

**ADDITIONAL AMPHIBIANS AND REPTILES FROM THE PHNOM SAMKOS WILDLIFE
SANCTUARY IN NORTHWESTERN CARDAMOM MOUNTAINS, CAMBODIA, WITH
COMMENTS ON THEIR TAXONOMY AND THE DISCOVERY OF THREE NEW SPECIES**

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ABSTRACT. – Nineteen novel records of amphibians and reptiles (eight frogs, seven lizards, and four snakes) from the northwestern portion of the Cardamom Mountains are reported. Six of these, including three undescribed species, are new records for Cambodia. This underscores the importance of the Cardamom Mountains and Cambodia as a whole in biodiversity estimates of Indochina and the extent to which it still remains understudied.

KEY WORDS. – Cambodia, Cardamom Mountains, Phnom Samkos, Taxonomy.

INTRODUCTION

Herpetofaunal studies throughout the Indochinese Peninsula have been relatively infrequent and somewhat sporadic for

much of the latter half of the 20th century. The bulk of this work has generally been taxon-oriented and often focused in relatively localized regions (see Bain et al., 2003; Bain & Nguyen, 2004; Campden-Main, 1970; Inger et al., 1999; Ohler

et al., 2000; Orlov et al., 2001, 2002, Stuart & Platt, 2004 and references therein). Although Cambodia occupies a key area within Indochina and forms a crucial geographical link between the faunas of its surrounding countries, our knowledge of Cambodian herpetology is still largely incomplete. Years of political unrest had all but halted any field-based studies in Cambodia, and as such, herpetological research still lags far behind that of neighbouring Vietnam and Thailand (e.g., Campden-Main, 1970; Cox, 1991; Deuve, 1970; Inger et al., 1999; Manthey & Grossmann, 1997; Nguyen et al., 2005; Stuart, 2005; Ziegler, 2002 and references therein). Only within the last few years has the political situation stabilized enough to enable reasonably safe fieldwork in some areas (Daltry & Momberg, 2000; Grismer et al., in press; Ohler et al., 2002; Stuart & Emmett, 2006; Stuart et al. 2006). Recent studies and studies currently in progress have demonstrated that many wide-ranging lineages previously considered to be single species, are composed of multiple species whose boundaries fall within central Indochina (e.g., Bain et al., 2003; Matsui, et al. 1996, 2001, 2005a,b; Ota et al., 2001; Wüster et al., 1995). Therefore, groundwork from baseline field surveys in Cambodia and systematic studies of its herpetofauna are essential in order to more fully understand its species composition and the historical biogeography of the Indochinese herpetofauna as well as to implement effective measures of conservation.

The Cardamom Mountains form an isolated massif in southwestern Cambodia, which extends along the northern edge of the Gulf of Thailand. This unique topographic feature of the Indochinese Peninsula ranges approximately 225 km along a northwest to southeast axis from Chanthaburi in southeastern Thailand to Kampong Bay in southern Cambodia and encompasses over 10,000 km² (Fig. 1). The most recent reports on the herpetofauna of this mountain range (Grismer et al., 2007a; Ohler et al., 2002, Stuart & Emmet, 2006) document the presence of at least 125 species. The latest of these reports (Grismer et al., 2007a) consolidated data from previous publications and presented separate species lists for each of the four distinct physiographic sections of the Cardamom Mountains. The northwestern section, the area

encompassing Phnom Samkos (elevation 1,717 m), Phnom Tumpor (elevation 1,551 m) and the low-lying regions between them contained within the Phnom Samkos Wildlife Sanctuary (Daltry & Momberg, 2002), was reported to have 76 species (23 frogs, 4 turtles, 1 crocodile, 20 lizards, and 28 snakes; Grismer et al., 2007a: Table 1). We report here on a new collection from lowland regions associated with the northwestern Cardamoms, which adds an additional 19 species to the Phnom Samkos Wildlife Sanctuary. Six of these species are new records for Cambodia, one of which was just recently described (Grismer et al., 2007b) and two remain undescribed. These new data underscore the importance of this region to the growing biodiversity estimates of Cambodia.

SURVEY SITES

Our survey focused on the eastern flank of Phnom Samkos and its low-lying periphery within the Phnom Samkos Wildlife Sanctuary. The survey was conducted from 4–13 August 2006 during the peak of the rainy season to maximize amphibian taxa. Additionally, sporadic surveys on Phnom Tumpor were done from January through July 2006 by JH, TN, and TC. Phnom Samkos reaches 1,717 m in elevation and supports three distinct vegetation types that align themselves along an altitudinal gradient: dry dipterocarp forest occupies the lowland areas surrounding the base of Phnom Samkos; hill evergreen forest covers the mountain slopes and foothills up to 1,500 m; and montane evergreen forest ranges from 1,500 m to the summit (Webb, 2005). The latter two regions have been placed in a distinct bioclimatic region referred to as the Cardamom Evergreen Forest Ecoregion (Fontanel, 1972). Phnom Samkos and its surrounding lowlands have been included in the Phnom Samkos Wildlife Sanctuary, a nominally protected area that still suffers from considerable illegal logging and poaching. The primary localities of our survey within this sanctuary were the town of Pramaoy, the village of Che Teal Chrum, and three separate camps located in the foothills and adjacent low-lying areas along the eastern periphery of Phnom Samkos. Specimens were also collected in transit from one study site to the next.

Pramaoy (12°18.437'N 103°06.096'E, 238 m; Fig. 2). Pramaoy is a small town located in an area of highly disturbed

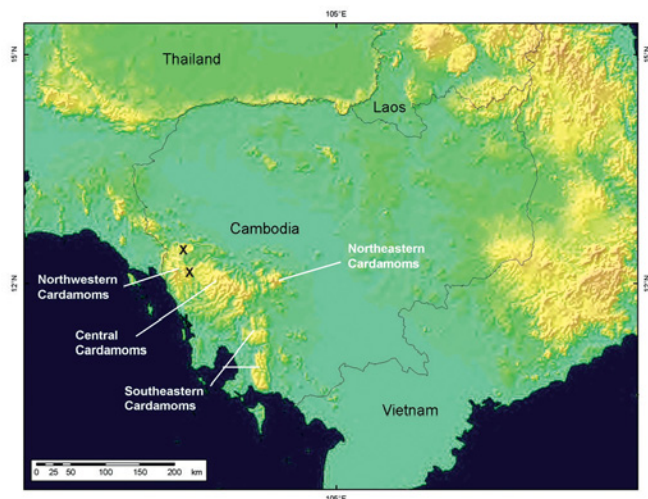


Fig. 1. Location of Phnom Samkos within the Cardamom Mountains, Cambodia.



