killed rat. It quickly regurgitated the rat and attempted to flee prior to being caught. As is typical for this species, it was aggressive when cornered and would move towards the potential aggressor in a high striking position, biting repeatedly.

Dendrelaphis pictus (Gmelin, 1789)

Coluber pictus J. F. Gmelin. 1789. Syst. Nat. 1(3):116.

Site 1: Two individuals of this species were encountered. One was rapidly fleeing on the ground across an open patch of cut grass to a

thicket of bush and small trees. The second was mostly concealed in a space between bamboo structures of the authors' stilted bungalow balcony (Fig. 19). This position is at ca. 5 m above ground. On attempt of capture, it escaped by dropping from the balcony into thick vegetation.

Xenochrophis piscator (Schneider, 1799)

Hydrus Piscator J. G. Schneider. 1799. Hist. Amphib. 1:247.

Site 1: Many sub-adults and adults were found primarily in the concrete water reservoirs after sunset.

Site 2: Two sub-adult individuals were found along the stream. One was resting on the surface of a narrow, slow moving portion of the stream in direct sunlight. The second was found on rocks at the base of a small waterfall. It was apparently catching small fish or shrimp that were thrown onto the rocks in the splash zone. When disturbed, it fled into the water and swam some 10 m down stream. Within 20 min, it had returned to exactly the original position. When disturbed a second time, it temporarily swam off before returning to the same spot within 2 h.

DISCUSSIONS

This short survey produced 24 species of herpetofauna, of which two species are new records for Bangladesh- *Hemidactylus garnotii* and *Lygosoma lineolatum*. Both species are primarily inhabitants of the south-east Asian subcontinent with *L. lineolatum* formerly considered endemic to Myanmar. Other species associated primarily with the south-east Asian subcontinent are *Kaloula pulchra*, *Microhyla berdmorei*, *Polypedates leucomystax, Cosymbotus platyurus*, *Gecko gekko*, *Sphenomorphus maculatus*, *Boiga ochracea*, and *Coelognathus radiatus*. Primarily Indian subcontinent species are *Euphlyctis cyanophlytis* and *Hoplobatrachus tigerinus*. The remaining species *Duttaphrynus melanostictus*, *Microhyla ornata*, *Hemidactylus frenatus*, *Eutropis macularia*, *Calotes versicolor*, *Dendrelaphus pictus*, and *Xenocrophis piscator*, all have considerable distributions on both subcontinents. Of these, *M. ornata* and *C. versicolor,* at least, are considered to be species complexes, consisting several similar but genetically distinct species. *Xenophrys parva* is another species that requires taxonomic work. The widely distributed *E. macularia* may represent a species complex, and several subspecies have been described from Thailand (Taylor, 1962), that may warrant specific recognition or synonymy. Further chromosomal and genetic investigations (Ota et al., 2001, Mausfeld and Schmitz, 2003) proved the existence of additional cryptic species from Thailand and Myanmar, however, to date, a Bangladesh sample has not been available for study.

For the species that were tentatively or not identified in this paper, the newly elevated genus *Sylvirana* (Dubois, 1992) and *Xenophrys* (Günther, 1864), are primarily dominated by south-east Asian and Chinese species. *Cyrtodactylus* (Gray, 1827) is another south-east Asian genus and currently *Fejervarya* (Bolkay, 1915) is dominated by Indian species. For *Fejervarya* at least, there is a large amount of work to be done on the *F. limnocharis* complex that most likely consists of a large number of yet undescribed cryptic species.

Biogeographically, the dominance of south-east Asian genera in this area may be due to the raising and lowering of sea levels during the Pleistocene (Zug et al., 2006), which most likely provided a lowland bridge at the southern extremity of the Indo-Myanmar mountain range. This lowland bridge would have allowed the movement of many south-east Asian species into Bangladesh and vice-versa. The apparent lack of Indian dominant species in this area may be due, in part, to the presence of the Brahmaputra River further west in Bangladesh which may form an important biogeographical barrier to the eastern expansion of certain species, the extent of which is presently difficult to assess due to lack of knowledge on confirmed species ranges in Bangladesh.

Most of the species found during this study are primarily species associated with or adaptable to anthropogenically modified habitats. The exceptions being *Microhyla* cf. *berdmorei* and *Cyrtodactylus* sp., both of which were only found in or directly next to less disturbed forest patches that most closely resemble the original habitat of the region. With this in mind, it should be assumed that many more of these less adaptable forest species may be confined to some small isolated forest patches in the surround-

ing area, or are possibly even locally extinct. However, much more field research is required in the Chittagong Hill Tracts, of both disturbed and undisturbed habitats to assess the true herpetological diversity of this area. As much of the original forest habitat in the Chittagong Hill Tracts of Bangladesh has now been cleared, a higher emphasis must be made for conserving what little remains.

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TRACKING *CUORA MCCORDI* ERNST, 1988: THE FIRST RECORD OF ITS NATURAL HABITAT; A RE-DESCRIPTION; WITH DATA ON CAPTIVE POPULATIONS AND ITS VULNERABILITY.

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(with 25 text-figures)

ABSTRACT.– **After an overall perspective supporting the validity of *Cuora mccordi* as a species, results of three partially successful Guangxi Province field trips by the authors, in search of the species are given. Surveys of turtle farms in five provinces and Shanghai uncovered many forms of hybrids, but only one non-breeding pair of *C. mccordi.* Habitat is hilly terrain at 50–150 m elevation, usually amongst bamboo in the vicnity of streams. Detailed morphological description of the species is presented, the known maximum carapace length being 18.4 cm. We also discuss ontogenetic changes in the keels and the unique colouration of the head, shell and soft parts, followed by the present status of *Cuora mccordi* both in captivity and in the wild, with recommendations for conserving the species.**

KEYWORDS.– **Testudines, Geoemydidae, *Cuora mccordi*, Guangxi, China.**

INTRODUCTION

Cuora mccordi was described by Ernst (1988), based on a series of 12 specimens collected in the early 1980's. All specimens were derived from the Hong Kong turtle dealer, Oscar Shiu. They were reported to have been purchased from locals near the city of Baise/Bose/ Paise in south-western Guangxi Province, China, close to the border of Yunnan Province, China. The locals claimed to have collected them in the surrounding "Highlands" of that city. Subsequent visits by non-Chinese-speaking turtle researchers (Artner, 1998, 2006; Auer, pers. comm.; Petras, pers. comm.; Hou, pers. comm.; Blanck, pers. obs.) to the area did not produce any specimens from the wild, nor where locals found in the city of Baise familiar with the species, leading these researchers to doubt the existence of the species in this area.

McCord and Iverson (1991) amended Ernst's locality of origin of the species to "in Yunnan Province, west of Paise, Guangxi Province", again according to Oscar Shiu; but field research in this vicinity has yet to confirm this, so the origin of the species remained a mystery since its first appearance a quarter of a century ago.

Speculation (e.g., Parham et al., 2001; Artner, 2003, 2006) arose during this time, that *C. mccordi* was possibly a hybrid between *Cuora trifasciata* (Bell, 1825) or *Cuora cyclornata* (Blanck et al., 2006; a name disputed in addendum by Spinks and Shaffer, 2007) and *Cuora flavomarginata* (Gray, 1863). Some felt that it

was just a colour-morph of *C. flavomarginata* (Asian Turtle Crisis Newsgroup). *C. mccordi* does share behavioural and morphologic features (compare Artner, 2006 with description below) with the three species mentioned, especially *C. cyclornata* and *C. trifasciata*, which led Yasukawa et al. (2001) to list *C. trifasciata* and *C. mccordi* in the same subgroup by morphology.

These speculations were strengthened by the discovery of many variations of both captive bred and wild hybrid turtles. Current genetic analyses (Stuart and Parham, 2004; Spinks et al., 2004; Parham et al., 2005; Stuart and Parham, 2006; Spinks and Shaffer, 2007) indicate that *C. mccordi* is not a hybrid, but a valid species with proof of wild origin still pending. Presumed natural hybrids such as *Cuora serrata* (Iverson and McCord, 1992; Shi et al., 2005), and perhaps *Mauremys pritchardi* (McCord, 1997) and *Sacalia pseudocellata* (Iverson and McCord, 1992) have sympatric parental lineages. *Cuora trifasciata/cyclornata* and *Cuora flavomarginata* are allopatric and do not have overlapping distributions, and thus have no chance of naturally hybridizing. This would leave Chinese turtle farms as the only possible source of a *C. trifasciata/cyclornata* x *C. flavomarginata* hybrid. At this time, both molecular studies and the consistent hatching of offspring identical to parental stock lead most to believe *C. mccordi* is a valid natural species.

Many regard *C. mccordi* as commercially or biologically extinct in the wild (Lau et al., 1995; CITES, 2000; Meier, 2000; McCord and Joseph-Ouni, 2002) but there are still rare specimens entering the pet trade (Shiu pers. comm.; the authors of this paper, pers. obs.) in China. The species has been listed as Critically Endangered in the IUCN Red List since 2000.

McCord and Joseph-Ouni (2002) listed the vicinity of Bose (following the original description) and added Hunnzhou (= Huangzhou, 25°33'55N; 110°19'27E; or should this be Hengzhou?), Guangxi; the latter locality for *C. mccordi* was yet again provided by Shiu.

In 2004, a Japanese tourist was rumoured to have found a specimen in a forest near the Chinese/Vietnamese border not far from the terra typica (Philippen, pers. comm.). Later that same year, rumours from China circulated that the species might originate from eastern rather than from western Guangxi Province (i.e., Bose).

In 2005, 2006 and 2007, these authors visited the type locality as well as other suspected localities along with many small and large turtle breeding farms in southern China to track down the true origin of *Cuora mccordi*. The following field data is the result of these efforts.

FIELD REPORTS

In late 2005, the IUCN Red List editor, van Dijk invited McCord to write the accounts for *Cuora mccordi* and *Cuora zhoui*. McCord invited Zhou to complete this assignment with him.

With prior collaboration and this new mission in mind, several field trips were undertaken; many difficulties had to be overcome. Our first objective was to confirm the distribution of *C. mccordi*, which has never been properly reported. We spent much time listening to animal traders about the source of *Cuora mccordi*. After analyzing information from many sources, we targeted western and south-eastern Guangxi Province.

In south-east Guangxi, we heard of and contacted a prominent turtle dealer by the name of Li. After some time, Li found a local turtle supplier, Yang who recognized *C. mccordi* from photos we provided. In late 2005, a flight was taken to Nanning with local transportation arranged to an undisclosed area "A".

The senior author arrived at Li's shop in a marketplace, where *Mauremys mutica* (Cantor, 1842), *Pelodiscus sinensis* (Wiegmann, 1835), *Platysternon megacephalum* (Gray, 1831) and *Sacalia quadriocellata* (Siebenrock, 1903) were being sold. Li introduced us to Yang and as there was no regular transportation to area "A" a flat boat was rented and both Li and Yang came as guides and translators. The river was approximately 300 m in width at that point, and Yang rowed against the current for about an hour to a destination on the south bank. The riverbank consisted of yellow sand and scattered rocks; the surrounding mountains were lush with trees. We struggled up steep hillsides to a small village of tiled houses. In the local dialect, Yang questioned a resident, using photos, about his knowledge of both *C. mccordi* and *C. trifasciata*. The man's answers convinced us that he was familiar with both

species. He said that he had caught *C. mccordi* among rocks on hillsides of mountain valleys, 10 minutes by boat on the north side of the river, and that they are much rarer now than just 10 years ago. He also mentioned *C. mccordi* comes out from hiding when it rains. Yang said he purchased a *C. mccordi* from this local in June, 2005, which he later provided photos of from the people he sold it to in Wuzhou, Guangxi Province.

