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HERPETOFAUNA OF THE NORTHERN CORRIDOR: A REVIEW OF RECENT HERPETOLOGICAL DISCOVERIES AROUND THE MALAYSIAN-THAI BORDER REGIONS

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ABSTRACT

A review of published herpetological literature of the areas around the Malaysian-Thai border reveal that these areas are herpetologically rich and support a unique assemblage of species not found elsewhere in the country. This region forms an important biogeographical transition zone between many Indochinese and Sundaland taxa. In recent years, many new species have been described from the northern states of Peninsular Malaysia and southern Thailand, with many of these new species being narrow ranged endemics. Thus, greater efforts must be made to thoroughly sample these areas to assess their herpetofaunal diversity so that appropriate measures can be taken to preserve them.

Keywords: Thai-Malay Peninsula, herpetofauna, amphibians, reptiles, biogeography

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INTRODUCTION

The Malaysian-Thai border that stretches for approximate 650 km is situated at the meeting point of two very important biogeographical regions, the Indo-Burmese or Indochinese region and the Sundaland region (Myers *et al*., 2000; Woodruff, 2010). This area is situated close to the Kangar-Pattani Line (KPL) at 6–7°N that is a point of major floristic and climatic transition from aseasonal to seasonal evergreen tropical forest in the Indo-Sundaic region of Southeast Asia (Van Steenis, 1950; Whitmore, 1984; Morley, 2000; Wikramanayake *et al*., 2000; Woodruff, 2003, 2010; Baltzer *et al*., 2008, 2009). Phytogeographers believe that the transition between Continental Asiatic flora to the north and Malesian flora to the south of the KPL is associated with the occurrence of one or more months of drought north of the KPL (Whitmore, 1990). These same climatic forces that have influenced the flora, have also impacted the distribution of the fauna in the region and many studies have demonstrated it to be an area of faunal exchange in variety of taxa such as birds, mammals, and lizards (Reddy, 2008; Woodruff & Turner, 2009; Patou *et al*., 2010; Grismer, 2011; Grismer *et al*., 2014b).

The region has always intrigued naturalist and the Malaysian-Thai border have been an area of herpetological interest for over a century (Flower, 1896, 1899; Laidlaw, 1900, 1901a, 1901b; Boulenger, 1903, 1912; Smith, 1930). The northern states of Perlis, Kedah, Perak and Kelantan in Peninsular Malaysia serve as the southernmost limit for the distribution of numerous species of amphibians and reptiles with Indochinese affinities that extend southward from adjacent Thailand along the Malay Peninsula (Chan *et al*., 2011). Some areas like the Belum-Temengor complex have been the subject of many surveys into its herpetofauna and many notable finds were made in the past (Diong *et al*., 1995; Kiew *et al*., 1995; Lim *et al*., 1995a; Lim *et al*., 1995b; Norsham *et al*., 2000; Grismer *et al*., 2004). Nevertheless, vast areas still remain that have never been surveyed. This is especially true on the east coast in the state of Kelantan that remains severely understudied in terms of its herpetofauna and will most likely harbour many species new to science.

METHODOLOGY

A review of published literature of herpetological surveys and new species discoveries around the Malaysian-Thai border regions from the 1890s to 2017 was conducted to mine for secondary data. Records were reviewed and compared and the biogeography of the region is discussed.

RESULTS & DISCUSSION

The border regions of Malaysia and Thailand have been areas of rich herpetological discoveries in recent years with many new species having been described in the last few years (Chan-ard, 2003; Grismer *et al*., 2006; Chan *et al*., 2009, 2011). In the four Malaysian states of Kedah, Perlis, Perak and Kelantan that share a border with Thailand, a total of thirteen species have been described in the last decade (Figure 1). When broken down by state, five were described from Perlis; *Chiromantis marginis* Chan, Grismer, Anuar, Quah, Grismer, Wood, Muin, and Ahmad, 2011, *Cnemaspis biocellata* Grismer, Chan, Nasir and Sumontha, 2008, *C. omari* Grismer, Wood, Shahrul, Riyanto, Ahmad, Muin, Sumontha, Grismer, Chan, Quah and Pauwels, 2014b, *Cyrtodactylus astrum* Grismer, Wood, Quah, Anuar, Muin, Sumontha, Ahmad, Bauer, Wangkulangkul, Grismer and Pauwels, 2012, *Lycodon cavernicolus* Grismer, Quah, Anuar, Muin, Wood and Nor, 2014a, six were from Kedah (Langkawi archipelago); *Bronchocela rayaensis* Grismer, Wood, Lee, Quah, Anuar, Ngadi and Sites 2015a, *Cnemapsis mahsuriae* Grismer, Wood, Quah, Shahrul, Ngadi and Ahmad, 2015b; *C. monachorum* Grismer, Norhayati, Chan, Daicus, Muin, Wood and Grismer, 2009b, *C. roticanai* Grismer and Chan 2010; *Cyrtodactylus macrotuberculatus* Grismer and Norhayati 2008, *C. langkawiensis* Grismer, Wood, Quah, Anuar, Muin, Sumontha, Ahmad, Bauer, Wangkulangkul, Grismer and Pauwels, 2012, one from Perak; *Sphenomorphus temengorensis* Grismer, Ahmad and Chan, 2009a, and two from Kelantan; *Cnemaspis karsticola* Grismer, Grismer, Wood and Chan, 2008b and *Cyrtodactylus jelawangensis* Grismer, Wood, Shahrul, Quah, Muin, Mohamed, Chan, Sumarli, Loredo and Heinz, 2014c. Many of these species are also narrow-ranged endemics, especially the karst-adapted forms such as *C. karsticola* and *L. cavernicolus* that are restricted to specific caves or karst blocks (Grismer *et al*., 2008b, 2014a; Grismer, 2011).