Fig. 2. Disturbed habitat in the town of Pramaoy, Pursat Province, Cambodia.

dipterocarp forest (Boyce et al., 2002). Temporary puddles within and alongside the roads running through the town as well as introduced shrubbery provided ample habitat for many species common in anthropogenically modified environments.

Che Teal Chrum Village (12°11.900'N 103°06.930'E, 283 m; Fig. 3). Che Teal Chrum Village lies on a flat, wide floodplain east of Phnom Samkos, which is crisscrossed by small streams. The surrounding vegetation is dry dipterocarp forest (Boyce et al., 2002), which is highly degraded from illegal logging. Temporary puddles within and around the village provided ample habitat for many species common in anthropogenically modified environments and adjacent disturbed forest with intermittent clearings provided alternative habitats for additional forest and flat-land species.

Camp 1 (12°08.817'N 103°08.067'E, 501 m; Fig. 4). Camp 1 was located near a small, rocky, ephemeral stream situated on a hillside in undisturbed hill evergreen forest with thick understory vegetation. Collecting was done along one of the small trails, within the understory, along the stream and a portion of the main footpath coursing along the lower flanks of the mountain.

Camp 2 (12°11.646'N 103°04.386'E, 331 m; Fig. 5). Camp 2 was situated in a low, flat area approximately 10 km from the eastern base of Phnom Samkos along an elephant trail that crossed the flood plain east of Phnom Samkos. The camp was flanked by two, deeply cut, rocky, fast-flowing streams beneath a closed canopy. Evidence of past logging was present and thick understory vegetation made collecting difficult. Several ephemeral ponds and puddles were present in swampy areas and along a narrow trail where several species of amphibians were collected. Additional collecting was done along and within the streams.

Camp 3 (12°11.860'N 103°03.168'E, 336 m; Fig. 6). Camp 3 was a former Khmer Rouge hideout situated along an unnamed river at the base of Phnom Samkos in a transitional zone between dry dipterocarp forest and hill evergreen forest.

No sign of extensive logging was evident and the understory was relatively free of vegetation. Collecting was done along the various trails, riverbanks, and within the river.

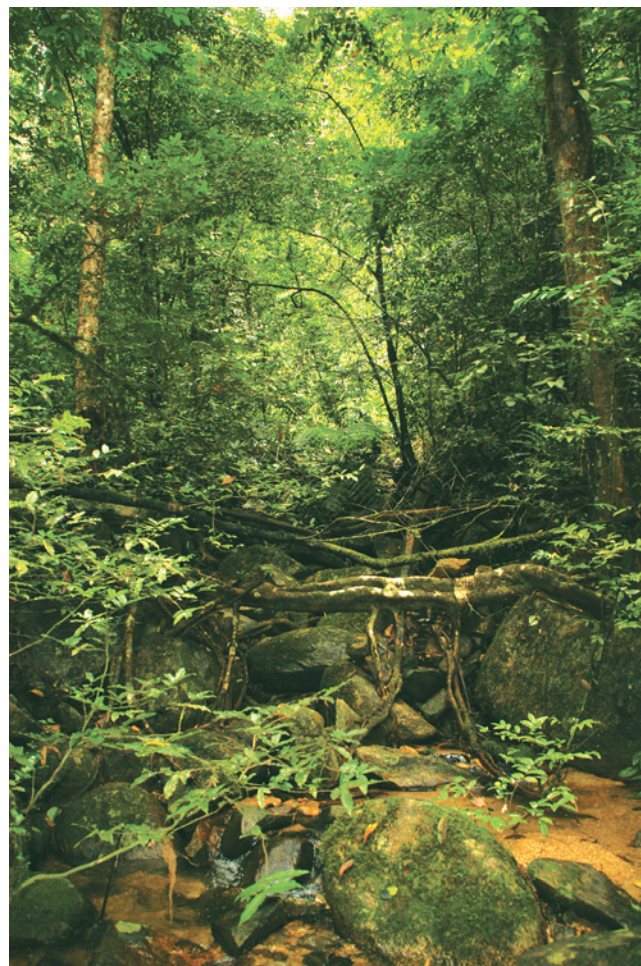


Fig. 4. Camp 1 on the eastern flanks of Phnom Samkos, Pursat Province, Cambodia.



Fig. 3. Disturbed habitat surrounding Che Teal Chrum Village, Pursat Province, Cambodia.



Fig. 5. Camp 2 in a secondary forest 10 km east of the eastern foothills of Phnom Samkos, Pursat Province, Cambodia.

MATERIALS AND METHODS

Surveys were done throughout all hours of the day and night and collections were made by hand, with the aid of blowpipes, and with the help of villagers in Che Teal Chrum. Specimens were photographed prior to euthanization, after which they were fixed with 10% formalin, and transferred into 70% ethanol for storage. Prior to fixation, liver tissue was removed and stored in 95% ethanol. All specimens were identified and compared to descriptions in the literature and, in some cases, to material on hand from the Field Museum of Natural History, Chicago, Illinois, USA (FMNH), The Natural History Museum, London, England (BMNH), the La Sierra University Herpetological Collection, Riverside, California (LSUHC), the Zoological Reference Collection (ZRC) in the Raffles Museum of Biodiversity Research, National University of Singapore, Singapore, and the Institute of Ecology and Biological Sciences (IEBR), Vietnamese Academy of Sciences and Technology, Hanoi, Vietnam. Voucher photographs were deposited in the La Sierra University Digital Photograph Collection (LSUDPC). Measurements were taken with dial calipers to the nearest 0.1 mm under a binocular, dissecting microscope. Only species records new to the northwestern Cardamoms are reported below and these are accompanied by diagnoses and/or descriptions, thus rendering our identifications open to scrutiny. All species known from the northwestern Cardamoms are listed in Table 1. All material is temporarily deposited in the LSUHC and will be repatriated to the appropriate institutions in Phnom Penh in the near future.

