

A NEW SPECIES OF *Chiromantis* PETERS 1854 (ANURA: RHACOPHORIDAE) FROM PERLIS STATE PARK IN EXTREME NORTHERN PENINSULAR MALAYSIA WITH ADDITIONAL HERPETOFAUNAL RECORDS FOR THE PARK

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Seven new species of amphibians and seven new species of reptiles are added to the herpetofauna of Perlis State Park including a new species of frog of the genus *Chiromantis* which is described here. The description is based on a single adult male that can be differentiated from all other Asian congeners in having dark spots on the dorsum and top of head; tympanum indistinct; dorsolateral stripe diffuse; width of third finger disc less than width of tympanum; and webbing between the third and fourth finger encompassing one-half of penultimate phalanx of third finger and reaching base of terminal phalanx of fourth finger (III 1.5 – 1 IV). This discovery and the 14 new species records highlights the understudied nature of northern Peninsular Malaysia which has been comparatively unsurveyed.

Keywords: *Chiromantis marginis*; herpetofauna; Southeast Asia; Malaysia; taxonomy.

INTRODUCTION

The Rhacophorid genus *Chiromantis* currently contains 15 species which are generally small, arboreal inhabitants of disturbed and primary forest. All are nocturnal and most active during periods of precipitation when males call for females along the edges of permanent and ephemeral bodies of water. *Chiromantis* is disjunctly distributed in tropical east and west Africa (Frost, 2009), northern India (Dey and Gupta, 2000; Ray, 1992), and most of Southeast Asia (Chan-ard, 2003; Grismer et al.,

2007; Norhayati et al., 2005; Orlov et al., 2002; Thy and Holden, 2008; Wilkinson et al., 2003) (Fig. 1). Asian members were previously assigned to the genus *Chirixalus*, which was demonstrated to be paraphyletic with respect to other rhacophorid genera (Delorme et al., 2005; Frost et al., 2006; Wilkinson, 2002). To avoid paraphyly, *C. palpebralis* and *C. gracilipes* were placed under the genus *Feihyla* (Frost et al., 2006) and *Gracixalus* (Li et al., 2008), respectively, and the remaining species were placed in the synonymy of *Chiromantis*. To ensure the monophyly of *Chiromantis*, *C. romeri* was then reassigned to the newly erected genus, *Liuxalus* (Li et al., 2008).

The northern states of Perlis, Kedah and Kelantan in Peninsular Malaysia serve as the southernmost limit of numerous species that extend southward from adjacent Thailand along the Malay Peninsula. This is embodied in Perlis State Park (located within Wang Kelian, a town approximately 1 km south of the Thai border) which is the northernmost forest reserve in Peninsular Malaysia and a herpetologically diverse region with 23 documented species of amphibians and 66 species of reptiles (Chan et al., 2010). During March 2010, field work in Perlis State Park resulted in an additional 15 species of amphibians and reptiles which represent new park and state records (Tables 1 and 2), including a new species of frog which we assigned to the genus *Chiromantis* based on its small

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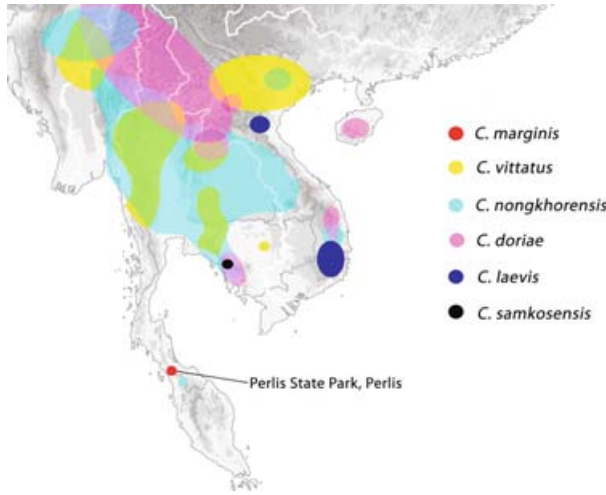


Fig. 1. General distribution of Southeast Asian *Chiromantis* based on Chan-ard (2003); Inger et al. (1999); Nguyen et al. (2009); Orlov et al. (2002); Stuart (2005); Thy and Holden (2008).

size (SVL 22.8 mm), smooth skin on the limbs and body, skin not co-ossified to the skull, and the first two fingers being opposable (Boulenger, 1893; Grismer et al., 2007; Wilkinson, 2003). The only previous record of *Chiromantis* from Malaysia is *C. nongkhorensis* (recorded as *Chirixalus nongkhorensis*) from Ulu Muda Forest Reserve, Kedah in northwestern Peninsular Malaysia, approximately 15 km from the Thai border (Leong and Lim, 2003; Norhayati et al., 2005). However, the specimen from Perlis State Park possesses a combination of unique characters that set it apart from all other congeners and is herein described as a new species.