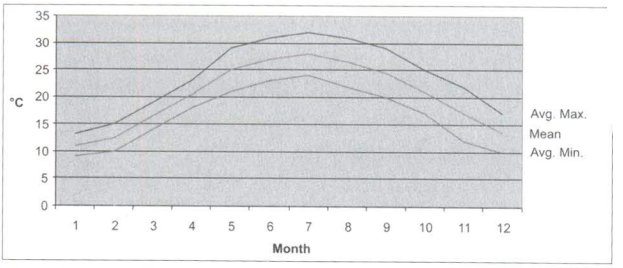

Figure 1. Average temperature for area "A".

Once at the given collection site (GPS coordinates to be given to IUCN), we searched among long-leaf forest foliage mixed with bamboo, *Camellia, Alocasia* and other plants. The site was at 50 m elevation. There was a winding, 1 m wide, permanent stream in the valley, flowing to the river. The major rivers of the area, namely the Qian and You/Yi/Yu rivers converge to become the Xun River, which flows through Zhujiang to the sea. The water in the stream was clear, 20–30 cm deep, 12.9°C, with a pH of 5.5. Yang said the locals often find *C. mccordi* where there are many bamboo and thus call it the "yellow bamboo turtle". Because the local economy is poor and the level of education is low, the people in area "A" are more concerned with survival than the affects of their activities on a turtle. They would catch and sell every last one if possible.

In January 2006, a field trip was made by the senior author to the You River basin in western Guangxi Province. Upon arrival at the Baise live animal market, questions were asked and photos of *C. mccordi* were shown, but only *Pelodiscus sinensis* and *Platysternom megacephalum* were present. Tiandong and Lingyun had equally disappointing results, but Pingguo gave some hope. After a number of people did not recognize *C. mccordi,* one elderly man said he had found the species eight years ago. Further questioning revealed that he did know differences between *C. mccordi* and *C. trifasciata*, giving his identification at least the possibility of having some merit, even if he was trying to please the senior author as is customary in China when dealing with a stranger.

In April 2007, Zhou, Blanck and Pi-Peng Li together with three Austrian turtle biologists undertook another journey to area "A". In this trip, more sites of suspected occurrence of *C. mccordi* were visited and more locals were interviewed to get further insight on the habitat and habits of *Cuora mccordi* in the wild. Due to the rarity of the species, we were unable to find a living specimen, but we continue to believe that the species exists in the vicinity. The data gathered (see below) further substantiates that *C. mccordi* has originated from this area.

More field research by these authors is planned in the spring of 2008.

TURTLE FARMS SURVEY

To end the speculation of farm origin of *Cuora mccordi* we visited many small and large turtle breeding farms in Hainan, Guangdong, Guangxi, Jiangsu and Zhejiang provinces, plus Shanghai City, China. We found only two specimens; one adult male and one adult female in a farm in Guangdong Province, without breeding success (Zhou and Gu, 2005, Zhou, 2006). *Cuora cyclornata*, *Cuora flavomarginata* and *Cuora trifasciata* are abundant in all sizes in these farms and are readily bred. Many hybrid-types were found in the farms, e.g. *Mauremys iversoni* (Pritchard and McCord, 1991), *Mauremys pritchardi* (McCord, 1997), *Ocadia sinensis* (Gray, 1834) x *Mauremys mutica, Chinemys nigricans* (Gray, 1834) x *Mauremys mutica*, *C. cyclornata* x *Cuora* (*Pyxidea*) *mouhotii, Mauremys annamensis* x *C. trifasciata*, etc. These hybrids were proudly shown to us by the farm owners, and no *Cuora mccordi*-like specimens were observed. No other surveys of Chinese turtle farms report finding *C. mccordi* (Shi and Parham, 2001; Parham and Shi, 2001; Shi and Fen, 2002; Shi et al., 2004; van Dijk, 2005; Zhou et al., 2005; Zhou et al., 2007; Auer, pers. comm.; Lau, pers. comm.; Shi, pers. comm.; van Dijk, pers. comm.). The above leads us to firmly believe that *Cuora mccordi* is not of hybrid origin.

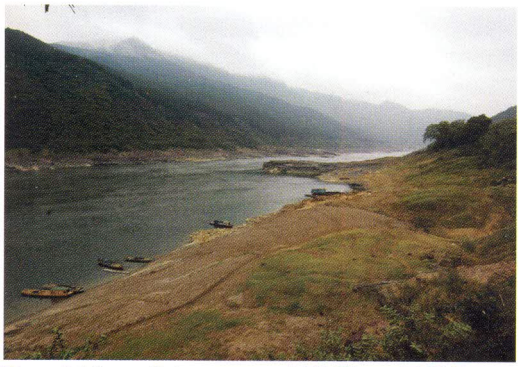

Figure 2. View of river at area "A". Photo Li Pi-Peng

Figure 3. A Saipan boat; the only access to *Cuora mccordi* habitat. Photo Li Pi-Peng

Figure 4. Valley with stream; *Cuora mccordi* habitat. Photo Zhou Ting

Figure 5. Stream and heavy vegetation; *Cuora mccordi* habitat. Photo Torsten Blanck

Figure 6. Stream and vegetation; *Cuora mccordi* habitat. Photo Torsten Blanck

Figure 7. Typical vegetation; *Cuora mccordi* habitat. Photo Torsten Blanck

Figure 8. Mountain village near *Cuora mccordi* habitat. Photo Li Pi-Peng

HABITAT

The habitat preference of the species appears to be complex. On first appearance, *C. mccordi* inhabits broad-leafed forests interspersed with thicket, shrubs and bamboo stands, situated near small, slow moving, shallow streams, in hilly areas at 50–150 m elevation. Upon further evaluation, populations seem to occur in isolated areas. According to the mountain villagers interviewed in 2007, all *Cuora mccordi* encountered were captured in three iso-

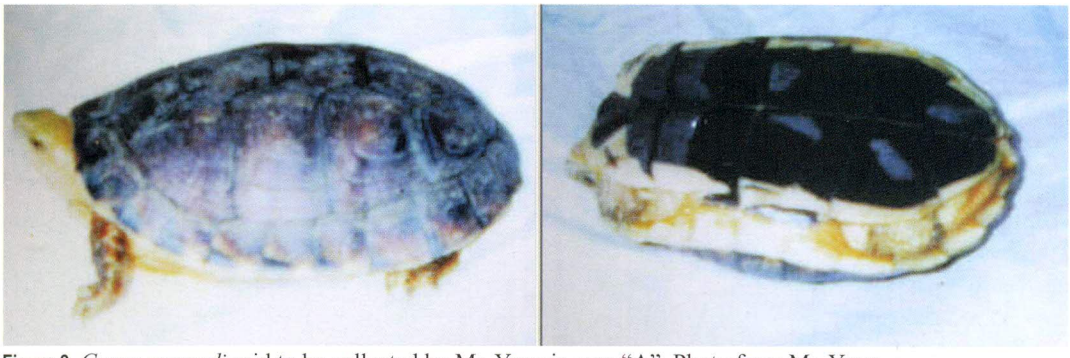

Figure 9. *Cuora mccordi* said to be collected by Mr. Yang in area "A". Photo from Mr. Yang

Figure 10. Bamboo leaf-litter; the most likely *Cuora mccordi* habitat. Photo Zhou Ting

Figure 11. Bamboo leaf-litter; the most likely *Cuora mccordi* habitat. Photo Torsten Blanck

Figure 12. Bamboo leaf-litter; the most likely *Cuora mccordi* habitat. Photo Zhou Ting

Figure 13. Close-up of bamboo leaf-litter; the most likely *Cuora mccordi* habitat. Photo Li Pi-Peng

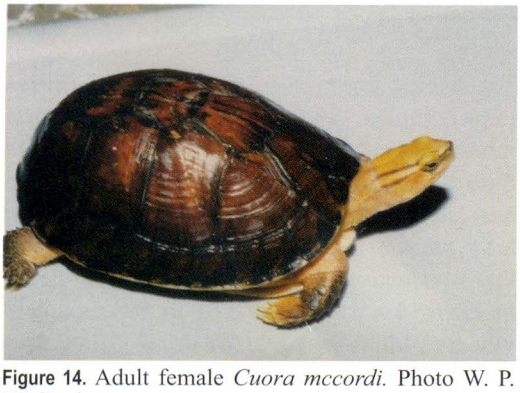

Figure 14. Adult female *Cuora mccordi*. Photo W. P. McCord

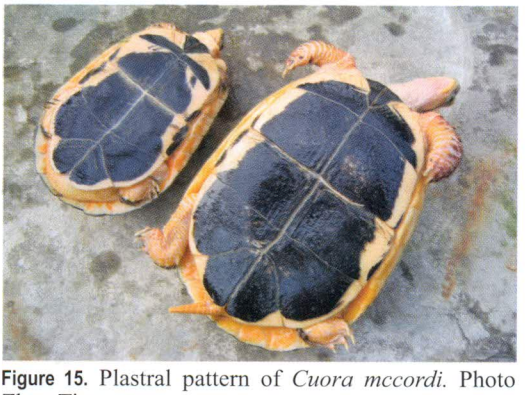

Figure 15. Plastral pattern of *Cuora mccordi*. Photo Zhou Ting

Figure 16. Head of *Cuora mccordi.* Photo Torsten Blanck

lated areas of about 1 km² each, approximately 2–3 km from each other. No turtle was ever captured between these areas. All these areas contain bamboo stands, amongst which most specimens have been captured. There is usually a stream nearby, and sometimes the terrain is quite steep. According to the villagers, *Cuora mccordi* occurs syntopically with *Cuora trifasciata*, but *Cuora mccordi* rarely if ever enters the stream, while *Cuora trifasciata* is always found in or near the stream. Other local species according to the villagers are *Sacalia quadriocellata, Platysternon megacephalum* and rarely *Geoemyda spengleri* (Gmelin, 1789) which has not been found for a decade.

BEHAVIOUR

Based on data provided by the mountain villagers, *Cuora mccordi* is most active during heavy rains and/or in the afternoon, generally between 1600–2100 h, while *Cuora trifasciata* is usually nocturnal. *Cuora mccordi* often hides amongst bamboo roots, beneath bamboo foliage or under shrubs and in the thicket; it does not dig into the soil. *Cuora mccordi* feeds on earthworms which appear at the surface of the soil when it rains. Mating has been observed in March, egg deposition in April and May. Eggs seem to be buried by several females in close proximity, generally in forest clearings. No turtles have been found in the wild during the cooler winter season.

DISTRIBUTION

Due to the scarcity of the species and the current demand as demonstrated by the prices offered, we refrain from more accurately disclosing this data (i.e. area "A") until effective measures of protection have been taken to keep this species from commercial exploitation, as has happened recently with *Cuora pani aurocapitata* (Luo and Zong, 1988) after detailed distribution data was published (Blanck and Kremser, 2007). The IUCN and Markus Auer, who is presently undertaking a major *Cuora* conservation project for

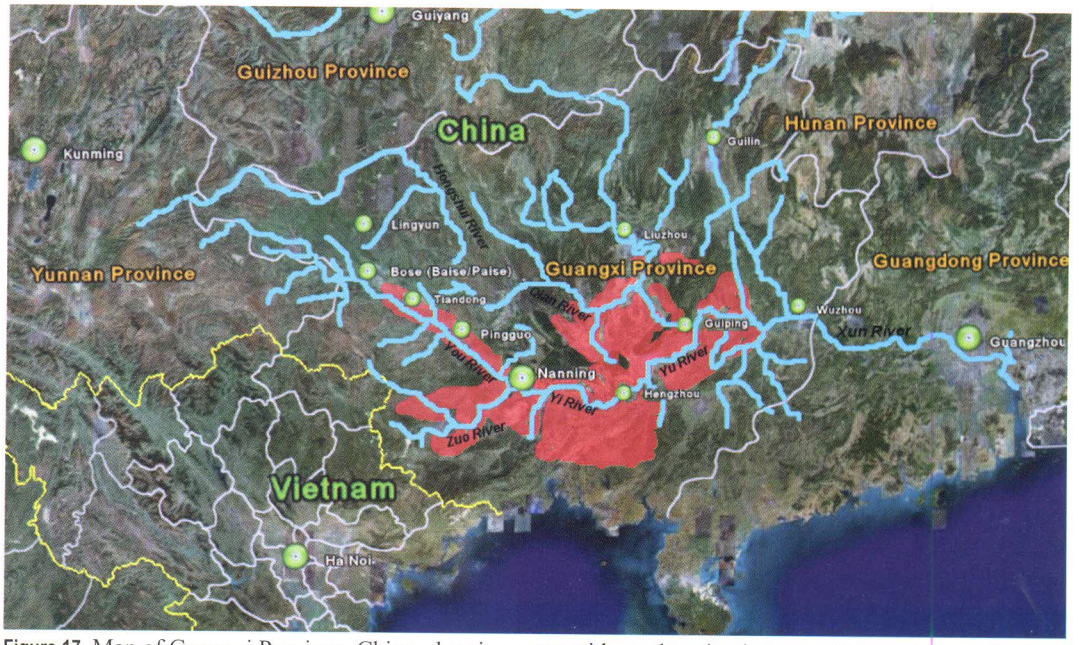

Figure 17. Map of Guangxi Province, China, showing areas with an elevation between 45 m and 250 m (red).