RESULTS

ANURA (Frogs)

Microhylidae

Kalophrynus interlineatus (Blyth, 1855)

(Fig. 7)

Material examined. – LSUHC 7819: Che Teal Chrum, 5 Aug.2006.



Fig. 6. Camp 3 in a transitional zone between dry dipterocarp forest and hill evergreen forest at the base of Phnom Samkos, Pursat Province, Cambodia.

Remarks. – An adult male generally matches the diagnosis of this taxon by Parker (1934) and that of two specimens from eastern Cambodia (Stuart et al., 2006) in having the second finger longer than the fourth; fourth finger well developed; nostrils located near the tip of the snout; and a vertebral stripe forming a narrow line commencing on the tip of the snout. It differs from their diagnoses in having the third and fifth toes being equal in length as opposed to the third toe being longer than the fifth and all the toes (except the fourth) are at least one-half webbed as opposed to having less webbing.

The specimen was collected at night while calling from the base of shrubs fringing an open grassy area containing temporary rain pools. Matsui et al. (1996) elevated *Kalophrynus interlineatus* from subspecific status within *K. pleurostigma* on the basis of its distinctive call. The two species appear to be allopatric (Matsui et al., 1996; Chanard, 2003). Ohler et al. (2002) and Long et al. (2001) report *K. interlineatus* from the central and northeastern Cardamoms.

Ranidae

Rana cf. milleti Smith, 1921

(Fig. 8)

Material examined. – LSUHC 7828, 7874: approximately 5 km north of Camp 1 (12°09.140'N 103°07.719'E), 6 and 8 Aug.2006, respectively; LSUHC 7892–97: Camp 2, 9 Aug.2006.

Remarks. – A series of eight males (SVL 45–48 mm) match the description of this species by Smith (1921) and more closely the expanded descriptions by Inger et al. (1999) and Chuaynkern et al. (2004) in having small round vocal sacs below the angle of the jaws with openings in the corners of the mouth; a strong dorsolateral fold; granular skin on back with many small tubercles capped by spinules with larger tubercles on the side; smooth skin on the belly; and a wide, dark stripe extending from the tip of the snout, through the eye, to the tympanum. The specimens differ in having more extensive webbing on the hind foot that extends to over one-half the length of the toes and the SVLs of males are greater



Fig. 7. *Kalophrynus interlineatus* from Che Teal Chrum.

TABLE 1: Checklist of the herpetofauna of the northwestern Cardamoms. Literature sources for species previously reported from the northwestern Cardamoms are listed in Grismer et al. (2007a).

	New to northwestern Cardamoms	New to Cambodia
ANURA (FROGS)		
Bufonidae		
<i>Bufo macrotis</i> Boulenger, 1887		
<i>Bufo melanostictus</i> Schneider, 1799		
<i>Ingerophrynus parvus</i> Boulenger, 1887		
Microhylidae		
<i>Kalophrynus interlineatus</i> (Blyth, 1855)	x	
<i>Kaloula pulchra</i> Gray, 1831		
<i>Microhyla annamensis</i> Smith, 1923		
<i>Microhyla berdmorei</i> (Blyth, 1856)		
<i>Microhyla fissipes</i> (Duméril, Bibron & Duméril, 1841)		
<i>Microhyla heymonsi</i> Vogt, 1911		
<i>Microhyla pulchra</i> (Hallowell, 1861)		
<i>Micryletta inornata</i> (Boulenger, 1890)		
Ranidae		
<i>Fejervarya limnocharis</i> (Gravenhorst, 1829)		
<i>Hoplobatrachus rugulosus</i> (Wiegmann, 1834)		
<i>Limnonectes gyldestolpei</i> (Anderson, 1916)		
<i>Limnonectes kochangae</i> (Smith, 1922)		
<i>Occidozyga lima</i> (Gravenhorst, 1829)		
<i>Occidozyga martensii</i> Peters, 1867		
<i>Paa fasciculispina</i> (Inger, 1970)		
<i>Rana faber</i> Ohler, Swan & Daltry, 2002		
<i>Rana cf. milleti</i> Smith, 1921		
<i>Rana mortenseni</i> Boulenger, 1903		
<i>Rana taiphensis</i> van Denburgh, 1909		
Rhacophoridae		
<i>Chiromantis nongkhorensis</i> (Cochran, 1927)	x	
<i>Chiromantis samkosensis</i> Grismer, Neang, Chav, & Holden, 2007	x	x
<i>Chiromantis vittatus</i> (Cochran, 1927)		
<i>Philautus cardamonus</i> Ohler, Swan & Daltry, 2002		
<i>Polypedates cf. leucomystax</i> (Gravenhorst, 1829)	x	
<i>Rhacophorus bipunctatus</i> Ahl, 1927		
<i>Rhacophorus bisacculus</i> Taylor, 1962		
TESTUDINES (TURTLES)		
Bataguridae		
<i>Cuora amboinensis</i> (Daudin, 1802)		
Testudinidae		
<i>Indotestudo elongata</i> (Blyth, 1853)		
<i>Manouria impressa</i> (Günther, 1882)		
Trionychidae		
<i>Amyda cartilaginea</i> (Boddaert, 1770)		
CROCODYLIA		
Crocodylidae		
<i>Crocodylus siamensis</i> (Müller, 1838)		
SQUAMATA (LIZARDS)		
Agamidae		
<i>Acanthosaura</i> sp.		
<i>Calotes emma</i> Gray, 1845		
<i>Calotes mystaceus</i> Duméril & Bibron, 1837		
<i>Calotes versicolor</i> (Daudin, 1802)		
<i>Draco maculatus</i> (Gray, 1845)		
<i>Draco taeniopterus</i> Günther, 1861		
<i>Physignathus cocincinus</i> Cuvier, 1829		
Gekkonidae		
<i>Cnemaspis chanthaburiensis</i> Bauer & Das, 1996	x	x
<i>Cyrtodactylus intermedius</i> (Smith, 1917)		
<i>Dixonius siamensis</i> (Boulenger, 1898)		
<i>Gekko gecko</i> (Linnaeus, 1758)		
<i>Hemidactylus platyurus</i> (Schneider, 1792)	x	
<i>Hemidactylus frenatus</i> Duméril & Bibron, 1836		
<i>Hemiphyllodactylus cf. yunnanensis</i> (Boulenger, 1903)	x	x

TABLE 1: Cont'd.

