



REVALIDATION OF *Lycodon hypsirhinoides* (THEOBALD, 1868) FROM ANDAMAN ISLANDS (SQUAMATA: SERPENTES: COLUBRIDAE)

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Abstract

The Andaman population of the genus *Lycodon* is compared to *Lycodon capucinus* Boie, 1827 and *Lycodon aulicus* (Linnaeus, 1758) occurring on the eastern and western parts of the range of this species complex. The population was found to be distinct and the species name *Lycodon hypsirhinoides* (Theobald, 1868) is revalidated for this population. It differs from both species in the size, proportions and colouration of adults and juveniles.

Key words: *Lycodon aulicus*, *Lycodon capucinus*, Andaman endemics, invasive species, taxonomy

Introduction

The genus *Lycodon* Boie, 1826 currently comprises 36 species (Uetz, 2012). This genus is characterized by the following combination of characters: head depressed dorsoventrally, barely set off from body; a relatively small eye with a vertically elliptic pupil; large nostril; an upper maxillary bone both strongly arched and bent inwards anteriorly; anterior maxillary teeth curved, with a gap between the very large anterior teeth and the subsequent ones; dorsal scales smooth or feebly keeled in 17, 19, or 21 rows at mid–body, and the ventrals rounded (Malkmus *et al.*, 2002). Species of this genus are small to medium sized, crepuscular to nocturnal ground dwellers with a good ability to climb. They feed mainly on lizards, frogs,

and snakes. Juveniles usually possess more intense colours and more contrasting patterns. All species are oviparous (de Lang & Vogel, 2005). Some are anthropophilous species, living close to human settlements, making dispersal by humans likely.

New species in this genus are continuously described (Ota & Ross, 1994; Mukherjee & Bhupathy, 2007; Vogel *et al.*, 2009; Vogel & David, 2010; Vogel & Luo, 2011; Zhang *et al.*, 2011). Like many other larger snake genera, *Lycodon* is badly in need of a review. There have been no phylogenetic investigations, so the evolutionary relationship of species in the genus remains unresolved. At least one species

of the genus, *Lycodon capucinus* Boie, 1827, is known to be easily introduced to non-native areas and is increasing its range (Smith, 1988; Fritts, 1993). Considering the issues surrounding invasive species such as *Lycodon capucinus* (Cogger, 2006), it is important to know the biogeographic patterns of members of the *Lycodon aulicus*–*capucinus* complex. The constant delay of these tasks will lead to problems in reconstruction of the original distribution area and might lead to unnoticed extinction of similar species, especially of the same genus. The introduction of an invasive species might be disguised. The disastrous results of the introduction of invasive snake species are well known (Rodda & Fritts, 1992; Rodda *et al.*, 1999, Cogger, 2006).

The long and confusing history of the genus name is discussed by Adler & Zhao (1995). The history of the species names *Lycodon aulicus* and *L. capucinus* has a similar complex past. It is beyond the scope of this paper to discuss the taxonomic history of these names in detail. Since Taylor (1965), both taxa are usually treated as full species (but see Lanza 1999). In 2007, another species of this group

was described from South India as *Lycodon flavicollis* Mukherjee & Bhupathy, 2007.

In 1868, Theobald described *Tyleria hypsirhinoides* based on a single specimen collected by R. C. Tytler from the ‘Andamans, in the Bay of Bengal’. He created the new genus by monotypy and compared this genus only with the genus *Hypsirhina* (now a synonym of *Enhydris*). The species was synonymized with *Lycodon aulicus* (including *L. capucinus*), by Theobald in 1876. Since then, it was treated as a subjective synonym of *Lycodon aulicus* or later *Lycodon capucinus* by others (Boulenger, 1893; Smith 1943) without being discussed. Das *et al.* (1998) listed the holotype in the collection of ZSI (ZSI 8145) (Figs. 1, 2). We show that the population from Andaman Islands warrant species status based on the biological species concept, i.e., a diagnosable, reproductively isolated population that does not naturally interbreed with other populations. The insularity of this population means it has an evolutionary history distinct from other *Lycodon* populations elsewhere, and we resurrect its species status as *Lycodon hypsirhinoides* (Theobald, 1868).



Figure 1: Holotype (ZSI 8145) of *Tyleria hypsirhinoides* Theobald, 1868



Figure 2: Holotype (ZSI 8145) of *Tytleria hypsirhinoides* Theobald, 1868; head and anterior body

Material & Methods

We compared 13 preserved and 26 live and uncollected specimens (for colour in life) of *L. hypsirhinoides* from different islands of the Andamans with 15 preserved and about 10 live specimens of *Lycodon capucinus* and 16 preserved and a larger number of live specimens of *Lycodon aulicus*. The preserved specimens were examined for external morphological characters and dentition (Appendix I). Twenty nine morphological and colouration characters were recorded for each specimen (Appendix 2). Not all of these characters were useful to distinguish between species in this study, but all of them were compared because they may be useful for further taxonomic actions.