Figure 18. Map of Guangxi Province, China, showing the remaining natural forest areas of the region (green).

Figure 19. Map of Guangxi Province, China, showing the suspected distribution of *Cuora mccordi* (yellow) created by showing where figures 16 & 17 overlap.

the EAZA, have been informed of the precise known distribution and will, in conjunction with other organizations attempt to enforce protection as soon as possible. For now, the published known and suspected distribution is restricted to the Qian, Xun and You/Yi/Yu river basins of Guangxi Province, China, and thus the species appears highly endemic.

GENERAL DESCRIPTION

According to Ernst (1988), also cited by Ernst and Barbour (1989), Zhou and Zhou (1992), Zhao and Adler (1993), Rogner (1995) and Ernst et al. (2000), a straight carapace length (SCL) of 13.4 cm (12.1 cm in males, 13.4 cm in females) is reached. McCord and Iverson (1992), also cited by Schilde (2004), reported an average

Figure 20. *Cuora* enclosures at Münster, Germany. Photo Torsten Blanck

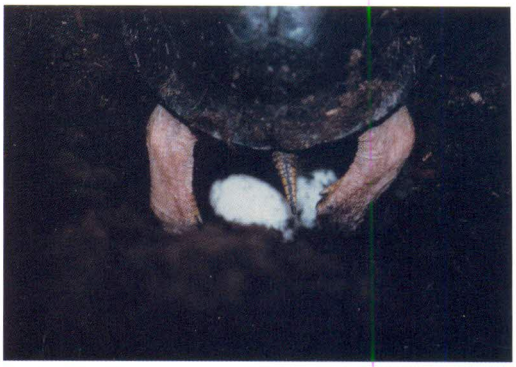

Figure 21. *Cuora mccordi* depositing eggs in nest. Photo Dave Lee

Figure 22. *Cuora mccordi* emerging from egg. Photo W. P. McCord

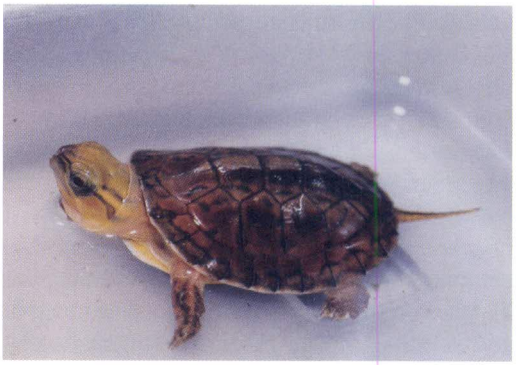

Figure 23. *Cuora mccordi* hatchling. Photo W. P. McCord

Figure 24. *Cuora mccordi* hatchling – note keels. Photo W. P. McCord

Figure 25. Hatchling *Cuora mccordi* – note marginal scute variation. Photo Lu Wei

SCL of 11.76 cm (10.7–13.1 cm) in males and 13.71 cm (12.1–14.9 cm) in females; Schroller (2005) reported males being 13.1–13.2 cm and females reaching 10.2–14.3 cm; Vetter and van Dijk (2006) stated 12–15 cm for the species in general; Artner (2003; 2006) mentioned that his males measured 13.4–14.1 cm and the females 15.36–15.74 cm, being the greatest SCL yet known. CITES (1999) listed that the species can reach up to 16.5 cm SCL referring to data from Artner (1998). Blanck (unpublished.) found an adult female of 16.55 cm SCL in a Hong Kong collection and Zhou (2007) reported a 15.0 cm SCL male and an 18.4 cm SCL female specimen, a new size record, verified by Blanck (2007). In general, males reach about 14cm SCL and females 16–17 cm. This demonstrates that *C. mccordi* is not "small" for a *Cuora*, as believed by Fritz and Obst (1998), but rather similar in size to most (except large *Cuora amboinensis* and *Cuora cyclornata) Cuora* species (see McCord and Iverson, 1991; Schilde, 2004; Blanck and

Tang, 2005; Blanck, 2005; Blanck et al., 2006a; Blanck et al., 2006b; Zhou, 2007; Zhou et al., 2007; for size records of other *Cuora* species). Weight of adult males varies from 350–450 gm and in females from 441–960 gm at SCL between 13.1–15.0 cm and 14.3–18.4 cm, respectively (Artner, 2003; 2006; Schroller, 2005; Zhou, 2007).

The carapace is oval and slightly elongated, slightly more oval in females than in males; moderate-highly domed in females and slightly or moderately domed (flatter) in males. The carapace displays a strong median keel in young animals, which fades to being only present on V3-4, then just V4, before disappearing completely in mature animals. Lateral keels are barely present (seen only with a keen eye and some imagination) in hatchlings and soon disappear. The ground colour is reddish brown to chocolate brown, with black pigmentation in the form of blotches, varying lines or darkened seams. The marginals may exhibit black round-triangular blotches on the distal inter-marginal seams, but always have varying black markings of some sort; marginals usually with an interrupted thin yellow periphery of varying thickness, more prominent in younger animals, often involving only M1-M8. The plastron has a poorly developed anal notch and has cream-yellow ground coloration, with a central black pattern extending from the anal to the humeral scutes, covering 90–95% of the pectoral, abdominal, femoral and anal scutes. The humeral scutes have a horizontal black stripe/bar of varying thickness along the caudal aspect, sometimes covering only 10% of the scute, usually 30–50%, rarely up to 90% of the scute. The gulars are usually completely black. The ventral marginals are usually uniformly yellow or orange, often a blend of the two colours with more intense orange posterior to M4; black triangular blotches are usually absent on the ventral marginals of *C. mccordi*, while always present in *Cuora trifasciata* and *Cuora cyclornata*. Two elongated, often connected black blotches are present along the bridge. The head is intense yellow dorsally, yellow laterally, with a deep yellow to usually orange lateral stripe bordered by two varying thin black lines from nostrils to anterior orbit, then posterior orbit to the posterior of the head, not extending onto the neck. The upper eyelids and dorsal head medial to the orbits have a greenish tinge. Irregular black blotches can sometimes be seen on the dorsal head. The iris is bright yellow, with a black horizontal bar running through the pupil. The chin is cream yellow to orange

The scales of the extremities are orange ventrally, chocolate brown to black dorsally (similar to carapace); soft parts are yellow-brown. The tail is yellow-orange ventrally, orange dorsally, with a median dorsal black stripe.

CAPTIVE MANAGEMENT

With the exception of *Cuora amboinensis* and *C. flavomarginata, C. mccordi* and all other *Cuora*, whether due to unavailability, price or high mortality, are poorly represented in private captive populations.

Despite the initial low numbers of wild stock of *C. mccordi* and early problems developing breeding techniques (Artner, 1998) the species is now successfully bred in Austria, China, Germany, Japan, Switzerland and USA, with the numbers in captivity more than doubling in the last five years.

The current estimates on specimens in captivity are as follows:

Barzyk (1999) estimated ca. 350 specimens worldwide in captivity; Meier (2000) estimated 70 specimens in US collections and 40–45 specimens in Europe; Struijk et al. (2005) listed 15.21.26 specimens in the European studbook and estimated that more than 80 specimens exist in Europe. Meier (pers. comm.) estimates that about 100 specimens are currently kept in Europe. According to our data, present captive stock is ~ 110 specimens in the US, ~ 40 specimens in Hong Kong, ~ 30 specimens in Japan, ~ 41 in China and ~ 110 specimens in Europe, all with some degree of breeding success.

According to Pauler and Praedicow (in Fritz and Obst, 1998) and to Hennig and Schilde (2005), the species is primarily aquatic, but many other authors believe *C. mccordi* is primarily terrestrial (Praedicow in Schilde, 2004; Hertwig, 2005; Schroller, 2005; Artner, 2003, 2006; Meier, pers. comm.; Valentin, pers. comm.; Tang pers. comm.; Lu Wei, pers. comm.) and maintain the species in terrariums with 33% or more land area and water depth of between 5–15 cm. According to Rogner (1995), *C. mccordi* is a good swimmer and hides in water when disturbed, but

Artner (2006) reports a case of drowning of a specimen that was kept primarily aquatic in 35 cm deep water. We observe adults of the species to spend 60–65% of the time out of the water, the rest of the time wading or swimming, thus we prefer to designate *C. mccordi* as semi-terrestrial. Hatchlings and juveniles enjoy hiding under the surface of shallow water, camouflaged by plant material such as submerged sphagnum moss. Artner (2006) reported a rather nocturnal lifestyle, while Meier (pers. comm.) and our observations show a diurnal pattern, with the most activity at dawn. *C. mccordi* usually hides buried in damp soil with only its head periscoping out at times, or beneath sphagnum, leaves or bark during much of the day (Artner, pers. comm., Meier, pers. comm., these authors, pers. obs.).

The species is best maintained at temperatures of 20–28°C with maximum acceptable temperatures of 32–35°C (Schilde; 2004; Hertwig, 2005; Schroller, 2005; Artner, 2006).

Some breeders hibernate their specimens from November to March at temperatures between 4–15°C (Schilde, 2004; Hertwig, 2005; Schroller, 2005; Artner, 2006; Meier pers. comm.; these authors, pers. obs.) and some claim that only hibernated specimens will mate and produce fertile offspring, although one of us (WPM) has regularly produced offspring for almost 20 years without hibernation. Lu Wei (pers. comm.) reports that specimens kept outdoors in Shanghai enter hibernation at ca. 10°C and resume motor activity at 16°C, feeding again at 18°C.

Courtship and mating in captivity occurs soon after hibernation (Artner, 2006), i.e., March-April, which is likely also the mating season in the wild. As with most other turtles, breeding is also stimulated during and after "rainfall".

In hibernated animals, eggs are deposited from April to August in 1–3 clutches with 1–4 eggs per clutch (Schilde, 2004; Artner, 2006). Eggs vary in size from 37–42 x 22–24.5 cm (Fritz and Obst, 1998; Schilde, 2004; Artner, 2003; 2006) in Europe and 44.5– 58.1 x 20.6–23.6 cm in China (Zhou, 2007) and weigh 12–20 gm. Non-hibernated animals are known to lay 2–3 clutches per year throughout the year, usually 2 eggs, rarely 1 or 3 per clutch.

The eggs have been successfully incubated at temperatures between 26.5–30°C with and without night fluctuation (Hertwig, 2005; Artner, 2006). Juveniles usually hatch after 72–82 days incubation at these temperatures (Schilde, 2004; Schroller, 2005; Artner, 2006) and measure 35–40 cm SCL, weighing 12–15 gm (Artner, 2006; these author's pers. obs.). To this date only female offspring have been produced in captivity (Meier pers. comm.; these authors pers. obs.).

VULNERABILITY AND THREATS

As with all turtles in China, habitat destruction and the collection of turtles for food, TCM and the pet trade have not left this species untouched. According to locals, the species was found in small but sustaining numbers two decades ago, whereas in the last few years, even a single specimen is a rare find. Unfortunately, the locals in the range of *C. mccordi* are giving increased attention to catching this highly endemic species, which appears to be on the brink of extinction. Knowledge of its current value in the Chinese pet trade has reached even the most remote mountain villages.