	New to northwestern Cardamoms	New to Cambodia
Lacertidae		
<i>Takydromus sexlineatus</i> Daudin, 1802	x	
Scincidae		
<i>Eutropis macularius</i> (Blyth, 1853)	x	
<i>Eutropis multifasciatus</i> (Kuhl, 1820)		
<i>Lipinia vittigera</i> (Boulenger, 1894)		
<i>Lygosoma bowringii</i> (Günther, 1864)		
<i>Lygosoma quadupes</i> (Linnaeus, 1766)		
<i>Scincella melanosticta</i> (Boulenger, 1887)		
<i>Scincella</i> sp.	x	x
<i>Sphenomorphus indicus</i> (Gray, 1853)		
<i>Sphenomorphus maculatus</i> (Blyth, 1853)		
Leiolepidae		
<i>Leiolepis belliana</i> (Gray, 1827)	x	
Varanidae		
<i>Varanus salvator</i> Laurenti, 1768		
<i>Varanus nebulosus</i> Gray, 1831		
SQUAMATA (SNAKES)		
Typhlopidae		
<i>Ramphotyphlops braminus</i> (Daudin, 1803)		
<i>Typhlops diardii</i> Schlegel, 1839	x	x
Colubridae		
<i>Ahaetulla nasuta</i> (Lacépède, 1789)		
<i>Ahaetulla prasina</i> (Reinwart, in Boie, 1827)		
<i>Amphiesma boulengeri</i> (Gressitt, 1937)*	x	
<i>Boiga cyanea</i> (Duméril, Bibron & Duméril, 1854)	x	
<i>Chrysopelea ornata</i> (Shaw, 1802)		
<i>Dendrelaphis pictus</i> (Gmelin, 1789)		
<i>Enhydryis plumbea</i> (Boie, 1827)	x	
<i>Homalopsis buccata</i> (Linnaeus, 1758)		
<i>Lycodon cardamomensis</i> Daltry & Wüster, 2002		
<i>Oligodon barroni</i> (Smith, 1916)		
<i>Oligodon inornatus</i> (Boulenger, 1914)		
<i>Oligodon</i> sp.	x	x
<i>Oreophis porphyraceus</i> (Cantor, 1839)		
<i>Orthriophis taeniurus</i> (Cope, 1861)		
<i>Pareas margaritophorus</i> (Jan, 1866)	x	
<i>Psammodynastes pulverulentus</i> (Boie, 1827)		
<i>Ptyas korros</i> (Schlegel, 1837)		
<i>Ptyas mucosus</i> (Linnaeus, 1758)		
<i>Rhabdophis chrysargos</i> (Schlegel, 1837)		
<i>Rhabdophis nigrocinctus</i> (Blyth, 1856)		
<i>Rhabdophis subminiatus</i> (Schlegel, 1837)		
<i>Sibynophis collaris</i> (Gray, 1853)		
<i>Xenochrophis flavipunctatus</i> (Hallowell, 1860)		
Elapidae		
<i>Bungarus candidus</i> (Linnaeus, 1758)		
<i>Bungarus fasciatus</i> (Schneider, 1801)		
<i>Naja kaouthia</i> Lesson, 1831		
<i>Ophiophagus hannah</i> (Cantor, 1836)		
Viperidae		
<i>Calloselasma rhodostoma</i> (Boie, 1827)		
<i>Cryptelytrops albolabris</i> (Gray, 1842)		
<i>Cryptelytrops macrops</i> (Kramer, 1997)		
<i>Viridovipera vogeli</i> (David, Vidal & Pauwels, 2001)		

*Reported as *Amphiesma* cf. *khasiensis* (Boulenger 1890) in Grismer et al. (2007a).

than that reported by Chuaynkern et al. (2004; 45–48 mm vs. 32.6–41.7 mm). Stuart & Emmett (2006) noted similar webbing to that reported here for two specimens from the central Cardamoms. This series differs from those of Inger et al. (1999), Smith (1921), and Stuart & Emmett (2006) in that all ventral surfaces are immaculate as opposed to having dark mottling and they differ from the description of Chuaynkern et al. (2004) in that the posterior portion of the thigh is lightly mottled as opposed to being a uniform brown.

All specimens were collected in swampy areas that remain wet throughout the year. They were located during the day and night by their calls. Chuaynkern et al. (2004) report this species from the northeastern Cardamoms.

Rhacophoridae

Remarks. – Delorme et al. (2005), Frost et al. (2006), and Wilkinson et al. (2002) convincingly demonstrated that *Chirixalus* Boulenger, 1893, is paraphyletic with respect to other rhacophorid genera. To avoid this paraphyly, Frost et al. (2006) placed *C. palpebralis* into their newly formed genus *Feihyla*, and Delorme et al. (2005) placed *C. gracilipes* into their new genus *Aquixalus*. *Chirixalus romeri*, *C. ocellatus*, and *C. vittatus* were left incerta sedis by Frost et al. (2006)



Fig. 8. *Rana* cf. *miletti* from Camp 1.



Fig. 9. *Chiromantis vittatus* from Camp 1.

although Wilkinson et al. (2002) indicates that *C. vittatus* may be most closely related to *Polypedates* Tschudi, 1838, and Frost et al. (2006) suspect that *C. romeri* and *C. ocellatus* may eventually be transferred into *Feihyla*. Frost et al. (2006) placed the remainder of *Chirixalus* in the synonymy of *Chiromantis* Peters 1854. However, it should be cautioned that this latter arrangement is based only on the phylogenetic placement of *C. doriae* (see Wilkinson et al., 2002) and should be regarded as tentative. Nonetheless, we believe that the classification of Frost et al. (2006: Appendix 7) provides a taxonomy, which, at this point, is most consistent with what is currently believed to be the best estimate of this groups evolutionary relationships.

Chiromantis nongkhorensis (Cochran, 1927)

(Fig. 10)

Material examined. – LSUHC 7767: Pramaoy, 4 Aug.2006; LSUHC 7816: Che Teal Chrum, 5 Aug.2006; LSUHC 7833, 7841–46: Camp 1, 6 Aug.2006.