MATERIAL AND METHODS

Measurements were taken under a Nikon SMZ 1500 dissecting microscope with Mitutoyo dial calipers to the nearest 0.1 mm and are as follows: SVL, snout-vent length, taken from the tip of the snout to the vent; HL, head length, taken from the posterior margin of the lower jaw to the tip of the snout; HW, head width, taken immediately posterior to the eyes; ELW, width of upper eyelid, measured from the medial base of the upper eyelid to the lateral edge at its widest point; ED, eye diameter, the distance between the anterior and posterior corners of the upper and lower eyelids; IND, internarial distance, the distance between the nostrils; IOD, interorbital distance, the distance across the top of the head between the medial margins of the orbits at their closest points; SNL, snout length, measured from the anterior corner of the eye where the upper and lower lids meet to the tip of the snout; DNE, distance from the nostril to the eye, taken from the anterior corner of the eye to the posterior edge

TABLE 1. Amphibians of Perlis state

Taxa	Reported by	
	Chan et al. (2009)	This study
Bufo		
<i>Duttaphrynus melanostictus</i>	×	
<i>Ingerophrynus parvus</i>		×
<i>Phrynooidis aspera</i>	×	
Dicroglossidae		
<i>Fejervarya cancrivora</i>	×	
<i>Fejervarya limnocharis</i>	×	
<i>Hoplobatrachus rugulosus</i>	×	
<i>Occidozyga lima</i>	×	
<i>Occidozyga martensii</i>		×
<i>Limnonectes blythii</i>	×	
<i>Limnonectes doriae</i>	×	
<i>Taylorana hascheana</i>		×
Megophryidae		
<i>Leptobrachium hendricksoni</i>	×	
<i>Xenophrys aceras</i>	×	
Microhylidae		
<i>Kaloula baleata</i>		×
<i>Kaloula pulchra</i>	×	
<i>Microhyla heymonsi</i>	×	
<i>Microhyla butleri</i>	×	
<i>Microhyla berdmorei</i>	×	
<i>Microhyla fissipes</i>		×
<i>Micryletta inornata</i>	×	
Ranidae		
<i>Rana glandulosa</i>	×	
<i>Rana labialis</i>	×	
<i>Rana macrodactyla</i>	×	
<i>Rana miopus</i>	×	
<i>Rana nigrovittata</i>	×	
<i>Odorrana hosii</i>	×	
Rhacophoridae		
<i>Chiromantis marginis</i> sp. nov.		×
<i>Polypedates leucomystax</i>	×	
<i>Polypedates macrotis</i>	×	
<i>Theلودerma licin</i>		×

of the nostril; TD, tympanum diameter, taken as the horizontal width of the tympanum at its widest point; FLL, forelimb length, measured from the elbow to the tip of the third finger; HLT, hand length, measured from the proximal edge of the palmar tubercle to the tip of the third finger; THL, thigh length, measured from the center of the knee to the center of the hind limb insertion; TIL, tibia length, measured from the center of the knee to the center of the ankle; FL, foot length measured from the proximal edge of the inner metatarsal tubercle to the tip of the fourth toe; 3FDW, width of the disk of the third fin-