In an interview in 2007, one of the mountain villagers claimed that 20 years ago, he got about 50 Yuan (about $/€ 5) per turtle, be it *C. mccordi* or *C. trifasciata*, but now, he is offered 20,000 Yuan (about $/€ 2,000) per specimen of either species. This does not include the commission of the mountain trader like Yang selling to the city trader like Li who again sells it to a pet trader in Wuzhou or Guangzhou which leads to a retail price of $/€ 3,000 or more, depending on size and sex. The villagers are always searching for the rare turtles these days, as one turtle fetches more than a year's wages for a mountain family. The adult mountain villagers say they collected dozens of *C. mccordi* and *C. trifasciata* annually 20–30 years ago but it is now more difficult with one to two specimens per year captured in recent years. The last reported *C. mccordi* caught was in 2005. Fortunately, the habitat visited remains mostly intact, with some wood gathering by the villagers only, suggesting that the release of captive bred animals would be plausible in the future.

We recommend the following conservation measures to be taken immediately to protect the species:

- Further field investigation to clarify the distribution and current population status.

- Improvement in captive breeding techniques. *C. mccordi* is known to acclimatize and breed well in captivity, however only female offspring have been produced. Thus, we suggest an in situ breeding project with the hope of hatching some males.
- Educate local citizens as to the plight of this national treasure.
- Creation of protected areas.
- Enforcement of existing protective measures since *C. mccordi* is presently on the Chinese Species Red Name List, is in the China Endangered Animal Red Book, is internationally regulated on Appendix II of CITES, and is indicated as Critically Endangered in the IUCN's Red List. The key measure that must be taken is to include *C. mccordi* in Chinese domestic legislation as a Class I protected species, similar to the Giant Panda.

ACKNOWLEDGEMENTS

We would like to thank Mr. Yang, Mr. Li and the mountain villagers for their knowledge and guidance in the field and Peter Valentin, Tanja Kremser and Verena Leitner for joining our trip in 2007. Michael Tang provided translations of Chinese papers and manuscripts, photos and interesting discussions.

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A POSSIBLE THIRD SPECIMEN OF THE PITVIPER GENUS *TROPIDOLAEMUS* FROM INDIA

(with three text-figures)

The existence in India of the pitviper genus *Tropidolaemus* has been based on two neonates discovered together in the High Wavy Mountains of southern India by Angus Hutton during the 1940s (Hutton, 1949). The snakes were sent to the British Museum, and examined by Malcolm Smith, who named them *Trimeresurus huttoni* Smith, 1949. One of the snakes was retained as the holotype at the British Museum (BMNH 1948.1.8.75), the other returned to Hutton, who donated it to the Bombay Natural History Society (BNHM 2658).

David and Vogel (1998) re-examined and described in detail the holotype, and concluded that it was morphologically close to *Tropidolaemus wagleri*, to which genus they transferred *huttoni*. They noted that *T. huttoni* had apparently not been rediscovered. Gumprecht et al. (2004) and Vogel (2006) provided colour photographs of the preserved holotype, and mentioned no additional records. During an inventory of viperids in the Louisiana State University Herpetology Collection (LSUMZ), I discovered a specimen of *Tropidolaemus* from the Western Ghats that had been mislabeled *Trimeresurus gramineus*. From the LSUMZ specimen, I provide descriptive data on scalation, colour pattern, dentition and hemipeneal morphology. The specimen is relatively soft, so that body and tail measurements were made along a metric ruler.

The specimen, LSUMZ 45547, is an adult or subadult male, 469 mm TTL (395 mm SVL), head length 24.0 mm (measured with dial calipers to the rear of the quadratomandibular apex), greatest head width 18.2 mm, interorbital diameter 11.1 mm, eye diameter 3.6 mm, snout length (to anterior margin of eye) 9.0 mm, ventral margin of eye-mouth margin distance 3.5 mm, posterior rim of nostril-posterior rim of loreal pit distance 4.6 mm, posterior rim of loreal pit-anterior margin of eye distance 1.7 mm (Fig. 1). The specimen has 147 ventrals, 51 subcaudals (all divided), and an undivided cloacal shield. Supralabials - 9 on the right side, 10 on the left. Anterior scale rows are 21 at one head-length behind the angle of the jaw, and at the level of the tenth ventral. Midbody scale rows are 21. Posterior scale rows are 17 at one head-length anterior to the vent, and 15 at the antepenultimate ventral. All dorsal scale rows are keeled, but the keel on the outermost scale row is limited to the imbricating portion.

The specimen appears to be formalin darkened, the ground colour being dark grey throughout, with pale ventral margins (Fig. 2). The dorsum is marked by an irregular series of dull white paravertebral spots, covering one scale each, 29 on the right side, 32 on the left side excluding the tail. The tip of the tail is pale for a distance of 20 subcaudals. The only other marking is a pale postocular streak, about one and two half scale rows wide, that extends forward to the posterior margin of the loreal pit.

One hemipenis was dissected in situ. It bears longitudinal folds at its base, and forks at the level of the seventh subcaudal. The lower forked portion bears 8–9 series of spines, which disappear at the level of the eleventh subcaudal. The remainder of the hemipenis is smooth to its tip at the fifteenth subcaudal. The dentigerous elements of the left side of the head bear 5 palatine, 13 pterygoid and 13 dentary teeth. The palatine has a low, even dorsal margin, which is diagnostic for *Tropidolaemus* (Brattstrom, 1964).

The LSUMZ snake differs from the holotype of *T. huttoni* as follows (based on the redescription in David and Vogel 1998). The nasal is rectangular (triangular), internasals in contact (separated by a small scale), canthals similar in size to other snout scales (slightly larger), supraoculars as wide as internasals (narrower), ten intersupraoculars (nine), lower temporals smaller than posterior subralabials (equal), 9–10 supralabials (9–9), 1–2 granular scales between second supralabial and nasal (1–1), third supralabial 1.6 times as long as high (2.3 times), fourth supralabial shorter than third (nearly equal), infralabials 10–11 (10–10), ventrals 147 (146), subcaudals 51 (52), scale rows 21–21–17

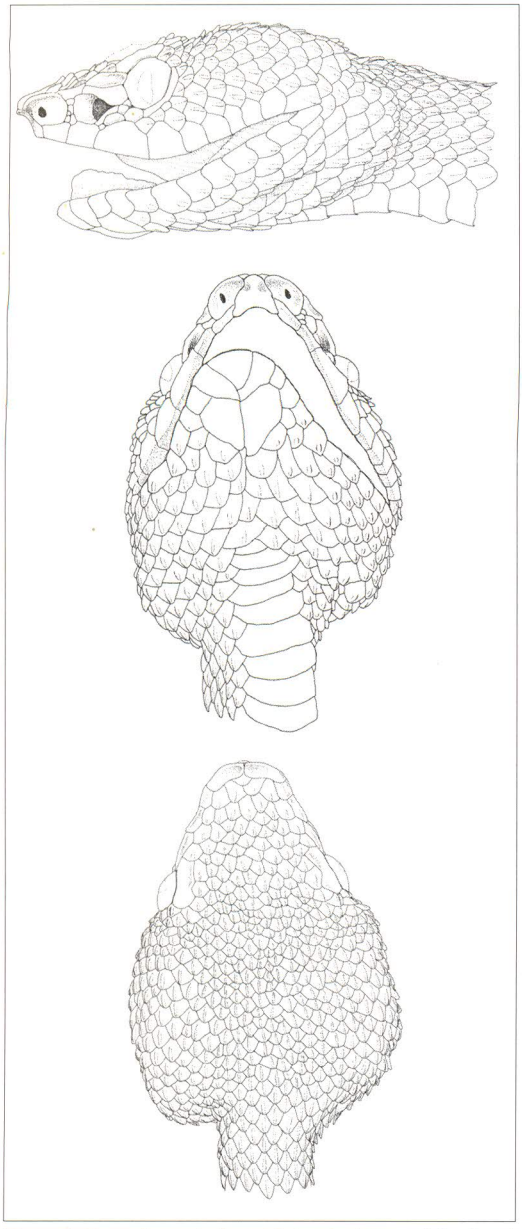

Figure 1. Dorsal, ventral and lateral views of the head of *Tropidolaemus*, LSUMZ 45547, India: Maharashtra: Lonavale.

(25–23–19), relative tail length 16% (28%). Some of the relative shape and size differences may be ontogenetic. The colour patterns are identical except that the very pale upper margin of the light postocular streak is lacking in the LSUMZ snake. The paratype data are 139 ventrals, 49 subcaudals, 8 intersupraoculars, a scale present between the internasals (as in the LSUMZ snake), and relative tail length of 29%.

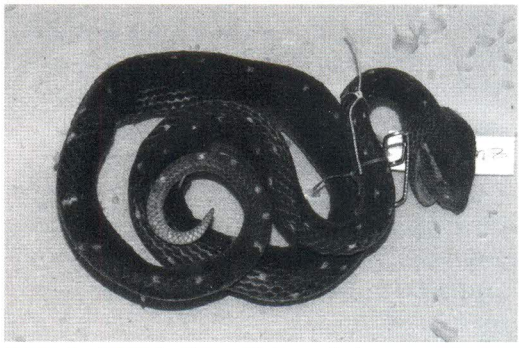

Figure 2. Dorsal view of *Tropidolaemus*, LSUMZ 45547, India: Maharashtra: Lonavale.

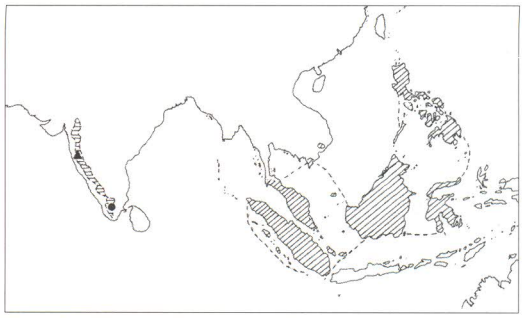

Figure 3. Map of the range of the genus *Tropidolaemus*. Diagonal lines, *T. wagleri* complex (after Vogel, 2006); horizontal lines = extent of Western Ghats (after Murthy, 1990); black circle, occurrence of *T. huttoni* (High Wavy Mountains); black triangle, occurrence of LSUMZ specimen (Lonavale).

The two types are said to be females (Murthy, 1990).

The only stated characters that differentiate *T. huttoni* from *T. wagleri* are the relative tail length (28–29% vs 14–19% total length) and the number of intersupraoculars (8–9 vs 10–17; David and Vogel 1998). Relative tail length in the LSUMZ snake is within the range of *T. wagleri* (16%). The relative tail lengths of six small *T. wagleri* (177–288 mm SVL; JAM BSI–0824 and BSI–2151, MCZ 25850, 25852, 37800, MVZ 111878) range from 15–17%, discounting the possibility of ontogenetic change in relative tail length. The LSUMZ snake has 10 intersupraoculars, at the low range for *T. wagleri*. Tooth counts for the LSUMZ snake are identical to modal values for *T. wagleri* (Brattstrom 1964: table 7). Other characters of the *T. huttoni* types are within the range of *T. wagleri*. Several characters of the *T. huttoni* types, and the LSUMZ snake, are at or near the lower range of variation for *T. wagleri*: degree of dorsal scale carination,

and counts of midbody scale rows, intersupraoculars and infralabials (David and Vogel, 1998). The degree of carination of the LSUMZ snake is identical to the photograph of the *T. huttoni* holotype (David and Vogel, 1998:Fig. 3), and to a specimen of *T. wagleri* of the same length from the Philippines (LSUMZ 7404).