Remarks. – Nine specimens agree with Cochran's (1927) description of the type series from Nong Khor in southeastern Thailand and Stuart & Emmett's (2006) description of specimens from the central Cardamoms, and two specimens collected from the northeastern Cardamoms (Grismer et al., 2007a) in having the two outer fingers (digits III and IV) nearly opposable to the inner two (digits I and II); interorbital distance much greater than the width of the upper eyelid; SVL greater than 20 mm (SVL 26–35 mm in our sample); dorsum reddish-brown with dark, transverse blotches and barred limbs; head slightly wider than body; tibiotarsal articulation reaching the eye or slightly beyond it; toes nearly completely webbed; canthus angular; tympanum distinct. Taylor (1962) stated that the outer fingers are 2/3 webbed but in our specimens, webbing is restricted to the base with the fingers being 1/4–1/2 webbed at most.

All specimens were calling while seated on small leaves of low bushes adjacent to temporary rain pools along the edge of the main trail. Stuart & Emmet (2006) report *Chiromantis nongkhorensis* from the central and southeastern Cardamoms



Fig. 10. *Chiromantis nongkhoriensis* from Pramaoy.

and Grismer et al. (2007a) report it from the northeastern Cardamoms.

***Chiromantis samkosensis* Grismer, Neang, Chav, & Holden, 2007**
(Fig. 11)

Material examined. – LSUHC 7831–32: Camp 1, 6 Aug.2006.

Remarks. – Two specimens (ZRC 1.11897, female, SVL 25 mm and ZRC 1.11896, male, SVL 25 mm) of a new rhacophorid *Chiromantis samkosensis* was described by Grismer et al. (2007b) having a relatively small SVL (25 mm); skin of body and limbs smooth; skin of head not co-ossified to skull; pupil horizontal; digits having disks with a ventromarginal groove and a transverse groove across the pad; fingers I and II without webbing, fingers II and IV nearly one-half webbed; fingers I and II oppose fingers III and IV; and toes at least three-quarters webbed.

Both specimens were found seated on leaves approximately 1 m above the ground on the edge of a temporary rain pool in an open area along the edge of the main trail. They were part of a breeding chorus that included *Chiromantis nongkhorensis* and *C. vittatus*.

***Polypedates leucomystax* complex**

Material examined. – LSUHC 7759–65: Pramaoy, 4 Aug.2006; LSUHC 7817: Che Teal Chrum, 5 Aug. 2006; LSUHC 7847: Camp 1, 6 Aug.2006; LSUHC 7899: Camp 2, 9 Aug.2006.

Remarks. – The *Polypedates leucomystax* complex is an incompletely understood species group with many distinct forms from various regions masquerading under a single name (Inger et al., 1999; Narins, et al., 1998; Orlov et al., 2001; Trepanier et al., 1999; Zhao & Adler 1993) if not more. Seven adult males (LSUHC 7759–65; SVL 52–57 mm) from Pramaoy and an adult female (LSUHC 7817; SVL 79 mm) from Che Teal Chrum match the description of *Polypedates leucomystax leucomystax* in Taylor (1962) and four specimens from the northeastern Cardamoms (Grismer et al., 2007a;

LSUHC 7347–48, 7354–55) in that the skin of the head is fused to the frontoparietal and nasal bones; vocal sac present in males; interorbital space wider than upper eyelid; tympanum distinct; fingers with small (nearly absent in our sample) webbing; toes at least 2/3 webbed; digital discs smaller than tympanum; tibiotarsal articulation reaching from eye to end of snout; vomerine teeth present; and an hourglass-shaped, dark marking on head and occiput reaching shoulders (only in LSUHC 7760–62, 7764–65; pattern obscured in LSUHC 7759, 7763). LSUHC 7817 from Che Teal Chrum has four, dark, dorsal stripes instead of an hourglass marking, thus matching the description of *P. l. sexvirgatus* (Taylor, 1962). Similar variation was reported in populations of this complex from Phnom Aural (Grismer et al., 2007a).

Individuals of these two populations were collected at night while sitting on the leaves of low bushes next to roadside puddles in anthropogenically modified habitats. Many others were heard calling from nearby vegetation.

LSUHC 7847 from Camp 1 (adult male, SVL 49 mm) matches Taylor’s (1962) description except that the dorsum has dark mottling and the flanks have dark stippling. This specimen was collected deep within undisturbed forest while sitting in vegetation along a small stream.

LSUHC 7899 from Camp 2 is a large adult female (SVL 99 m) generally matching Taylor’s (1962) description except that the dorsum is cream coloured with a few isolated dark spots. This specimen was collected while sitting 1.5 m above a fast-flowing, rocky stream coursing through secondary forest.

This species complex has been reported from the central Cardamoms by Ohler et al. (2002) and from the northeastern Cardamoms by Grismer et al. (2007a), Ohler et al. (2002), Stuart & Emmett (2006), and Swan & Daltry (2002).

SQUAMATA (Lizards)

Gekkonidae

***Cnemaspis chanthaburiensis* Bauer & Das, 1998**
(Fig. 12)

Material examined. – LSUHC 7882: Camp 1, 8 Aug.2006.



Fig. 11. *Chiromantis samkosensis* from Camp 1.



Fig. 12. *Cnemaspis chanthaburiensis* from Camp 1.

Remarks. – A single adult male (SVL 33.3 mm) matches the description of the type series ($n = 3$) from southeastern Thailand (Bauer & Das, 1998; Dring, 1979) in being small (SVL 34.5–40.9); having an additional phalanx in the second digit of the manus and pes (phalanges counted by the number of joints in the digit); eight preanal pores; no femoral pores; ventral and subcaudal scales smooth; fifth digit of manus only slightly shorter than fourth; snout relatively short, only slightly depressed; 21 or fewer subdigital scales (counted from the proximal interphalangeal joint to the toe tips) on digits 3, 4, and 5 of the pes; dorsal pattern with white paravertebral markings.

The specimen was found beneath the rain fly of a camping tent. This species has been previously reported from the Thai portion of the Cardamoms (Bauer & Das, 1996; Dring, 1979) so its occurrence in the northwestern Cardamoms is not unexpected. This represents a new species and genus record for Cambodia.

Hemidactylus platyurus (Schneider, 1792)

Material examined. – LSUHC 7853: Che Teal Chrum, 8 Aug.2006.