TABLE 2. Reptiles of Perlis state

Taxa	Reported by		Taxa	Reported by	
	Chan et al. (2009)	This study		Chan et al. (2009)	This study
TURTLES			Varanidae		
Bataguridae			<i>Varanus nebulosus</i>	×	
<i>Cyclemys dentata</i>	×		<i>Varanus salvator</i>	×	
<i>Heosemys grandis</i>	×		SNAKES		
<i>Heosemys spinosa</i>	×		Colubridae		
<i>Notochelys platynota</i>	×		<i>Ahaetulla fasciolata</i>		×
<i>Siebenrockiella crassicollis</i>	×		<i>Ahaetulla prasina</i>	×	
Testudinidae			<i>Boiga cynodon</i>	×	
<i>Indotestudo elongata</i>	×		<i>Boiga drapiezii</i>	×	
LIZARDS			<i>Boiga jaspidea</i>	×	
Agamidae			<i>Calamaria lumbricoidea</i>	×	
<i>Acanthosaura armata</i>	×		<i>Chrysopelea ornata</i>	×	
<i>Acanthosaura</i> cf. <i>crucigera</i>		×	<i>Dendrelaphis kopsteini</i>	×	
<i>Bronchocela cristatella</i>	×		<i>Dendrelaphis pictus</i>	×	
<i>Calotes emma</i>	×		<i>Dryophiops rubescens</i>	×	
<i>Calotes versicolor</i>	×		<i>Enhydris plumbea</i>	×	
<i>Draco blanfordii</i>	×		<i>Gonyosoma oxycephalum</i>		×
<i>Draco abbreviatus</i>	×		<i>Lycodon</i> cf. <i>butleri</i>		×
<i>Draco formosus</i>	×		<i>Lycodon laoensis</i>	×	
<i>Draco maculatus</i>	×		<i>Macropisthodon rhodomelas</i>	×	
<i>Draco melanopogon</i>	×		<i>Oligodon purpurascens</i>	×	
<i>Draco sumatranus</i>	×		<i>Orthriophis taeniurus</i>	×	
<i>Draco taeniopterus</i>	×		<i>Pareas margaritophorus</i>	×	
Gekkonidae			<i>Psammodynastes pulverulentus</i>	×	
<i>Cnemaspis biocellata</i>	×		<i>Ptyas carinatus</i>	×	
<i>Cnemaspis kumpoli</i>	×		<i>Ptyas korros</i>	×	
<i>Cyrtodactylus macrotuberculatus</i>	×		<i>Rhadophis chrysargos</i>		×
<i>Cyrtodactylus pulchellus</i>	×		<i>Xenelaphis hexagonotus</i>	×	
<i>Gehyra mutilata</i>	×		<i>Xenochrophis piscator</i>	×	
<i>Gekko gecko</i>	×		<i>Xenochrophis trianguligerus</i>	×	
<i>Gekko monarchus</i>	×		Elapidae		
<i>Gekko smithii</i>	×		<i>Bungarus candidus</i>	×	
<i>Hemidactylus brookii</i>	×		<i>Bungarus flaviceps</i>	×	
<i>Hemidactylus platyurus</i>	×		<i>Calliophis bivirgatus</i>	×	
Leiolepididae			<i>Naja kaouthia</i>	×	
<i>Leiolepis triploida</i>	×		<i>Naja sumatrana</i>	×	
Scincidae			<i>Ophiophagus hannah</i>	×	
<i>Eutropis multifasciata</i>	×		Viperidae		
<i>Eutropis macularius</i>	×		<i>Calloselasma rhodostoma</i>	×	
<i>Sphenomorphus tersus</i>	×		<i>Cryptelytrops</i> cf. <i>venustus</i>		×
			<i>Parias hageni</i>		×
			<i>Parias sumatranus</i>	×	
			<i>Tropidolaemus wagleri</i>	×	
			Typhlopidae		
			<i>Typhlops muelleri</i>	×	

ger; and 4TDW, width of the disk of the fourth toe. Digital webbing formulae follow (Savage and Heyer, 1997). Additional character states used in comparing Asian species of *Chiromantis* were obtained and modified from Grismer et al. (2007) and are presented in Table 3. The holotype has been deposited at the La Sierra University Herpetological Collection, USA (LSUHC). Voucher pho-

tographs for new species records have been deposited in the Universiti Kebangsaan Malaysia Digital Photograph Collection (UKMDPC). Voucher specimens have been deposited in the La Sierra University Herpetological Collection (LSUHC) at La Sierra University, Riverside, California and the Universiti Kebangsaan Malaysia

Herpetological Collection (HC) at Universiti Kebangsaan Malaysia, Bangi, Peninsular Malaysia.