The collection data for the LSUMZ specimen are "India: North Canara District: Lonavala; 18 July 1981; S. R. Ahuja." Lonavala (alt. Lonavale or Lonavla) is located in the State of Maharashtra at 18°44'N, 73°28'E, 623 m elevation (Falling Rain Genomics, Inc. 1996–2004). Lonavala is located 1,080 km airline NNW from the High Wavy Mountains, within the Western Ghats (Fig. 3). Ridges immediately to the north and south of Lonavala reach 1,126 m, within Tropical Wet Evergreen Forest (Mani, 1974). More specifically "the natural forest of the Lonavla region can be classified as 'semi-evergreen forests' belonging to the '*Memecylon umbellatum – Syzygium cumini – Actinodaphne angustifolia*' series described by Pascal (1988). However, only a few pockets of natural forests remain as the landscape is heavily impacted by cultivation, grazing and lopping for fuelwood. Thickets of *Carissa congesta* with a few species of the original forest such as *Catunaregam spinosa, Terminalia* spp., etc., are seen interspersed in secondary scrublands dominated by grasses" (A. Watve, pers. comm. to A. Captain). The types of *T. huttoni* were collected at 5,200 feet (= 1,585 m), also within Tropical Wet Evergreen Forest.

The LSUMZ snake was catalogued sometime during the early 1980s, but there are no accession data (R. Vaeth, pers. comm.). Several other species were catalogued with the specimen, and are indicated from reasonable localities: *Coelognathus helena* (Imphal, Manipur), *Boiga trigonatus* (Kottayam, Kerala), *Uraeotyphlus oxyurus* (Quilon, Kerala), and *Euphlyctis hexadactylus* (Trivandrum, Kerala). It is remarkable that a species of viper should remain so obscure in an area that was meticulously collected, prior to deforestation, by Col. Richard Beddome, and by collectors for Col. Frank Wall (Murthy, 1983). The veracity of Hutton's account is unquestioned, whereas the circumstances of the LSUMZ snake finds support within the series of other Indian taxa with which it was catalogued. All of the associated specimens were collected at different times by different individuals, and bear numbered, green labels (ZL–1, ZL–2, etc.), suggesting that they were acquired from an existing collection. However, no record of an exchange or donation of specimens could be located in the LSUMZ files.

Tropidolaemus wagleri occurs in the southern Philippines, much of the Sunda Shelf, and the Malay Peninsula, extending as far north and west as Phang Na Province, Thailand (Gumprecht et al., 2004; Vogel, 2006; Fig. 3). The existence of snake species pairs occurring in the Western Ghats, and no further west than the Malay Peninsula, is without precedence (Jayaram, 1974; Das, 1996).

Analysis of the LSUMZ snake suggests several scenarios: 1) the LSUMZ snake is a *T. wagleri* with erroneous locality data, leaving *T. huttoni* represented still by the two types, and diagnosable by relative tail length and intrasupraocular count; 2) *T. huttoni* is based on anomalous neonates, and represents a disjunct population of *T. wagleri*; 3) characteristics of the LSUMZ snake expand the diagnosis of *T. huttoni*; and 4) the LSUMZ snake represents an undescribed species of *Tropidolaemus* from India. In the second and third scenarios, *T. huttoni* would be synonymized with *T. wagleri*, but I consider those scenarios untenable. The fourth scenario seems the most likely. However, I refrain from designating the Lonavala specimen as a novel taxon pending a rangewide analysis of morphological variation in the genus, acquisition of additional material from the Western Ghats, and because I have discovered no morphological character that distinguishes it from *T. wagleri*.

I thank Adam Leaché and Van Wallach for measuring snakes at the MVZ and MCZ, respectively. Randy Vaeth provided insight relative to acquisition of the LSUMZ specimen. Aparna Watve provided details regarding floristics of the Lonavale region. Chris Austin, Ashok Captain and Patrick David reviewed the manuscript.

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PREDATION ON *MANIS JAVANICA* BY *PYTHON RETICULATUS* IN SINGAPORE

(with one text-figure)

Pangolins (*Manis* spp.) are members of the sole family (Manidae) within the Order Pholidota, with eight extant species worldwide, including the newly described Palawan pangolin, *M. culionensis* (Gaubert and Antunes, 2005). The Sunda Pangolin (*M. javanica*) is one of four species of Asiatic pangolins, found in south-east Asia (Lekagul and McNeely, 1988). Despite its relatively wide distribution, little is known of their habits in the wild and only anecdotal notes have been published (e.g., Hogg, 2003, Sonthichai et al., 2005). To date, there have been no detailed studies on their ecology.

Similarly, given the small number of detailed ecological studies from tropical areas worldwide, there is also a lack of studies on giant snakes, such as the Reticulated Python (*Python reticulatus*). While the presence of pangolin scales in the guts of *P. reticulatus* was first reported by Shine et al. (1998), the present report serves to act as additional direct evidence of the consumption of a radio-tagged Sunda Pangolin by *P. reticulatus*. In addition, notes on possible pangolin-python interactions are discussed in this report.

The observations for the present report were made during an ongoing study of pangolin behaviour and ecology in the lowland tropical rainforest of Singapore island, in the Sime forest, Central Catchment Nature Reserves (01°21'N, 103°48'E). The pangolin was fitted with a radio-transmitter (Telonics Inc., Arizona, U.S.A.) on the tail scales using screws, a method successfully used on the African species, *Manis temminckii* (see Richer et al., 1997), and was tracked using a directional H-antenna and portable radio-receiver (R-1000; Communications Specialist Inc., California, U.S.A.).

A juvenile Sunda Pangolin was captured on 3 July 2005 (time unknown) and handed over to the Singapore Zoological Gardens. It weighed 2.5 kg (head-body length: 37 cm; tail length: 32 cm) and was certified healthy by a veterinar-

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(with one text-figure)

Pangolins (*Manis* spp.) are members of the sole family (Manidae) within the Order Pholidota, with eight extant species worldwide, including the newly described Palawan pangolin, *M. culionensis* (Gaubert and Antunes, 2005). The Sunda Pangolin (*M. javanica*) is one of four species of Asiatic pangolins, found in south-east Asia (Lekagul and McNeely, 1988). Despite its relatively wide distribution, little is known of their habits in the wild and only anecdotal notes have been published (e.g., Hogg, 2003, Sonthichai et al., 2005). To date, there have been no detailed studies on their ecology.

Similarly, given the small number of detailed ecological studies from tropical areas worldwide, there is also a lack of studies on giant snakes, such as the Reticulated Python (*Python reticulatus*). While the presence of pangolin scales in the guts of *P. reticulatus* was first reported by Shine et al. (1998), the present report serves to act as additional direct evidence of the consumption of a radio-tagged Sunda Pangolin by *P. reticulatus*. In addition, notes on possible pangolin-python interactions are discussed in this report.

The observations for the present report were made during an ongoing study of pangolin behaviour and ecology in the lowland tropical rainforest of Singapore island, in the Sime forest, Central Catchment Nature Reserves (01°21'N, 103°48'E). The pangolin was fitted with a radio-transmitter (Telonics Inc., Arizona, U.S.A.) on the tail scales using screws, a method successfully used on the African species, *Manis temminckii* (see Richer et al., 1997), and was tracked using a directional H-antenna and portable radio-receiver (R-1000; Communications Specialist Inc., California, U.S.A.).

A juvenile Sunda Pangolin was captured on 3 July 2005 (time unknown) and handed over to the Singapore Zoological Gardens. It weighed 2.5 kg (head-body length: 37 cm; tail length: 32 cm) and was certified healthy by a veterinar-

Table 1. Date of the locations of radio-transmitter in Figure 1, distance from previous location and description of location.

Location	Date	Distance (m) from previous location	Description	Comments
1	4 July	-	Underground; base of a tree	Date of release
2	5 and 6 July	77	Among dense vegetation	-
3	7-11 July	110	Within a hollow log (*Shorea* sp., DBH 68 cm); across a small stream from previous location	Monitored throughout the night of 8 July but no shift in transmitter location; (did not track on 12 July)
4	13 July	252	Within a hollow log (*Shorea* sp., DBH 89 cm)	Visual confirmation of python

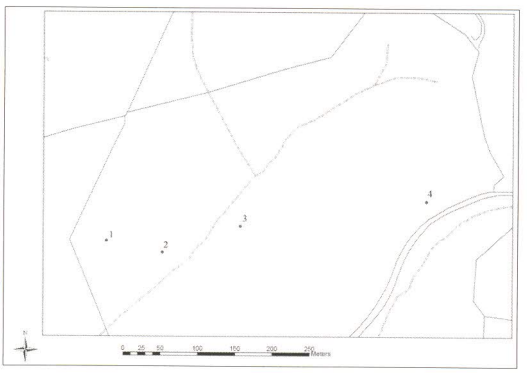

Figure 1. Map of locations of radio-transmitter during the 11 days it was tracked. Dotted lines are streams; solid lines are trails or roads. See Table 1 for dates and description of locations.

ian at the Singapore Zoological Gardens. It was then fitted with a radio-transmitter and released at Sime forest on 4 July 2005 at 1400 h.

The individual was tracked for the next 11 days (see Fig. 1 and Table 1 for map and description of locations, respectively) without any actual sighting of the animal. On 8 July 2005, despite having waited the entire night, the transmitter did not shift position. It remained the same for the next six days.

On 14 July 2005 (1720 h), the signal was traced to within a fallen tree trunk. On peering into this hollow log from one of the openings, a *Python reticulatus* was found coiled up inside. The signal from the transmitter coincided with the position of the python.

The snake was extracted from the tree trunk the next morning. It measured 3.0 m long, weighed ca. 10 kg in body mass and had no visible bulge along the body. With the radio-receiver, the transmitter was located at about ¾ down the python's body. The python was euthanized, dissected and the head was deposited at the Raffles Museum of Biodiversity Research (catalogue number: ZRC.2.6220). Inside the gut, intact pangolin scales and claws were present from the level of the snake's midbody to cloaca. These were also deposited in the Raffles Museum of Biodiversity Research (catalogue number: ZRC.4.8135). Upon retrieval, it was noticed that the metal edges of the radio-transmitter showed signs of early corrosion.

Pythons either lie in wait or actively search for prey (Pope, 1961) and they are not known to scavenge under natural conditions. It is therefore assumed that the pangolin was captured and killed by the snake. This is supported by the observation that the pangolin was in good health and active when it was released.

It is not known when or where the pangolin was attacked. From the daily location data, there is an apparent lack of movement between 7–11 July. In addition, the pangolin was not observed leaving its hiding place throughout the night of 8 July (from 2000 h onwards) and early morning of 9 July (until 0700 h). Therefore, it is likely that the attack took place before the night of 8 July. In addition, the posterior location of the pangolin scales and transmitter inside the gut supports this assumption that the pangolin had been consumed and was in an advanced stage of digestion.

However, it must be emphasized that there has not been any detailed study on the daily activity pattern of the Sunda Pangolin. As such, it might be natural for this animal to stay within the hiding place throughout the night and to return to the same hiding place for consecutive nights, explaining the pattern observed for the period 7–11 July. While the latter behaviour has been documented for three relocated African Cape Pangolin (*Manis temminckii*), none

remained in their hiding places throughout the entire night (Heath and Coulson, 1997; J. Swart, pers. comm.). This further supports the suggestion that the pangolin was consumed before the night of 8 July.

It is well-known that pangolins are non-aggressive and often curl up into a ball with the head tucked between the limbs and under the tail when faced with potential threat (see Lekagul and McNeely, 1988). The juvenile pangolin might be an easy meal for this medium-sized python, considering the fact that pythons have been recorded to consume larger animals, such as adult Sulawesi pig (*Sus celebensis*) (Auliya, 2003) and even the sun bear (*Helarctos malayanus*) (Fredriksson, 2005). In addition, given that both pangolins and pythons can be arboreal in habits (pers. obs.) and utilize natural crevices (e.g. tree hollows and underground burrows) extensively (pers. obs. for *Manis javanica*), there is much overlap in the microhabitat utilization and thus a high chance of encounter between these two species. However, it is unclear whether pythons are able to coil around and constrict a curled-up pangolin, especially within a narrow space like a tree hollow. Since pythons in general often wait in ambush at a spot (Slip and Shine, 1998), it is more likely that the attack took place in the open, when the pangolin encountered the waiting python.