Remarks. – A broken tail was recovered from a mis-capture of a specimen 2 m up on the side of a tree in the forested area surrounding Che Teal Chrum Village. It is identified as belonging to *Hemidactylus platyurus* (*fide* Carranza & Arnold, 2006) and not *H. craspedotus* in that the fringe on the tail is one-quarter the width of the body of the tail whereas in *H. craspedotus* the fringe is equal to the width of the body of the tail. The morphology of LSUHC 7853 matches that of the tails of LSUHC 7323–24 from the northeastern Cardamoms and additional material from West Malaysia (LSUHC 3874, 5564, 6430, 6636, 6732, 7146, 8230). The tail was compared to the tails of seven *H. craspedotus*, (LSUHC 4754, 5080–81, 5613, 6316, 6330, 6672) from West Malaysia.

Hemiphyllodactylus cf. yunnanensis (Boulenger, 1903) (Fig. 13)

Material examined. – LSUHC 8242: Phnom Tumpor, Ou Kran stream (102°88.805'E 13°69.474'N, 1,100 m) 8 May 2006.



Fig. 13. *Hemiphyllodactylus cf. yunnanensis* from Phnom Tumpor. Photograph by JH.

Remarks. – A single adult female (SVL 43 mm) collected from Phnom Tumpor is placed in the genus *Hemiphyllodactylus* Bleeker, 1860 (Smith, 1935; Taylor, 1963) in that it has weakly webbed digits; four, clawed, outer digits and a vestigial inner digit lacking a free, distal phalanx (and a claw); subdigital lamellae transversely expanded with the distal lamellae being divided medially; terminal phalanges short, arising from within the expanded section of the digit (absent on first digits) not the tip; dorsal scales small, granular, lacking tubercles; no cutaneous expansion along the side of the body; ventral scales larger, cycloid, smooth, imbricate; and pupil vertical. The specimen somewhat matches Taylor's (1963) diagnosis of a Thai specimen except that the postmentals are distinctly enlarged vs. somewhat enlarged; having 10 as opposed to nine infralabials and nine as opposed to 10 infralabials; having large as opposed to small supranasals; having five as opposed to six or seven oblique, subdigital lamellae on the fourth toe; and the first finger lacking as opposed to having a minute claw. *Hemiphyllodactylus yunnanensis* is extremely variable however in postmental and lamellar morphology (Kai-ya et al., 1981; Taylor, 1963). We examined 10 specimens (FMNH 7716–17, 14451–52, 180866–71) from China, Laos, and Thailand and noted significant variation in fourth toe lamellae number and morphology; presence or absence of claw on first toe; shape and size of the supranasal, mental, and postmentals, numbers of supralabials, and number of infralabials. Two of the main diagnostic characters for this species, number of preanal and femoral pores and size of the subcaudal scales could not be assessed being that LSUHC 8242 is a female with a regenerated tail. The specific identity is therefore tentative.

The specimen was found inside a tent in near a small stream in hill evergreen forest.

Lacertidae

Takydromus sexlineatus Daudin, 1802 (Fig. 14)

Material examined. – LSUHC 7795: Pramaoy, 4 Aug.2006. LSUHC 7809: Che Teal Chrum, 5 Aug.2006; LSUHC 7854, 7856–57, 7886, 8 Aug.2006; LSUHC 7968, 12 Aug.2006.

Remarks. – Five adult males (LSUHC 7795, 7809, 7854, 7856, 7857; SVL 50–59 mm) and two adult females (LSUHC 7786, 7968; SVL 55–65 mm) match Taylor's (1963) diagnosis and the description of this species from the central Cardamoms (Stuart & Emmett, 2006) in having unregenerated tails nearly four times longer than the SVLs; nasals meeting on the median line; keeled frontal scale; a single preanal pore at the base of each hind limb; and a single, enlarged anal scale flanked by two small scales on each side. They differ in that Taylor (1963) reports *Takydromus sexlineatus* having six rows of enlarged keeled scales on the neck and front one-half of the body followed by four rows. However, LSUHC 7795, 7856–57, 7886, and 7968 have eight rows of enlarged keeled scales on the neck which become four rows at the

level of the forelimb insertion. LSUHC 7809 and 7854 have eight enlarged rows on the neck, becoming six rows at the level of the forelimb insertions, and four rows in the anterior region of the trunk. All scale rows are strongly keeled with the keels forming a continuous ridge running the length of the body. Taylor (1963) also notes that there are 10–14 rows of enlarged, keeled ventral scales, whereas the series examined here have 6–10 rows. This, however, may be due to a difference in counting where Taylor counted all keeled scale rows including the two ventrolateral rows on each side of the body and we counted only the ventral scale rows. They differ from Stuart & Emmett's (2006) specimen in that only the frontal scale is keeled rather than all the head shields.

All specimens from Che Teal Chrum were found during the day generally 0.5–1 m above the ground in the grassy, open areas between patches of secondary forest near the village. LSUHC 7795 from Pramaoy was found beneath a log during the late afternoon in a refuse pile at the edge of town. This species has been reported from the central and southeastern Cardamoms by Stuart & Emmett (2006) and from hilly eastern Cambodia by Stuart et al. (2006).

Scincidae

Eutropis multifasciatus (Kuhl, 1820)

Material examined. – LSUHC 7796, 7810: Che Teal Chrum, 5 Aug.2006. LSUHC 7859, 8 Aug.2006. LSUHC 7998, 13 Aug.2006.



Fig. 14. *Takydromus sexlineatus* from Che Teal Chrum.

Remarks. – Three juvenile (LSUHC 7798, 7859, 7998; SVL 51–57 mm) and one adult female (LSUHC 7810; SVL 100 mm) are largely in accord with Taylor's (1963) diagnosis of Thai specimens, a specimen from Phnom Aural (LSUHC 7370) reported by Grismer et al. (2007a), and a series from northern West Malaysia (LSUHC 6811, 6843, 7080, 7101, 7106, 7113–14, 7118–19, 7121–22, 7151, 7170–72) in having the supranasals slightly separated; a postnasal; prefrontals in contact; first loreal higher than second; no transparent disc in the lower eyelid; dorsals tricarinate; 30–32 longitudinal scale rows around midbody (30–34 in Taylor's material); and flanks dark with ocelli.