Similarly, the southern provinces of Thailand have also served as the type locality for many species of amphibians and reptiles such as *Icthyophis suppachaii* Taylor, 1960, *Ansonia siamensis* Kiew, 1985, *Leptobrachium hendricksoni* Taylor, 1962b, *L. smithi* Matsui, Nabhitabhata and Panha, 1999, *Leptolalax solus* Matsui, 2006, *Kaloula aureata* Nutphand, 1989, *Limnonectes jarujini* Matsui, Panha, Khonsue and Kuraishi, 2010, *Humerana miopus* (Boulenger, 1918), *Polypedates discantus* Rujirawan, Stuart and Aowphol, 2013, *Rhacophorus cyanopunctatus* Manthey and Steiof 1998, *R. robinsonii* Boulenger, 1903, *Theloderma horridum* (Boulenger, 1903), *Hieremys annandalii* (Boulenger, 1903), *Leiolepis boehmei* Darevsky and Kupriyanova, 1993, *Larutia nubisilvicola* Chan-ard, Cota, Makchai and Lhaotaew, 2011, *Dibamus alfredi* Taylor, 1962a, *Cnemaspis chanardi* and *C. narathiwatensis* Grismer, Sumontha, Cota, Grismer, Wood, Pauwels and

Kunya, 2010, *Cyrtodactylus sanook* Pauwels, Sumontha, Latinne and Grismer, 2013, *C. thirakhupti* Pauwels, Bauer, Sumontha and Chanhome, 2004, *C. wangkulangkulae* Sumontha, Pauwels, Suwannakarn, Nutatheera and Sodob, 2014, *Lycodon ophiophagus* Vogel, David, Pauwels, Sumontha, Norval, Hendrix, Vu and Ziegler, 2009 and *Trimeresurus fucatus* (Vogel, David & Pauwels, 2004). Some of these species such as *Leptobrachium hendricksoni, L. smithi, Humerana miopus* and *Theloderma horridum* are already known to occur in Malaysia (Berry 1975; Norhayati *et al*., 2005; Grismer *et al*., 2006) and recent fieldwork has recorded a number of new country records for some of these more northerly taxa in the country such as *Leptolalax solus* (Matsui *et al*., 2017).

Figure 1 Some species described from the Malaysian-Thai border regions. **A**: *Chiromantis marginis*. **B**: *Lycodon cavernicolus*. **C**: *Cyrtodactylus macrotuberculatus*. **D**: *Cnemaspis biocellata*. **E**: *Cyrtodactylus astrum*. All photographs by Evan S.H. Quah.

Another example was the discovery of the Narathiwat Rock Gecko (*Cnemaspis narathiwatensis*) that was a new country record during the most recent herpetofauna survey at Sungai Enam of the Belum-Temengor region (Quah & Shahrul, 2013). The discovery of *C. narathiwatensis* was a noteworthy find as previously this species was only known from the Province of Narathiwat in Thailand (Grismer *et al*., 2010; 2014b). Given the proximity of the Belum-Temengor region to the Thai border, the discovery did not come as a surprise. Previously Temengor was also the locality of the first country record of the frog *Raorchestes parvulus* (previously *Philautus parvulus*) (Sukumaran, 2002). It is a member of a largely South Asian group that just crosses the border of Thailand is now known from scattered locations in Northern Peninsular Malaysia. Another Indochinese species which has been recorded at Temengor is the lizard *Sphenomorphus maculatus* (Diong *et al*., 1995) which distribution extends from eastern India eastwards to southern China and Vietnam and southwards through Laos, Cambodia, Myanmar and Thailand (Taylor 1963; Grismer, 2011; Chanard *et al*., 2015).