RESULTS

Systematics

Chiromantis marginis sp. nov. (Fig. 2A)

Holotype. LSUHC 9700 was collected on 18 March 2010 by Evan Quah, L. Lee Grismer, Chan Kin Onn, Shahrul Anuar, and Jesse L. Grismer at 22:30 from the dam behind Perlis State Park chalets, Perlis, Peninsular Malaysia (6°41'52.53" N 100°11'29.91" E; elevation 140 m a.s.l.).

Diagnosis. *Chiromantis marginis* can be distinguished from all other congeners in having a light, narrow, diffuse dorsolateral stripe; small, dark spots on the dorsum, top of head, and dorsal surfaces of limbs; snout truncate; indistinct tympanum; disc on third finger smaller than tympanum; distinct glandular fold between eye and shoulder; and webbing between the third and fourth finger encompassing one-half of penultimate phalanx on third finger and reaching base of terminal phalanx on fourth finger (III 1.5 – 1 IV).

Description of holotype. Male 22.9 mm SVL; head wider than body, relatively flat; snout truncate in lat-

eral and dorsal profile, shorter than diameter of eye (ED/SNL = 72%), sloping anteroventrally, slightly projecting beyond mouth; canthus rostralis rounded, distinct; loreal region vertical and concave; nostrils located laterally near tip of snout, non-protuberant; internarial distance less than interorbital distance (IND/IOD = 81%); interorbital width greater than width of upper eyelid (ELW/IOD = 38%); eyes large, protuberant, 33% of head length; tympanum indistinct, subcircular, 57% of eye width; supratympanic fold absent; vomerine teeth absent; choanae oval; tongue attached anteriorly, deeply notched posteriorly; single median vocal sac; vocal slit in corner of mouth on left side.

Forearms moderate in length (FLL/SVL = 44%); hands and forearms relatively robust; third finger longest followed by fourth, second, and first; expanded disks with a circummarginal groove; no transverse ventral groove; disk on third finger largest, less than width of tympanum (3FDW/TD = 69%); no webbing between first and second, and second and third fingers; webbing between the third and fourth finger reaching half of the penultimate phalanx on the third finger and base of the terminal phalanx on the fourth finger (III 1.5 – 1 IV); inner two fingers widely separated from outer two fingers (opposable); subarticular tubercle between penultimate

TABLE 3. Diagnostic Characters of Asian *Chiromantis*

Character	<i>marginis</i> sp. nov.	<i>doriae</i>	<i>dudhwaensis</i>	<i>laevis</i>	<i>nongkhorensis</i>	<i>punctatus</i>	<i>shyamrupus</i>	<i>simus</i>	<i>vittatus</i>	<i>sankosensis</i>
Dark stripes on dorsum present (1) or absent (0)	0	1	1	0	0	0	1	1	1	0
Light dorsolateral stripes present (1) or absent (0)	1	0	1	0	0	1	1	0	1	0
Dorsal and ventral border of dorsolateral stripe well defined (1) or not (0)	0	0	1	0	0	1	1	0	1	0
Dark postorbital stripe present (1) or absent (0)	1	1	1	0	1	0	0	0	1	1
Banding on dorsal aspect of thighs (1) or not (0)	1	0	0	1	1	0	0	0	1	0
Blotched pattern on dorsum (1) or not (0)	1	0	0	0	1	0	0	0	0	0
Small dark spots on dorsum (1) or not (0)	1	0	0	1	0	1	0	0	0	1
White patch on side of upper jaw (1) or not (0)	0	0	—	0	1	0	0	0	0	1
Tympanum distinct (1) or indistinct (0)	0	1	1	1	1	0	1	1	0, 1	1
Canthus rostralis distinct (1) or indistinct (0)	1	1	1	1	1	0	1	0	1	1
External vocal sac present (1) or absent (0)	1	0	1	—	1	1	—	—	1	1
Inner metatarsal tubercle present (1) or absent (0)	1	1	1	1	1	1	0	1	1	1
3 rd and 4 th fingers 1/4 webbed (1) or less (0)	1	0	0	0	0	0	0	0	0	1
Disk on 3 rd finger as large as tympanum (1) or not (0)	0	1	0	0	1	1	0	0	1	0
More (1) or less (0) than 1/3 webbing on toes	1	1	1	0	1	1	1	1	1	1
Snout obtusely pointed (1) or truncate (0)	0	0	1	1	0	1	1	0	1	0
Skin of dorsum smooth (1), with small tubercles (0) or finely granular (×)	1	1	×	1	0	1	1	0	1	1
Glandular fold between eye and shoulder distinct (1) or faint (0)	1	0	0	0	1	0	1	1	1	0
Sample size	1	11	*	*	11	*	*	*	27	2

Note. —, unable to assess; *, character obtained from literature.

and adjoining proximal phalanx and between penultimate and terminal phalanx well developed; skin of ventral surface of hand composed of large, overlapping folds; palmar tubercles absent; small, rectangular, nuptial pad on inner surface of base of first digit.