All specimens were observed foraging in open areas except for LSUHC 7798, which was found beneath a log. This species is common in both disturbed and undisturbed environments and has been reported from the central Cardamoms by Daltry & Chenang (2000), Stuart & Emmett (2006), Long et al. (2001) and Daltry & Traeholt (2003), and from the northeastern Cardamoms by Grismer et al. (2007a).

Scincella sp.

Material examined. – LSUHC 7976: Camp 3, 11 Aug.2006; LSUHC 7977: Camp 2, 12 Aug.2006.

Remarks. – Two specimens (LSUHC 7976; male, SVL 30.6 mm and LSUHC 7977; female, 29.3 mm) of a scincid lizard are referred to the genus *Sphenomorphus* Fitzinger 1843, on the basis of lacking supranasal scales; having a deeply sunk tympanum; five digits on both limbs; subdigital lamellae of the fourth toe fewer than 30; fourth toe with two rows of supradigital scales; inner preanal scales overlap outer preanal scales; and lower eyelid composed of multiple small scales with a medial transparent disc. They can not be assigned to any currently known species of *Scincella* (Oubter, 1986) and are currently being described as a new species (Oaks & Grismer, in prep.).

Both specimens were found during the day beneath leaf litter in the vicinity of a stream or river.

Leiolepididae

Leiolepis belliana (Gray, 1827) (Fig. 15)

Material examined. – LSUHC 7955–66, 7970–71: Che Teal Chrum, 9–11 Aug.2006.

Remarks. – Fourteen specimens (seven males, SVL 68–83 mm; seven females, SVL 61–103 mm) match Smith's (1935) and Taylor's (1963) diagnoses and descriptions of *Leiolepis belliana belliana* [thereby separating them from *L. reevesi* (Gray, 1831) and *L. guttata* Cuvier, 1829] from Thailand in having 7–12 scales across the undersurface of the tibia at the midline; ventral scales as broad as three or four dorsal scales; widely scattered light spots on the dorsum lacking black edges that do not form a dark, dorsal reticulum; and thin, cream-

colored, vertebral and dorsolateral stripes. They differ from a series of *L. belliana* (LSUHC 4844–48, 4858–64, 6810, 6822, 6835–36, 6842, 6887, 7492, 7595) from northern West Malaysia near the type locality of Seberang Peri in having much smaller dorsal spots and thinner dorsal stripes; less blue on the head, neck, and forelimbs; the black bars on the flanks are wider than the orange bars instead of the reverse; and they lack an ontogenetic change in color pattern in that the complete striping pattern is retained into adulthood.

The only other report of *Leiolepis* from the Cardamom Mountains were sight records of *L. reevesi* (Swan & Daltry, 2002) from the vicinity of Aural Village in the northeastern Cardamoms. We collected an additional series of *Leiolepis* (LSUHC 7979–87, 8000–01) 46.5 km east of Che Teal Chrum and 165 km west of Aural Village from a mine field south of Pursat (12°18.632'N 103°31.677'E) that approach the colour pattern of *L. reevesi* in having slightly more enlarged dorsal spots and stripes and having only faint dark bars in the flanks. However, they match *L. belliana* in scale morphology (Taylor, 1963). An additional collection (LSUHC 8003–08) was made further east at Tbeng (11°52.862'N 104°36.463'E) 165 km east of Che Teal Chrum and 43 km east of Aural Village that look even more like *L. reevesi* in having wider dorsal spots whose edges are fused in some places, even wider dorsal stripes, and less dark barring in the flanks. Scale morphology, however, still matches *L. belliana*. Based on this and additional material we examined from southern Vietnam (IEBR 1575–76; LSUDPC 1959, 2006), we suspect that *L. belliana* and *L. reevesi* may grade into one another across southern Cambodia and on into southern Vietnam, suggesting the two forms may be a single species as previously considered by Smith (1935) and Taylor (1963). Owing to the more northerly distribution of *L. reevesi* throughout southern China, Laos, and eastern Thailand (Chan-ard et al., 1999:134; Zhao & Adler, 1993), coupled with the variation reported here in populations from southern Cambodia, it is unlikely that *L. reevesi* occurs in the northeastern Cardamoms juxtaposed between two populations of *L. belliana*.

The specimens from Che Teal Chrum were collected by residents of the village, who use this species as a food source. Lizards were dug out of holes in open, grassy areas surrounding the village.



Fig. 15. *Leiolepis belliana* from Che Teal Chrum.

SQUAMATA (Snakes)

Typhlopidae

Typhlops diardii Schlegel, 1839

(Fig. 16)

Material examined. – LSUHC 7969: Che Teal Chrum, 12 Aug.2006.

Remarks. – A single juvenile (SVL 97 mm) matches Wallach's (2001) diagnosis reasonably well in having the preocular scale separate from the nasal scale; inferior nasal suture contacting the second supralabial; two postoculars; 28 midbody scale rows reducing to 24 posteriorly; eight rows of subcaudal scales; eye distinct with a pupil; parietals twice as broad as deep; and a gradual, lateral transition between the opaquely purple dorsal coloration (specimen nearly ready to shed) and the cream-colored venter. It differs from Wallach's (2001) diagnosis in having 383 total middorsal scales as opposed to 298–341 (Wallach, 2001:40; $n = 6$). In this regard, it falls within the range of *T. muelleri* (298–402), which has been reported from the central Cardamoms (Stuart & Emmett, 2006).

Although this is the first record of this species from Cambodia, it has been reported to range from India to Thailand and Vietnam (see David & Vogel, 1996) so its occurrence in Cambodia is not unexpected. The specimen was dug up from a garden by a villager.

Colubridae

Boiga cyanea (Duméril, Bibron & Duméril, 1854)

(Fig. 17)

Material examined. – LSUHC 7879: Camp 1, 6 Aug.2006.

Remarks. – An adult female (SVL 944 mm) agrees with the description of this species by Taylor (1965) and that of a specimen from the central Cardamoms (Stuart & Emmett, 2006) in having eight supralabials; 12 infralabials; one preocular; two postoculars; 21 body scale rows with enlarged vertebrals; 252 ventral scales; 138 divided, subcaudal scales; and being uniform green above with black interstitial skin.



Fig. 16. *Typhlops diardii* from Che Teal Chrum.

This species has been previously reported from central Cambodia (Saint Girons, 1972), the central Cardamoms (Stuart & Emmet, 2006), and hilly eastern Cambodia (Stuart et al., 2006).