These discoveries echo findings made at other areas along the Malaysian-Thai border. Frogs tentatively assigned to the species *Chiromantis nongkhorensis* (then identified as *Chirixalus cf. nongkhorensis*) were recorded at Ulu Muda, Kedah (Norhayati *et al*., 2004, 2005) . It is a member of another largely Indochinese group with only a few members reaching as far south as the Malaysian border. In 2011 a new species, *Chiromantis marginis* was described from Perlis (Chan *et al*., 2011). In the vicinity of the same area, two species of snakes that have their most southerly distributions in northern Peninsular Malaysia were recorded as well. Norsham *et al*. (2005) recorded *Subsessor bocourti* (formerly *Enhydris bocourti*) and *Boiga cyanea* from Ulu Muda. This record of *Boiga cyanea* is the only known mainland record of this species in Peninsular Malaysia. The only other location where this species is known from is on Pulau Langkawi. The location of the island archipelago in the far north has also seen the crossover of a number of other Indochinese taxa, some of which are not recorded elsewhere in the country such as *Leptobrachium smithi, Limnonectes macrognathus, Indotestudo elongata, Hieremys annandalii, Acanthosaura crucigera, Draco maculatus, Oligodon fasciolatus, Calliophis maculiceps* and *Trimeresurus venustus* (Grismer *et al*., 2006). In addition to those species, a few other amphibian and reptile are also restricted only to the northern regions of Malaysia such as *Hylarana macrodactyla, Ingerana tenasserimensis, Cnemaspis kumpoli, Draco taeniopterus, Leiolepis triploida, Sphenomorphus tersus, Lycodon laoensis, Rhabdophis subminiatus*, *Xenochrophis flavipunctatus*, *Calloselasma rhodostoma* and yellow morph *Naja sumatrana* (Berry 1975; Tweedie, 1983; Wüster & Thorpe, 1989; Chan

et al., 2011; Grismer, 2011; Vogel & David, 2012). Conversely, there are some species of Indo-Malayan taxa such as *Aeluroscalabotes felinus*, *Aphaniotis fusca*, *Cyrtodactylus consobrinus, Eutropis rugifera, Lipinia surda*, *Asthenodipsas laevis*, *A. malaccanus*, *Calamaria lumbricoidea, C. schlegeli*, *Macrocalamus lateralis*, *Pseudorabdion longiceps* and *Xenodermus javanicus* that reach their northerly distribution limits at the southern provinces of Thailand close to the country borders (Taylor 1963, 1965; Cox *et al*., 2012; Chan-ard *et al*., 2015).

In addition to being a meeting zone for Indochinese and Indo-Malayan taxa that reach their southerly and northerly distribution limits respectively, this area has driven the evolution of unique lineages found nowhere elsewhere. An example of this are four sister species of rock geckos; *Cnemaspis biocellata, C. kumpoli, C. monachorum* and *C. niyomwanae* that are a geographically circumscribed lineage restricted to southern Thailand and north-western Peninsular Malaysia and sandwiched between the biogeographic boundaries of the Isthmus of Kra in the north and the Kangar-Pattani Line in the south (Grismer *et al*., 2014b). The lineage of this four species was named the Pattani clade and was shown to be basal to all other species of *Cnemaspis* geckos from the Sunda shelf with the exception of the two species of the Ca Mau clade, *C. boulengerii* and *C. psychedelica* from the islands of southern Vietnam (Grismer *et al*., 2014b). This is interesting and highlights the importance of this area as a repository for biodiversity and that much still remains to be learnt about the species in these areas.

CONCLUSION

In conclusion, the Malaysian-Thai border regions is an important area for new species discoveries, a crossover zone for various taxa of either Indochinese or Indo-Malayan affinities and a biogeographic region driving the evolution of unique lineages. The findings presented here highlight the unique position of the regions fringing the Malaysian-Thai border that supports a rich assemblage of herpetofauna and a significant degree of local endemism. Continued efforts should be sustained to survey these border regions as they are a herpetologically important confluence zone and meeting point for some of the Indochinese taxa with their more southerly Sundaland counterparts (Pauwels *et al*., 2000, 2002; Chan-ard *et al*., 2003; Grismer *et al*., 2011). Some of these regions are very remote and probably harbour species new to science that should be duly described so that efforts can be made to save these habitats.

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