Based on the stomach contents of 1,070 individuals of *Python reticulatus* in Sumatra, 229 contained identifiable remains and six adult pythons held remains of *Manis javanica* (Shine et al., 1998). The observed cases of stomach containing pangolins is less than that of Rice Field Rat, *Rattus argentiventer* (148 cases), Long-tailed Giant Rat, *Leopoldamys sabanus* (31 cases), Silvered Leaf Monkeys, *Semopithecus cristatus* (11 cases) and domestic chickens, *Gallus* sp. (eight cases) (Shine et al., 1998). Even though Rahm (1990) listed python as a predator of pangolins, alongside humans and the leopards, no reference was cited to give an indication of the frequency of such occurrences. Perhaps due to limited field studies on the armadillos or anacondas, there has not been any (English language) published accounts of anacondas preying on armadillos, even though it is likely that armadillos may be a prey item for the constrictor (J. Loughry, pers. comms.).

This recorded incident of predation was made possible because the pangolin was fitted with a radio-transmitter. However, due to lack of telemetry studies on Sunda Pangolins and an equal lack of prey studies of wild *Python reticulatus*, it is unclear whether python predation on pangolin is a common event.

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NOTES ON THE DISTRIBUTION, TAXONOMY AND BIOLOGY OF THE SKINK *EUTROPIS DISSIMILIS* (REPTILIA: SQUAMATA: SCINCIDAE), WITH FIRST RECORDS FROM ASSAM, INDIA

(with two text-figures)

Mausfeld et al. (2002) and Mausfeld and Schmitz (2003) argued for the partition of the nearly cosmopolitan lygosomine scincid genus *Mabuya*. They presented evidence for the monophyly of the Asian members of this group as a clade for which the name *Eutropis* was available. This group is relatively speciose in India and other parts of south Asia. Although several of the Indian species of *Eutropis* appear to be narrow endemics with limited ranges, others have broad distributions (Sharma, 2002). Nonetheless, comprehensive range data are lacking for even the most common and widespread species.

One of the most widely distributed species of skink in South Asia was initially described as *Euprepis dissimilis*. Often attributed to "Hallowell, 1860" (e.g., Greer et al., 2004), this species was actually described by Hallowell in 1857 (Troschel, 1858). Confusion regarding the date of publication has evidently resulted because the title page of the volume of the *Transactions of the American Philosophical Society* in which the description appeared is dated 1860– the date of publication of the last article in volume. The correct generic allocation of this species has also been a matter of contention. Earlier authors (e.g., Smith, 1935; Anderson, 1999) considered *E. dissimilis* to have its closest affinities with Middle Eastern "*Mabuya*" species, Mausfeld and Schmitz (2003) determined that it was the sister group to *Dasia* and *Apterygodon*, albeit with only marginal support (both parsimony and likelihood bootstraps < 70%). Mausfeld and Schmitz (2003) signaled the need for additional data to resolve the taxonomic status of *dissimilis*, but they retained Hallowell's original generic allocation for the species. However, *Euprepis* has been shown to be a junior synonym of *Mabuya* sensu stricto, a name now applied to a clade of New World skinks (Bauer, 2003). The name *Trachylepis* Fitzinger, 1843 is applicable to the chiefly African and south-west Asian taxa referred to *Euprepis* by Mausfeld et al. (2001) and Mausfeld and Schmitz (2003). Although we agree with the latter authors that the affinities of the species *dissimilis* need further clarification, we believe that its attribution to either *Euprepis* or *Trachylepis* would be positively misleading as there is no evidence suggesting that it is a member of, or sister to, either the American or African clades of the more inclusive *Mabuya* group. Indeed, in phylogenetic analyses in which its relationships were resolved, the *Dasia* clade, to which *dissimilis* may belong, has been found to be the sister group of *Eutropis* (Honda et al., 2001, 2003; Mausfeld and Schmitz, 2003). On this basis, we tentatively allocate *Euprepis dissimilis* Hallowell to *Eutropis,* pending additional phylogenetic study.

In the west, *Eutropis dissimilis* is widespread from "Rawalpindi, upper Indus Valley to Waziristan, extending into the Indus Delta" (M. S. Khan, 2002, 2004). However, the eastern extent of its range has been variously reported by different authors. Smith (1935) summarized earlier records and considered the species to be widespread from Pakistan to Bengal. The type localities of *Euprepis dissimilis* and that of its

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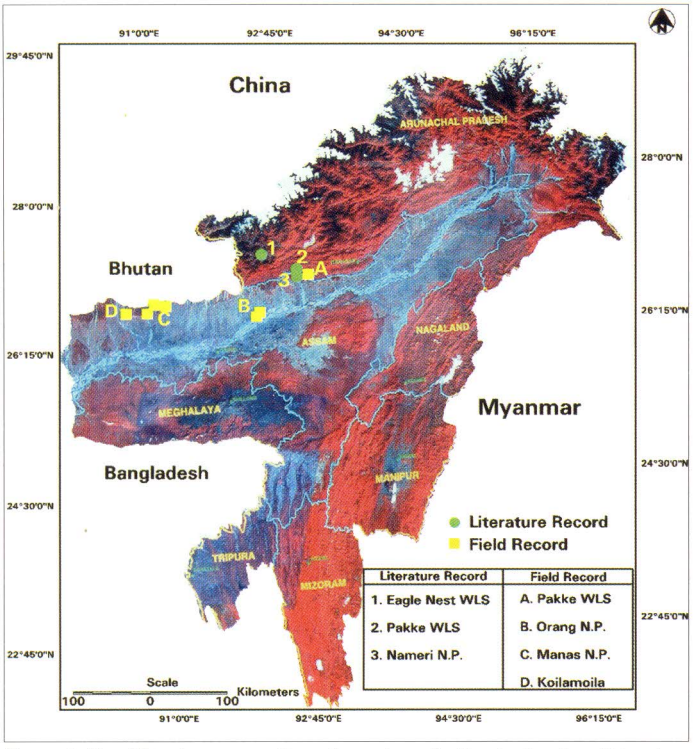

Figure 1. Satellite imagery of north-eastern India, indicating literature (numbers) records and new observations (letters) of *Eutropis dissimilis* in Arunachal Pradesh and Assam. The large river flowing from north-east to south-west through Assam is the Brahmaputra.

oldest junior synonym, *Euprepes monticola* Günther, 1864, are in eastern India/Bangladesh, in "Bengal" and "Sikkim," respectively. More recently, Murthy (1990) gave the distribution of *E. dissimilis* in India as "the plains and grasslands of northern India" and noted records from Kashmir, Punjab, Bihar, Madhya Pradesh and Bengal. Subsequently, however, Tikader and Sharma (1992) considered it to occur in "dry open country" in Bihar and Rajasthan and presented a map showing the species' range ending to the west of Bangladesh. Sharma (2002), subsequently confirmed Bengal as one of the states in which the species occurs, but retained the earlier map of Tikader and Sharma (1992) showing only a more western species range. This skink is also distributed across the Terai of southern Nepal (Shah 1995; Schleich and Kästle 2002) and into parts of eastern Afghanistan (Clark et al., 1969). All of these authors excluded Sikkim from the range of *E. dissimilis* and even the most recent regional fauna of Sikkim (Jha and Thapa, 2002) makes no mention of the species there, despite the record of Günther (1864).

Most authors have not previously noted the occurrence of *Eutropis dissimilis* in Bangladesh, although Husain (1974) and M. A. R. Khan (1982, 2004) had previously included it in the fauna, the latter listing it as uncommon and giving its distribution as the "evergreen, semi-evergreen and mixed deciduous forests of Chittagong, Chittagong Hill Tracts and Sylhet" and Das (1994) noted its presence in Bangladesh as well. It was subsequently listed in the Red List for Bangladesh as occurring in the north-east and south-east of the country and in the Jamuna River islands (IUCN Bangladesh, 2000). These records, as well as a recent record from north-central Myanmar (Zug et al., 1998) confirm that the species extends even further east than Smith (1935) had recognized.

Pawar and Birand (2001) have recently recorded *Eutropis dissimilis* from northeast India in open habitats in the Nameri National Park and Pakhui (Pakke) Wildlife Sanctuary in the Arunachal Pradesh/Assam border area. However, these authors provided no information about voucher specimens or the exact locality (-ies) where this skink was observed or collected. Most recently, Athreya (2005) reported a specimen from Eaglenest Wildlife Sanctuary

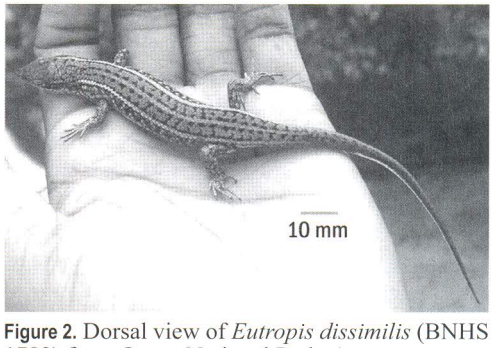

Figure 2. Dorsal view of *Eutropis dissimilis* (BNHS 1782) from Orang National Park, Assam.

in Arunachal Pradesh. Although this last report did not provide the explicit coordinates of the site of observation, it has subsequently been stated to be at Doimara (450 m elevation) and we have confirmed that it has also been observed at 27°18'8.0" N, 92°25'08.9" E at 620 m elevation.

We here report additional records of *Eutropis dissimilis* from north-eastern India, including Arunachal Pradesh and the first confirmed records from Assam (Fig. 1). In Arunachal Pradesh, this species was observed at Pakke Tiger Reserve (26°54'N, 92°36'E; 210 m elevation) and in Assam, it was found in Orang National Park (26°30'53.8"N, 92°16'24.4"E; 56 m elevation), in Manas National Park (26°41'–26°50'N, 90°45'–91°25'E), and at Koilamoila, Bongaigaon District (ca. 26°42'N, 90°36'E). All of these localities in north-east India are north of the Brahmaputra River, suggesting that the river forms a barrier or demarcates a habitat change that is significant for *E. dissimilis*.

Most specimens were located in protected microhabitats. One specimen from Orang National Park (Bombay Natural History Society – BNHS 1782) was found under accumulated vegetation near a seasonal stream, whereas another (Fig. 2) was located under a log on the sandy slope of a river bank, as were two specimens from Pakke Tiger Reserve. At Manas, one individual was found in leaf litter and a second, a gravid female, was found dead adjacent to an old wooden bridge. The specimen from Koilamoila was found in a grassy patch on an exposed sand bar of the Kanamakra River. These situations are consistent with observations elsewhere that the species is terrestrial and often occurs along river and stream courses (Shah, 1995). The localities in Manas National Park and at Koilamoila are close to the Bhutanese border, suggesting that *Eutropis dissimilis*, which has not yet been recorded from this country (Bauer and Günther, 1992; Das and Palden, 2000), may be expected to be found there, particularly in the Royal Manas National Park immediately adjacent to the border.

The gravid specimen from Manas National Park, found on 30 August 2006, contained 10 mature eggs. This is a significantly larger clutch size than reported for *E. dissimilis* in Pakistan (3–7, M. S. Kh an, 2006; 3–8, Greer et al., 2004) or most other localities in India (6–7, Smith, 1935) and somewhat smaller than reported in Jammu and Kashmir (11–15, Sahi and Duda, 1986). The seasonality of reproduction in Assam appears to resemble that in Kashmir, where large oviductal eggs have been reported in September (Sahi and Duda, 1986), and is slightly earlier than reported for Pakistan, where oviducal eggs have been recorded in October and November (Minton, 1966; Greer et al., 2004; although M. S. Khan [2006] reported oviposition from March to July).