This specimen was found at night approximately 3 m above the ground crawling through the branches of a small tree.

***Enhydris plumbea* (Boie, 1827)**

(Fig. 18)

Material examined. – LSUHC 7823, 7890, 7972, 7995–96: Che Teal Chrum, 5–11 Aug.2006.

Remarks. – Four females (LSUHC 7823, 7890, 7972, 7995; SVL 279–383 mm) and one male (LSUHC 1996; SVL 232 mm) match Taylor’s (1965) diagnosis and description of Thai specimens in having 19 dorsal scale rows; the single internasal not touching the loreal; dark olive above with three outer dorsal scale rows yellow; and a yellow venter.

All specimens were collected at night in temporary rain pools and buffalo wallows within the village. Daltry & Chenang (2000), Long et al. (2001), and Daltry & Traeholt (2003) reported this species from the central Cardamoms.



Fig. 17. *Boiga cyanea* from Camp 1.



Fig. 18. *Enhydris plumbea* from Che Teal Chrum.

***Oligodon* sp.**

(Fig. 19)

Material examined. – LSUHC 7883: Che Teal Chrum, 8 Aug.2006.

Remarks. – Due to a peculiar misplacement of type material, Günther (1861) described and redescribed (Günther, 1864) two different species of *Oligodon* from separate collections under the name *Simotes taeniatus*. Malcom Smith brought this to the attention of George Boulenger who rectified the situation with the description of the subspecies *S. t. mouhoti* (Boulenger, 1914) based on Günther’s (1864) material and some additional specimens. Smith (1943), however, considered *S. t. mouhoti* a junior synonym of *S. taeniatus* (now *Oligodon taeniatus*), which was followed by Taylor (1965). In fact, Taylor (1965) conflated the putatively diagnostic characters of these taxa in his key, diagnosis, and description of *O. taeniatus*.

We obtained a female (SVL 310 mm) from Che Teal Chrum that had a mixture of the diagnostic characters of *Oligodon taeniatus* and *O. mouhoti* (as diagnosed in part by Campden-Main, 1969; Günther, 1864; Smith, 1943; and Taylor, 1965), as well as some unique features. Like *O. taeniatus*, it lacks a large black, dorsal band at the base and tip of the tail as seen in *O. mouhoti* (see Cox et al., 1998:60). It has a head pattern and dorsal stripes similar to that of *O. taeniatus* in that the cream-colored vertebral stripe encompasses the vertebral scale row and is bordered by irregular, dark, paravertebral stripes although the dark lateral stripes are more faint like that in *O. mouhoti*. It has 17 dorsal scale rows at midbody like that of *O. mouhoti* whereas *O. taeniatus* has 19. This specimen represents a new species currently being described (Patrick David, in press).

***Pareas margaritophorus* (Jan, 1866)**

(Fig. 20)

Material examined. – LSUHC 7880: Camp 1, 6 Aug.2006.

Material examined. – A juvenile female (SVL 285 mm) matches Grossmann & Tillack’s (2003) characterization of



Fig. 19. *Oligodon* sp. from Che Teal Chrum.

the genus and Smith's (1943) description of the species in having a single preocular; the supralabials being prevented from contacting the eye by suboculars; lacking a single, median inframaxillary but having three pairs of inframaxillaries instead; 149 ventrals; 38 undivided subcaudals; 15 rows of smooth dorsal scales at midbody lacking an enlarged vertebral row; the head being distinct from the neck; body not laterally compressed; dorsal scales grey, edged in black; series of transversely aligned black spots occasionally edged in white extending from neck to base of tail; and black nuchal band divided by a tripartite orange band. This specimen is in accord with a specimen collected from Phnom Aural in the northeastern Cardamoms in Kampong Speu Province (LSUHC 7463; Grismer et al., 2007a) and with a specimen from Siem Pang in Stung Treng Province in northeastern Cambodia (FMNH 263022; Stuart et al., 2006).

The specimen was found crawling near the base of a tree at 0500 hours.

Additional Records from Phnom Tumpor based on Photographic Vouchers

Additional records from Phnom Tumpor gathered by JH, TN, and TC are *Microhyla berdmorei* (LSUDPC 1998); *Rana faber* (LSUDPC 2000–03); *R. mortenseni* (LSUDPC 1993–94); *Philautus cardamonus* (LSUDPC 1996); *Rhacophorus bipunctatus* (LSUDPC 1997), new for the northwestern Cardamoms; *Rh. bisacculus* (LSUDPC 2004); and *Amphiesma boulengeri* (LSUDPC 1156).

DISCUSSION

Despite the growing number of published reports resulting from expeditions into the Cardamom Mountains (Daltry & Chenang, 2000; Daltry & Traeholt, 2003; Grismer et al., in press; Long et al., 2001; Ohler et al., 2002; Stuart & Emmett, 2006; Stuart & Platt, 2004; and Swan & Daltry, 2002) new additions to their herpetofauna and to that of Cambodia still continue to mount at a surprising rate. The 19 new records reported here for species in the northwestern Cardamoms (Table 1) represent six new records for Cambodia (*Chiromantis samkosensis*, *Cnemaspis chanthaburiensis*,



Fig. 20. *Pareas margaritophorus* from Camp 1.

Hemiphyllodactylus cf. *yunannensis*, *Scincella* sp., *Typhlops diardii*, *Oligodon* sp.) of which one *C. samkosensis* was just described (Grismer et al., 2007b) and two remain undescribed. Of additional significance is that *Leiolepis belliana*, *Cnemaspis chanthaburiensis*, *Hemiphyllodactylus* cf. *yunannensis*, *Typhlops diardii*, and *Oligodon* sp. fill substantial geographical and taxonomic gaps across the southern portion of the Indochinese Peninsula between southeastern Thailand and eastern Cambodia (see Stuart et al., 2006) and southern Vietnam (Grismer & Ngo, 2007). This clearly underscores the importance of this region to the biodiversity of Cambodia and Indochina, as well as continuing to highlight the need for further field work in these remote mountains. Additionally, the northwestern Cardamoms are composed of a complex series of forested, granitic foothills between Pursat and Pramaoy, which have never been explored, largely because they are surrounded by mine fields. We are certain that additional new records and potentially new species will be found here and we have targeted this area for research in the near future.

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