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A diminutive new species of cave-dwelling Wolf Snake (Colubridae: *Lycodon* Boie, 1826) from Peninsular Malaysia

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Abstract

A newly discovered, diminutive, cave-dwelling, lowland species of the colubrid snake genus *Lycodon* Boie is described from a limestone cave along the Thai-Malaysian border in the state of Perlis, northwestern Peninsular Malaysia. *Lycodon cavernicolus* **sp. nov.** is most closely related to *L. butleri* Boulenger, an endemic, upland, forest-dwelling species from Peninsular Malaysia of the *fasciatus* group but is separated from *L. butleri* and all other species of the *L. fasciatus* group and the closely related *L. ruhstrati* group by having the combination of 245 (male) and 232 (female) ventral scales; 113 (male) and 92 (female) paired, subcaudal scales; a single precloacal plate; nine or 10 supralabials; 10 or 11 infralabials; a maximum total length of 508 mm (female); a relative tail length of 0.25–0.27; an immaculate venter in juveniles and dark-brown, posterior, ventral scale margins in adults; and dorsal and caudal bands in juveniles white. The discovery of *L. cavernicolus* **sp. nov.** adds to a rapidly growing list of newly discovered reptiles from karst regions and limestone forests of Peninsular Malaysia, underscoring the fact that these areas should be studied before they are quarried as they harbor a significant portion of the Peninsular Malaysia's herpetological diversity.

Key words: new species, *Lycodon*, karst, limestone, cave, conservation, endemic biodiversity, Peninsular Malaysia

Introduction

Karst formations are formed through the dissolution of layers of carbonate bedrock creating caves, sinkholes, and karst towers and compose some of Peninsular Malaysia's most spectacular landscapes. Exposed karst surfaces are particularly subject to weathering and as such, karst towers and cliff faces are often marked by deep, corrugated surfaces resulting from years of erosion and fracturing. These erosive processes also create extensive networks of cave systems that permeate karst formations and create a unique microhabitat to which a number of organisms have become adapted (see Clements *et al.* 2006; Vermeulen & Whitten 1999). Despite the astonishing degree of floral endemism in karst habitats and their surrounding limestone forests (Kiew 1998) karst formation are generally not considered to harbor high numbers of endemic, terrestrial vertebrates (i.e. Alström *et al.* 2010; Jenkins *et al.* 2004; Woxvold *et al.* 2009) and as such, remain understudied by vertebrate systematists (see Grismer *et al.* 2014a). In contrast to this notion, however, our recent herpetological surveys of karst regions in Peninsular Malaysia have revealed 13 endemic, karst-adapted species of geckos (eight species of *Cnemaspis*—Grismer *et al.* 2008a,b, 2009; 2013; Wood *et al.* 2013 and five species of *Cyrtodactylus*—Grismer *et al.* 2012, 2014a,b,c) and a new species of limestone forest-adapted colubrid snake of the genus *Dendrelaphis* (Quah *et al.* in preparation). Remarkably, we have only explored approximately 2% of the known karst formations and associated limestone forests in Peninsular Malaysia (Price 2001) and anticipate that tens of additional new species will eventually be discovered as our explorations continue.

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Norhayati, Bauer, Wangkulangkul, Grismer & Pauwels and *Cnemaspis mcguirei* Grismer, Grismer, Wood & Chan from Bukit Larut in the Banjaran Bintang mountain range are the sister species of *Cyrtodactylus bintangrendah* Grismer, Wood, Quah, Anuar, Muin, Sumontha, Norhayati, Bauer, Wangkulangkul, Grismer & Pauwels and *Cnemaspis grismeri* Wood, Quah, Anuar, & Muin, respectively (Grismer *et al.* 2012; Grismer *et al.* in prep.), from the adjacent lowlands. Similarly, in the Banjaran Titiwangsa mountain range, the upland *Cyrtodactylus trilatofasciatus* Grismer, Wood, Quah, Anuar, Muin, Sumontha, Norhayati, Bauer, Wangkulangkul, Grismer, & Pauwels is the sister species to the lowland *C. sharkari* Grismer, Wood, Anuar, Quah, Muin, Mohamed, Chan, Sumarli, Loredo & Heinz (Grismer *et al.* 2014b) and the upland *Cnemaspis* sp. Grismer, Wood, Grismer, Chan, Quah, Anuar, Riyanto, Norhayati, Muin, Sumontha & Pauwels is the sister species to the lowland *C. bayuensis* Grismer, Grismer, Wood, & Chan (Grismer *et al.* in prep.). This same pattern is also beginning to emerge in the Banjaran Timur mountain range in northeastern Peninsular Malaysia where the upland *Cyrtodactylus tebuensis* Grismer, Anuar, Muin & Quah is the sister species of the lowland *C. sworderi* (Smith) (Grismer *et al.* 2013).

The discovery of *Lycodon cavernicolus* **sp. nov.** adds to a growing body of evidence that karst regions should be better studied prior to being quarried for cement. If reptiles are an indication of the hidden diversity within these unique habitats, then limestone forests may be some of the most biotically rich habitats in Peninsular Malaysia with a level of herpetological endemism commensurate with that of Malaysia's islands (Chan *et al.* 2010; Grismer 2011a,b; Grismer *et al.* 2011).

Key to the species of *Lycodon* from Peninsular Malaysia

1.	Loreal and preocular present	.2
	Either loreal or preocular absent	6
2.	Loreal in contact with eye	3
	Loreal not in contact with eye; dorsal scales smooth	5
3.	Precloacal plate entire	4
	Precloacal plate divided; dorsal scales strongly keeled; ventrals keeled and notched; body elongate and slender; adults uniform grey	*albofuscus*
4.	Loreal in contact with internasals; eight or nine supralabials; nine or 10 infralabials; dark ground color with 28–36 lighter bands on body; 14-23 light bands on tail	*butleri*
	Loreal not in contact with internasals; nine or 10 supralabials; 10 or 11 infralabials; dull-brown color with 36–45 faint bands on body; 29–41 light bands on tail	*cavernicolus* **sp. nov.**
5.	No light cross-bands on body and tail; fine reticulated pattern on dorsum; light band on nape	*capucinus*
	Body and tail bearing yellow bands on dark ground color; belly immaculate	*laoensis*
6.	Preocular absent; prefrontals and loreals contact eye; precloacal divided	*subcinctus*
	Loreal absent; prefrontals contact 2nd and 3rd supralabials; anal entire	*effraenis*

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