An adult specimen collected from Orang National Park (BNHS 1782) had the following measurements (recorded to the nearest 0.1 mm with a dial vernier caliper: snout to vent length: 77.7 mm, tail length 104.3 mm, tail width at base 11.1mm, axila-groin length: 45.0 mm, tibial length 12.3 mm, forearm length: 20.9 mm, head length (from base of jaw to snout tip) 14.8 mm, head width 10.6 mm, head depth 7.9 mm, eye diameter 4.7 mm, eye-ear distance 4.2 mm, eye-snout distance 5.8 mm, eye-nostril distance 2.7 mm, interorbital distance 1.8 mm, internarial distance 2.8 mm and ear length 2.2 mm. The size of this individual is well within the range reported for the species across most of its distribution (Sharma, 2002; Schleich and Kästle, 2002; Greer et al., 2004), but M. S. Khan (2006) reported only 53–55 mm SVL for Pakistani populations. Differences in both size and reproduction suggest either significant clinal variation in the western part of the species range or the existence of more than one biological entity masquerading under the name *Eutropis dissimilis*. This was hinted at by Minton (1966) who stated that eastern and western specimens of *E. dissimilis* were strikingly different in appearance.

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A RANGE EXTENSION FOR *LIPINIA NOTOTAENIA* (BOULENGER, 1914) (SQUAMATA: SCINCIDAE) AND THE REPRODUCTIVE MODE OF THE SPECIES

Lipinia nototaenia (Boulenger, 1914) was recently redescribed (Shea and Greer, 2002), based on the holotype and two additional specimens, all from Papua Province, Indonesia (formerly Irian Jaya). During a recent visit to the National Museum of Natural History (USNM), Smithsonian Institution, Washington D.C., I found a fourth individual of this species, previously misidentified as *Sphenomorphus minutus*. This additional individual represents the first record of the species from Papua New Guinea, a range extension of 323 km ESE of the previous easternmost specimen (Kloof Camp on the Lorentz River) and on dissection proved to be a gravid female, providing the first record of reproductive mode, litter size and timing of reproduction for this species.

The newly identified specimen, USNM 203866, was collected at the Palmer River, 0.5 miles above the confluence with the Wai Pinyang River, in Western Province, Papua New Guinea (05°53'S, 141°32'E) on 12 November 1975, and donated to the collection by Tyson R. Roberts. The locality is recorded in the collection database as "Station Fly 75-12", presumably referring to the ichthyological survey by Roberts (1978).

All four records for the species are associated with rivers flowing south of the central cordillera, and at least two (Kloof Camp and the new record) are close to the base of the cordillera. The other two localities are from unspecified points along the Setekwa and Lorentz Rivers which flow south from the cordillera.

In most features, the new specimen agrees well with the redescription of the species provided by Shea and Greer (2002). Of variable characters previously reported for the species, the new specimen has 24 midbody scales, 57 paravertebral scales, 19L/18R lamellae below the fourth toe, prefrontals narrowly separated medially, and 3L/3R nuchal scales. The number of paravertebral scales slightly extends the previous range (52–55). Further, the specimen

slightly extends the known variability for the species in previously invariant features by having five supraoculars on the right side with the first three contacting the frontal (previously four, with the first two), 10 supraciliaries on the left side (previously nine), and four presubocular scales on the right side (previously three). The specimen has snout-vent length 44 mm, axilla-groin length 24 mm, forelimb length 9 mm, hind limb length 13.5 mm, head length 7.9 mm, head width 5.2 mm and head depth 3.8 mm. These values slightly extend previously reported proportions: axilla-groin length 54.5% of snout-vent length (previously 49.4–51.2%), forelimb length 20.5% of snout-vent length (previously 24.2–26.0%), hind limb length 30.7% of snout-vent length (previously 35.8–39.0%), head length 18.0% of snout-vent length (previously 19.5–21.6%), head width 65.8% of head length (previously 66.7–73.7%), head depth 48.1% of head length (previously 50.0–56.6%). Given that the previous range of variation was based on only three individuals, some extension of the known variation is to be expected.

The specimen is a gravid female, with a single embryo in the right oviduct and an empty left oviduct.

Of the other New Guinea species of *Lipinia*, reproductive mode is known for *L. noctua*, *L. rouxi* and *L. venemai* (Hediger, 1933; Brongersma, 1953; Oliver and Shaw, 1953; Whitaker, 1970; Greer and Mys, 1987; Zug, 1991). *Lipinia noctua* and *L. venemai* are viviparous, while *L. rouxi* is oviparous. Reproductive mode has not been reported for *L. albodorsalis*, *L. cheesmanae*, *L. longiceps*, *L. occidentalis*, *L. pulchra* or *L. septentrionalis*. Number of offspring has previously been reported for *L. albodorsalis, L. noctua, L. rouxi, L. septentrionalis* and *L. venemai*. For all except *L. rouxi*, the number of offspring is two (*L. albodorsalis, L. septentrionalis, L. venemai*; single observations by Shea and Greer, 2002; Günther, 2000, and Brongersma, 1953, respectively) or 1–2, modally two (*L. noctua*: Hediger, 1933; Oliver and Shaw, 1953; Whitaker, 1970; Zug, 1991). *Lipinia rouxi* has a fixed clutch size of one (Greer and Mys, 1987).

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A SECOND SPECIMEN OF *COMPLICITUS NIGRIGULARIS* (OTA & HIKIDA, 1991)

(with three text-figures)

Large agamid lizards typically inhabit tall trees, and are thus effectively out of the reach of most field collectors. Consequently, several arboreal agamids have been described from relatively well-collected areas in recent years (e.g., Hallermann and Böhme, 2000; Hallermann and McGuire, 2001; Inger and Stuebing, 1994). Additionally, a number of species, long known from the original type series, have been recollected after a hiatus of decades (e.g., Ota and Hikida, 1996; Inger and Lakim, 1998; Das and Das, 2007). In this paper, we report on a specimen of *Complicitus nigrigularis* (Ota & Hikida, 1991), which represents the second known individual of the species.

Complicitus nigrigularis (Ota & Hikida, 1991) enters the scientific literature as *Gonocephalus* sp. (in Hikida, 1980), and was subsequently formally described as *Calotes nigrigularis* Ota and Hikida, 1991, based on a unique type, OMNH R 3964 (*ex* KUZ 13223; holotype; fide Hatooka, 1996), from "Kinabalu Park, Sabah (alt. ca 1500 m)" (06° 00–15'N; 116° 15–45'E, East Malaysia, Borneo). No further specimens have been reported.

Manthey and Grossmann (1997) diagnosed the monotypic genus *Complicitus* (Latin for black-throated, an allusion to the throat colouration of the holotype), with *Calotes nigrigularis* Ota and Hikida, 1991, as the type species, based on this material. The genus and species were characterised by the following combination of characters: arboreal agamid; dewlap with lateral pockets and granular scutellation; nuchal crest present; limbs and tail relatively short; dorsal scales heterogenous and rhombic, their tips typically rounded and dorsals and ventrals subequal. Apart from listing in taxonomic works (e.g., Welch, 1994; Manthey and Grossmann, 1997; Manthey and Denzer, 2000; Malkmus et al., 2002; Das, 2004; 2006; Das and Yaakob, 2007),

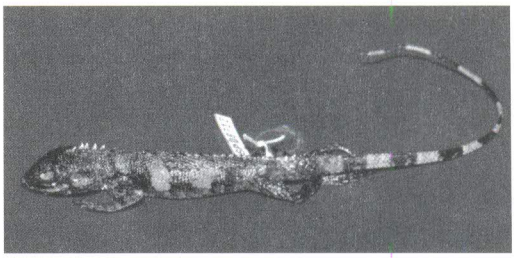

Figure 1. The second known specimen (SP 06712) of *Complicitus nigrigularis* (Ota & Hikida, 1991).

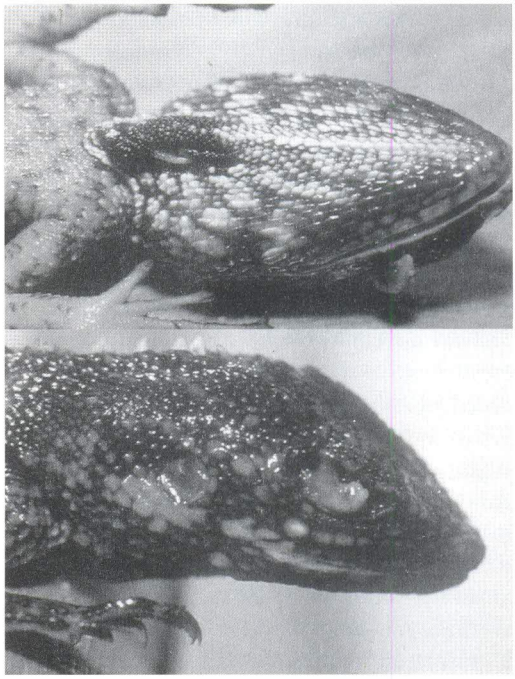

Figure 2. *Complicitus nigrigularis* (Ota and Hikida, 1991), showing head in ventral (top) and lateral (bottom) views (SP 06712).

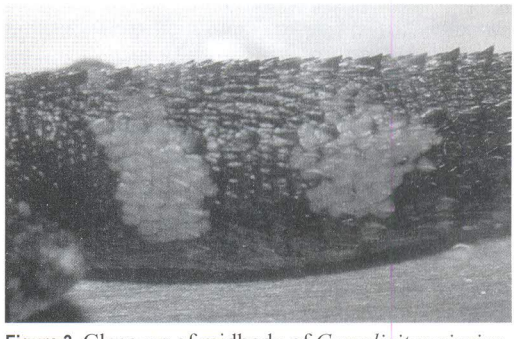

Figure 3. Close-up of midbody of *Complicitus nigrigularis* (Ota & Hikida, 1991), showing heterogenous and rhombic dorsal scales, with rounded tips (SP 06712).

nothing has been recorded in the literature about this species.

We report here a second specimen of *Complicitus nigrigularis*, based on an adult female collected from the type locality, the Headquarters of Kinabalu Park, Ranau District (Sabah Parks Zoological Museum, SP 06712). It was found between 0900–1000 h, ca. 1.2 m up on a concrete wall of the Kinabalu Conservation Centre Building, near a herbarium, on 15 June, 2004, about 14 years after the description of the species. This specimen (SP 06712; Figs. 1–3) agrees with the description of the holotype, except being larger– SVL 75.5 mm and TL 157.3 mm (vs. 69.6 mm and 155.0 mm, respectively).

A brief description of the specimen is provided: habitus relatively robust; body short; snout tapering, rounded; tail relatively long (208.3% SVL); gular pouch small; a slight oblique fold in front of shoulder; midbody scale rows 60; scales on upper 3–4 rows directed backwards; the rest directed obliquely downwards; nuchal crest comprising six pale, enlarged scales, preceded by two smaller spinous scales and followed by a single spinous scale; middorsal crest slightly enlarged, strongly keeled; anterior nine scales of crest elongated and compressed; upper half slightly keeled; lower half unkeeled; dorsal surface of body dark brownish-grey, with two broad transverse white bands on trunk between the fore and hind limbs; a large cream patch in postocular region, covering the tympanum; neck and shoulder mottled with white; a narrow cream patch at the region of axilla, above level of forelimbs; another cream patch forming a transverse bar on anterior or body, at level of elbow of flexed forearms and a third pale blotch at around midbody; dewlap black with a pair of cream spots near the distal end; limbs with several indistinct white bands; tail with 10 broad transverse pale grey bands and venter cream, with a dark-mottled pattern; except the throat, which has a series of longitudinal dark stripes and edge of lateral pockets of gular sac yellow. The ground colour of body in life is suspected to be green or olive.

Complicitus nigrigularis appears to be a rare agamid, inhabiting submontane forests and is probably arboreal, insectivorous and diurnal in activity. The holotype, a mature adult with enlarged testes and well developed epididymides with convoluted tubes, was collected while crossing a road at an altitude of ca. 1,500 m in mid-March. At this locality, it is syntopic with five other species of agamids, including *Hypsicalotes kinabaluensis* (de Grijs, 1937), *Phoxophrys borneensis* Inger, 1960, *P. cephalum* (Mocquard, 1890) and *Bronchocela cristatella* (Kuhl, 1820).