Hind limbs relatively long; tibiotarsal articulation extends beyond snout when leg is adpressed against body; heels overlap when thighs and tibia placed at right angles to vertebral column; tibia 47% SVL; foot 37% SVL; fourth toe longest followed in length by fifth, third, second, and first; toes bearing expanded disks with circummarginal grooves; no transverse ventral groove; webbing relatively thick and granular; webbing pattern: I 1 – 2 II 1 – 2 III 1 – 2 IV 2 – 1 V; rounded, subarticular tubercles well developed; elongate, inner metatarsal tubercle distinct; no outer metatarsal tubercle; skin of ventral surface of foot composed of large, elongate, longitudinal folds. All dorsal surfaces smooth; ventral surfaces composed of large, hexagonal granules. Measurements taken on the holotype are as follows: SVL = 22.8; HL = 7.0; HW = 6.9; ELW = 1.2; ED = 2.3; IND = 2.6; IOD = 3.2; SNL = 3.2; DNE = 1.8; TD = 1.3; FLL =

= 10.1; HTL = 5.9; THL = 10.7; TIL = 10.8; FL = 8.4; 3FDW = 0.9; 4TDW = 0.7

Coloration in life. Base color chalky white; entire dorsal surface of body covered with fine, dark-brown speckles; some speckles clump together, forming dark, irregular blotches on top of the head, dorsum and dorsal surfaces of limbs; dense speckles form a dark pre and post-orbital stripe which extends from the tip of the snout, through the eye, and to the angle of the jaw; a less distinct, lateral stripe formed by sparser speckles extends from the post-orbital stripe to the inguinal region; a white dorsolateral stripe borders the lateral pre- and post-orbital stripe dorsally; dorsal and ventral borders of the white dorsolateral stripe not well defined but are diffused by dark speckling; ventral surfaces white with dark speckling on the hands, feet and tibia.

Coloration in preservative. Base color chalky white; dorsal speckling indistinct; top of the head, dorsum and dorsal surfaces of limbs covered with irregular blotches which are densest on the top of the snout; pre and post-orbital stripe visible but lateral stripe indistinct; dorsolateral stripe almost not visible; ventral surfaces white with dark speckling on the hands, feet and tibia.

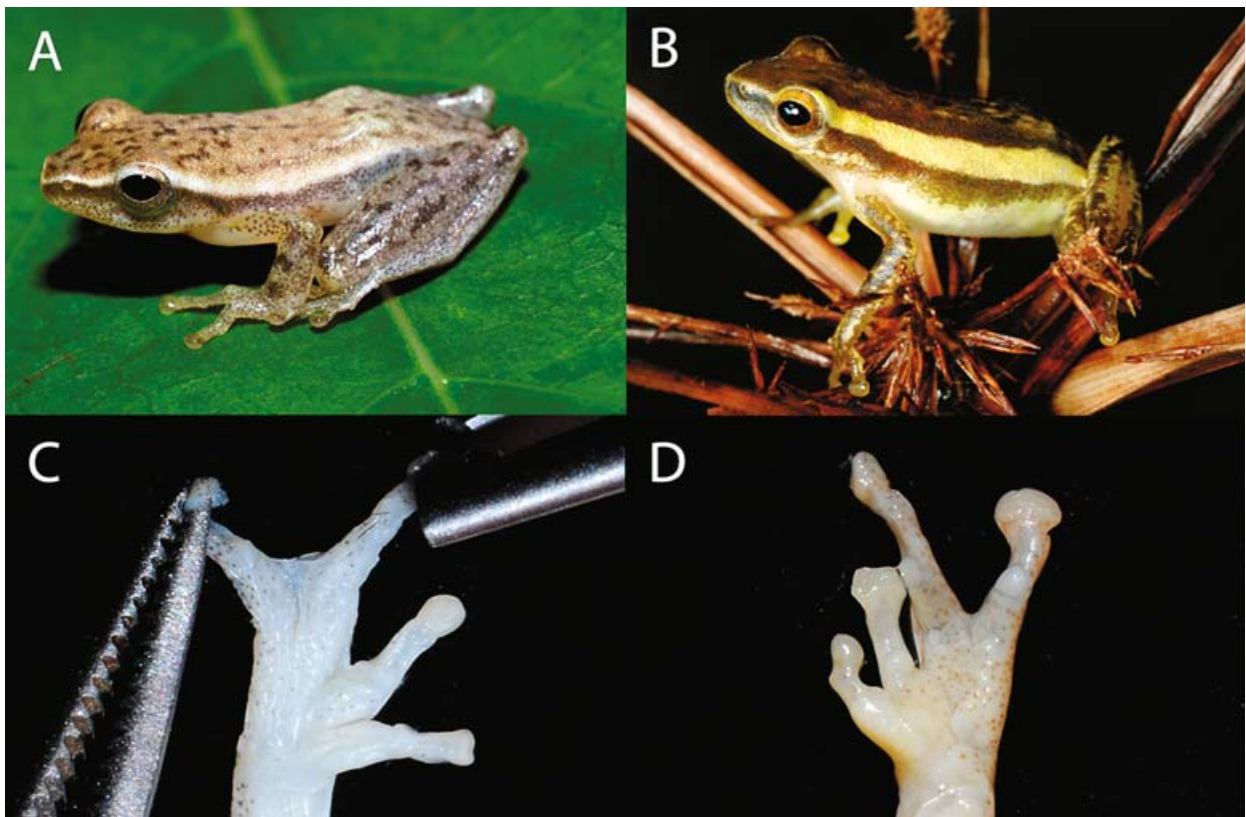


Fig. 2. A, holotype of *Chiromantis marginis*; B, *Chiromantis vittatus* from Phnom Samkos, Pursat Province, Cambodia (Photo by Jeremy Holden); C, hand webbing of *C. marginis*; D, Hand webbing of *C. vittatus*.

Distribution. *Chiromantis marginis* is currently known only from Perlis State Park but most likely ranges throughout the lowland forests of the Nakhawan Range on the borderlands of Thailand and Malaysia with which it is continuous.

Natural history. *Chiromantis marginis* was found at 22:30 during light precipitation while seated on the upperside of the leaf of a large-leaved plant 1.0 m above the ground near the edge of a man-made dam behind the Perlis State Park chalets. Several repeated attempts from June to September 2010 to find more specimens failed. Other species found within the vicinity of the dam were the frogs *Phrynoidis aspera* and *Microhyla berdmorei*, the lizards *Draco maximus* and *Cnemaspis kumpoli*, and the snakes *Ahaetulla prasina* and *Boiga drapiezii*.

Etymology. The specific epithet is derived from the Latin noun “margo” which means border, in reference to the type locality of this new species in Wang Kelian, Perlis at the Thai-Malaysian border. The suffix “inis” is attached to denote gender which in this case is neutral.

Comparisons. *Chiromantis marginis* can be distinguished from all other Southeast Asian congeners except *C. hansenae*, *C. punctatus*, and *C. vittatus* in having a white dorsolateral stripe. It differs from these three species by having a narrow, diffuse dorsolateral stripe as opposed to a wide, well defined stripe; and a smaller third toe disc that does not equal or exceed the width of the tympanum; it can be further differentiated from all other Asian *Chiromantis* except *C. samkosensis* by having more extensive webbing between the third and fourth fingers (III 1.5 – 1 IV) (Fig. 2C). These and other characters are compared with other Asian *Chiromantis* across Table 3.