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HEMIDACTYLUS KARENORUM (SQUAMATA, GEKKONIDAE) IN INDIA

In 1868, Theobald recognized the Burmese spotted gecko, *Hemidactylus karenorum*, as a new species from the Sittaung Valley of south-central Burma. Its reported distribution remained confined to the Pegu area (now encompassed by the Ayeyarwady, Bago and Yangon Districts) until De Rooij (1915) gave a Borneo occurrence in addition to the Burmese one. Malcolm Smith (1935) briefly noted that De Rooij's specimen "does not appear to be this species. . ." Although Smith did not see the specimens, De Rooij provided a detailed description in her book (1915) that permitted him to recognize her misidentification. Many aspects of her specimens match *H. karenorum*, e.g., dorsum of small granular scales and numerous small tubercles, number of fore- and hindfoot digital lamellae, but the number of precloacal-femoral pores does not. She described a male with a small chevron of 6 precloacal pores; Burmese *H. karenorum* have 26–38, usually ≥34 pores (Zug et al., 2007). While Smith removed this erroneous distributional record, he added a new and puzzling locality, "Cachar in Assam." He did not identify the source of this information, and The Natural History Museum, London does not possess a *Hemidactylus* specimen from this locality.

The Assam locality is puzzling owing to its distance and habitat difference from south-central Myanmar. The puzzle has been largely ignored because there have been few voucher specimens to delimit the distribution of *H. karenorum*. The joint California Academy of Sciences-Nature and Wildlife Conservation Division-Smithsonian Institution's Myanmar Herpetofaunal Survey has obtained adequate voucher specimens to define this species distribution as central and south-central Myanmar, hence a distribution with its northern limit distant from Assam and potentially isolated by the mountain ranges separating Myanmar and India.

One of us (SM) recently visited the Zoological Survey of India (ZSI) collection to examine lizard specimens, and discovered four specimens (ZSI 6402, 12050, 12075, 21712) of

Hemidactylus labelled *H. karenorum*. Three of these, now in alcohol, are extremely brittle. The fourth specimen (ZSI 21712) is modestly well preserved. The dehydrated condition makes identification difficult; nevertheless, tentative identification is possible. Two of the dried specimens (ZSI 12050, 12075) and undehydrated one (ZSI 21712) show characteristics distinctive of *H. platyurus*, i.e., digits webbed, ventrolateral trunk fold well-developed, and no enlarged tubercles dorsally; however, of these three specimens, we are confident of our identification as *H. platyurus* on only ZSI 21712 (collected 1964 at "Umtham, Upper, K. & J. Hills [presumably Khasi & Jaintia Hills, Meghalaya State], Assam" by A.K. Nanda). The final dehydrated specimens (ZSI 6402; from "Govindpur, Burma, May 1866 and Oct. 1867") might represent *H. karenorum*. For characters discernable from the specimen's current condition, it has moderately large tubercles among the granular scale of the dorsum, lacks webbing between the digits and a ventrolateral fold on the trunk, and has 7 lamellae on finger IV and about 8 on toe IV. The trunk tubercles, however, are arranged in 10–11 distinct longitudinal rows, in contrast to our Myanmar *H. karenorum* that show numerous scattered tubercles without a longitudinal arrangement. The longitudinal rows of enlarged tubercles suggest that this specimen may represent *H. brookii* or a member of the *brookii* complex (Zug et al., 2007).

We have made several assumptions about the ZSI "*H. karenorum*." First and foremost, that they represent the Assam record reported by M. Smith, because two (ZSI 12050, 12075) derive from Cachar, Assam (collected by J. Woodmason, without date). Second, Smith did not include Govindpur because he already had a Burma record or Smith was uncertain of the specimen's identification.

We are unable to locate Govindpur as a geographic entity in Burma (Myanmar), but we have located several in India. Our gazetteer (US Board of Geographic Names. India. vol. 1. 1952) lists two Govindpur localities: one as a town at 21° 29'N 85° 21'E, and the other as a canal/stream at 22° 33'N 88° 19'E. A third Govindpur is listed on the web Global Gazetteer 2.1 (www.fallingrain.com) as 25° 22' N 75° 32'E. These localities are in the states of Orissa, West Bengal, and Rajasthan, respectively. Woodmason's Cachar locality is presumably 25° 05'N 92° 55'E (for Cachar district) in the state of Assam. What is the likelihood that "true" *H. karenorum* occurs at any of these four localities? The Orissa and Rajasthan localities seem most unlikely to harbour *H. karenorum* owing to their great geographic distance from the known *H. karenorum* distribution. The possibility of *H. karenorum* in Assam and West Bengal is certainly greater because they are geographically closer. Nevertheless, we suggest that if a *H. karenorum*-like gecko occurs at either or both locations, it is likely an undescribed sibling species, as our ongoing studies of the central Burmese herpetofauna continue to demonstrate that lizards may share the same species names between Myanmar and India but they are not the same species (e.g., Zug et al., 2006).

We wish to thank our colleagues at Zoological Survey of India collection Kolkata [ZSI] (B.H.C.K. Murthy) and The Natural History Museum [BMNH] (C. J. McCarthy) for access to their respective collections. We also appreciate S. Biswas' and J. Vindum's careful reading and comments for improving this manuscript. GZ's research into the biology and systematics of Asian herpetofauna has been supported by the Research Opportunity Fund and the Biological Survey and Inventory Program of the National Museum of Natural History, and the NMNH Department of Vertebrate Zoology. The National Science Foundation – Biodiversity Surveys & Inventories program has made the comprehensive survey of the Myanmar herpetofauna possible through DEB–9971861 and DEB–0451832.

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FOOD AND FEEDING HABITS OF *ELACHISTODON WESTERMANNI* REINHARDT, 1863

(with one text-figure)

Feeding habits of egg-eating snakes have been described in the African egg eater, *Dasypeltis* (Gans, 1952; 1974; Gans and Williams, 1954; Das, 2002). However, there are no reports available on Indian egg eater, *Elachistodon westermanni*, which is known from Nepal, Bangladesh and India. Occurrence of the species in central India was reported by Captain et al. (2005).

No specimens of *Elachistodon westermanni* has ever been kept in captivity and there exists no notes on its habits, with the exception of Reinhardt's (1863) specimen with egg yolk [?]. I observed egg yolk in the stomach of a road-killed specimen, and also report here observations of live specimens feeding on eggs. Observations were made at Wardha (20°45'0"N; 78°37'0"E) and Akola (20°44'0"N; 77°0'0"E), both in Maharashtra State, western India. Wardha city lies within a scrub forest. Around Akola lies extensive dry deciduous forests, in addition to scrub forests, and is a nesting site of many local bird species. The following plant species are known from the two sites: Teak (*Tectonal grandis*) is the dominant species with its common associate, Lendia (*Lagestroemia parviflora*), Moyan (*Lanmea coromondolica*), Ain (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*), Haldu (*Adina cordifolia*), Kalanb (*Mitrigyna parviflora*) and Dhaman (*Grewia tiliafolia*).

Feeding habits of *Elachistodon westermanni* reported here are based on observation made in situ in December, 2005 on two live individuals in the wild, and photographed with Nikon FM10. Videos were taken with a Panasonic GS–120 3CCD camera.

Elachistodon westermanni is a small, slim snake, with glossy chocolate brown to black colour. Bluish-white flecks are present on posterior of body, black checkered marking on forebody, and a florescent or cream stripe present along the middorsal line from neck to tail tip. Head is brown in colour and dark black arrow mark present on it. Ventrals are white, with brownish dots. It is primarily nocturnal, but has also been observed during the day. These snakes are not aggressive but at times, assume an s-shaped position.

For the present studies, I searched 13 nests of sparrows (*Passer domesticus*), 51 nests of bayas (*Ploceus philippinus*), eight of munias (*Lonchura malabarica*) and 11 nests of doves (*Streptopelia senegalensis*). Ultimately, I observed *Elachistodon westermanni* near the nest of the sparrow. After continuous observation, I recorded the following event. An individual of *Elachistodon westermanni*, after entering a bird nest, examined all eggs in the nest, smelled them and selected one of them, and swallowed it. The time taken for selection, swallowing and glutting was ca. 1 to 1.30 min. After taking the egg in the cervical region, a crushing sound ("Tiss") was heard. Peristaltic muscular movements of esophageal wall to move the egg contents towards the tubular stomach followed. The cervical vertebrae probably aided the crushing of the egg-shell. Similar observations are reported by Gans (1952) for *Dasypeltis*. He suggested that

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FOOD AND FEEDING HABITS OF *ELACHISTODON WESTERMANNI* REINHARDT, 1863

(with one text-figure)

Feeding habits of egg-eating snakes have been described in the African egg eater, *Dasypeltis* (Gans, 1952; 1974; Gans and Williams, 1954; Das, 2002). However, there are no reports available on Indian egg eater, *Elachistodon westermanni*, which is known from Nepal, Bangladesh and India. Occurrence of the species in central India was reported by Captain et al. (2005).

No specimens of *Elachistodon westermanni* has ever been kept in captivity and there exists no notes on its habits, with the exception of Reinhardt's (1863) specimen with egg yolk [?]. I observed egg yolk in the stomach of a road-killed specimen, and also report here observations of live specimens feeding on eggs. Observations were made at Wardha (20°45'0"N; 78°37'0"E) and Akola (20°44'0"N; 77°0'0"E), both in Maharashtra State, western India. Wardha city lies within a scrub forest. Around Akola lies extensive dry deciduous forests, in addition to scrub forests, and is a nesting site of many local bird species. The following plant species are known from the two sites: Teak (*Tectonal grandis*) is the dominant species with its common associate, Lendia (*Lagestroemia parviflora*), Moyan (*Lanmea coromondolica*), Ain (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*), Haldu (*Adina cordifolia*), Kalanb (*Mitrigyna parviflora*) and Dhaman (*Grewia tiliafolia*).

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For the present studies, I searched 13 nests of sparrows (*Passer domesticus*), 51 nests of bayas (*Ploceus philippinus*), eight of munias (*Lonchura malabarica*) and 11 nests of doves (*Streptopelia senegalensis*). Ultimately, I observed *Elachistodon westermanni* near the nest of the sparrow. After continuous observation, I recorded the following event. An individual of *Elachistodon westermanni*, after entering a bird nest, examined all eggs in the nest, smelled them and selected one of them, and swallowed it. The time taken for selection, swallowing and glutting was ca. 1 to 1.30 min. After taking the egg in the cervical region, a crushing sound ("Tiss") was heard. Peristaltic muscular movements of esophageal wall to move the egg contents towards the tubular stomach followed. The cervical vertebrae probably aided the crushing of the egg-shell. Similar observations are reported by Gans (1952) for *Dasypeltis*. He suggested that

Figure 1. Sequence of events showing *Elachistodon westermanni* smelling and picking up bird egg (A - top), swallowing egg (B - middle) and egg in cervical region, being crushed (C - bottom).

the cervical vertebrae in egg eaters are modified structurally for crushing the swallowed eggs.

After these observations, the snake was caught for further observations. On the second day, I collected four eggs from another nest of sparrow. All of them were kept on the ground before the snake, which started approaching the eggs, smelled all of them and selected one egg to eat, swallowed it (Fig. 1A–B) and crushed in the cervical region (Fig. IC). This egg was the largest of the four eggs. In both incidences, the snake smelled the eggs before swallowing. Similar observations have been recorded by de Queiroz and Rodríguez-Robles (2006), who described the origins of egg-eating in snakes. These workers speculated that egg-eating phenomenon in egg eater snakes has a genetic basis, which functions through the smell receptors, probably involving Jacobson organ. They speculated further that egg-eaters are specific in food selection, and bird egg-eaters have their ancestors feeding on birds. It was also observed that *Elachistodon westermanni* ingested passerine eggs. The eggs of munias are much smaller than the eggs of sparrow and doves. When the snake was given 10 eggs each of munia, sparrow and doves on different days, it was observed that the snake fed on seven eggs of munia at a time, four eggs of sparrow at a time and two eggs of doves.

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