DISCUSSION

Chiromantis marginis is most similar to *C. hansenae* and *C. vittatus* but differs from them by having a narrow, diffuse, dorsolateral stripe, webbing between the third and fourth fingers, and having dorsal spots (Fig. 2B, D). Additionally, the only morphological differences reported to separate *C. hansenae* from *C. vittatus* are a distinct, as opposed to an indistinct tympanum (Cochran 1927), and a smaller maximum SVL in *C. hansenae* (Taylor 1962). However, Wilkinson et al. (2003) noted that the tympanum was indistinct in half of the *C. hansenae* specimens he examined. We examined 27 specimens of *C. vittatus* and found that only some had indistinct tympanae and thus, do not consider this character to be of diagnostic value. Taylor (1962) reported that male *C. vittatus* from Thailand ranged from 26 – 28 mm in SVL and females ranged from 31 – 32 mm. He reported male *C. hansenae* from Thailand to have a SVL range of 21 – 21.5 mm and females to range from

23 – 24 mm SVL. Taylor (1962), however, reported both *C. hansenae* and *C. vittatus* from the same locality in Chiang Mai (Kaeng Paeng Tao), Thailand and *C. hansenae* from an additional locality in Loei Province, east of Chiang Mai near the border of Laos. This is in contrast to Chan-ard (2003: pp. 144, 146) who considered these species allopatric, reporting *C. vittatus* from western Thailand and *C. hansenae* from the east. Due to the lack of evidence supporting the separation of *C. hansenae* and *C. vittatus* and their putative sympatry in northern Thailand by Taylor (1962), we consider *C. hansenae* (Cochran 1927) to be a junior synonym of *C. vittatus* (Boulenger, 1887) as previously suggested by Stuart and Emmett (2006) and Wilkinson et al. (2002).

Describing a new species based on a single specimen can be potentially problematic owing to the inability to assess the range of intrapopulational variation that could obscure the delimitation of species boundaries. However, the discrete character state of having significantly more webbing between the third and fourth toes shows no variation in any other species of *Chiromantis*, thus we have no scientific justification for assuming it would in *C. marginis* with the examination of additional specimens. Additionally, the southernmost record for *C. vittatus* is in the province of Kanchanaburi, Thailand (Chan-ard, 2003), more than 750 km north of Perlis State Park. Therefore no data support a hypothesis that *C. marginis* is conspecific with *C. vittatus*.

Chan et al. (2009) reported 23 species of amphibians and 66 species of reptiles from Perlis State Park and adjacent areas. To this we add the following new records and their associated voucher photographs: *Ingerophrynus parvus* (UKMDPC 1.0142, 1.0143), *Kaloula baleata* (UKMDPC 1.0153), *Microhyla fissipes* (UKMDPC 1.0145), *Occidozyga martensii* (UKMDPC 1.0146, 1.0147), *Taylorana hascheana* (UKMDPC 1.0148), *Chiromantis marginis* sp. nov. (LSUHC 9700), *Theloderma licin* (UKMDPC 1.0149, 1.0150), *Acanthosaura* cf. *crucigera* (LSUHC 9911 – 9915), *Ahaetulla fasciolata* (UKMDPC 1.0155), *Gonyosoma oxycephalum* (UKMDPC 1.0152), *Lycodon butleri* (UKMDPC 1.0154), *Rhabdophis chrysargos* (UKMDPC 1.0156), *Cryptelytrops* cf. *venustus* (UKMDPC 1.0144), and *Pariasis hageni* (UKMDPC 1.0151).

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APPENDIX

Specimens examined

Chiromantis doriae (Boulenger, 1893): China, Hainan Island, 5 km NW of Shi Yun, LSUHC 4144–4154.

Chiromantis nongkhorensis (Cochran 1927): Cambodia, Kampong Speu Province, Aural Village, LSUHC 7349, 7350; Cambodia, Pramaoy, 7767; Cambodia, Che Teal Chrum Village, LSUHC 7816; Cambodia, Pursat Province, Camp 1, LSUHC 7833, 7841–7846.

Chiromantis samkosensis Grismer, Thy, Thou and Holden, 2007: Cambodia, Pursat Province, Camp 1, ZRC 1.11896, 1.11897.

Chiromantis vittatus (Boulenger, 1887): Thailand; Chiang Mai Province, Kaeng Pang Tao (FMNH 36224–36228), Kanchanaburi Province, Sangkla, Kwai Yai River area (FMNH 213971–213979), Chantaburi Province, Khao Soi Daow Wildlife Sanctuary (FMNH 216027, 216033). Cambodia; Siem Reap Province, Bayon Temple, Angkor Wat complex (FMNH 257346, 259410, 259413), Koh Kong Province, Areng River Valley (FMNH 267804), Pursat Province, Phnom Samkos (LSUHC 7834–7840).