Measurements, except body and tail lengths, were taken with a slide-caliper to the nearest 0.1 mm; all body measurements were made to the nearest millimeter. The number of ventral scales was counted according to Dowling (1951). Half ventrals were counted as one. The first scale under the tail meeting its opposite was regarded as the first subcaudal, the terminal scute was not included in the number of subcaudals. The dorsal scale rows were counted at one head length behind head, at midbody (i.e., at the level of the ventral plate corresponding to a half of the total number of ventrals), and at one head length before vent.

We considered sublabials being those shields that were completely below a supralabial. Values for paired head characters are given in left / right order. The sex was determined by dissection of the ventral tail base when possible or by everting the hemipenes in male specimens.

Museum abbreviations: **BMNH:** The Natural History Museum, London, UK; **CAS:** California Academy of Sciences, San Francisco, USA; **NMW:** Naturhistorisches Museum Wien, Vienna, Austria; **SMF:** Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt-am-Main, Germany; **ZFMK:** Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; **ZMB:** Zoologisches Museum für Naturkunde der Humboldt-Universität zu Berlin, Berlin, Germany; **ZSI:** Zoological Survey of India, Kolkata, India; **HC:** Wildlife Institute of India collection to be deposited at ZSI. **Other abbreviations:** **SVL:** Snout-vent length (mm); **TaL:** Tail length (mm); **TL:** Total length (mm); **Rel TL:** Relative tail length TaL/TL

Results

Theobald's original description of the type is brief (Theobald, 1868), and we quote below the description of the genus and species verbatim. Page 66:

“TYTLERIA, Theobald.

Aspect of *Hipsirhina*. Scales, smooth, in seventeen rows. Nostril lateral, almost dividing a smallish oblong nasal: frontals two pair: three upper labials enter the orbit. Loreal elongate: anal and subcaudals bifid: eye small; pupil vertical.

T. hypsirhinoides, Theobald.

Habit moderate, aspect of the Enhydrinae. Head shield normal. Anterior frontals slightly pentagonal, half as large as posterior. Nasal a trifle less than loreal. Ante-ocular one, reaching to the vertical. Postoculars two, small. Vertical straight in front, sides rapidly converging behind. Superciliaries moderate, broad behind. Occipitals moderate. Upper labials nine, 3rd, 4th and 6th enter the orbit. Two pairs of chin shields touching one another. Sixth lower labial largest, touches the middle of second chin shield. Color uniform reddish brown above. Belly yellowish white, length 21.00, tail injured 1.00 = 22.00 inches.

a. type specimen. Andamans. Lt.–Col. Tytler.”

Diagnosis: A relatively large species of *Lycodon* (max. total length 717 mm) with stout body; juveniles with a speckled brown/white pattern on body and a dark brown head with white collar; adults uniform dark brown; collar band absent or very faint in younger specimens; body scales in 17:17:15, ventrals 188–210, divided anal, subcaudals 61–75.

Redescription of the holotype of *Tyleria hypsirhinoides* (ZSI 8145):

Holotype: ZSI 8145: unknown sex; Andamans (in the Bay of Bengal, India); *Coll.* R. C. Tytler; Date. Unknown (The holotype is a relatively large individual of unknown sex. Sex determination was not possible since we could not dissect the unique specimen but due to the number of ventrals we assume that it is a female. The specimen was soft to touch and very flexible).

Body stout; snout–vent length 525 mm: most of the tail missing; total length 550 mm; head depressed, dorso–ventrally flattened, widest at the temporal region; 9/9 supralabials, 3rd to 5th in contact with the eye; rostral broader than high; anterior and posterior nasals of similar size, nostril in the division of the two; single elongated loreal; loreal in broad contact with internasal and second and third supralabials; 1/1 preocular, in contact with the frontal; 2/2 post–oculars; temporals 2+3, subequal in size; internasals about half as long as prefrontals; prefrontals wider than internasals; frontal large, as long as the combined length of internasals and prefrontals; supraoculars about half as wide as frontal; parietals about 1.5 times as long as frontal; mental triangular, narrower than rostral; 10/10 infralabials, first pair in contact with each

other, sixth largest; anterior genials a little longer than posterior; scales in 17:17:15 rows; 210 ventrals, with a notch on either side; divided anal; 13+ subcaudals (tail incomplete).

Colour in alcohol: The entire specimen is pale buff coloured, a little lighter on the ventrals.

Natural history: *Lycodon hypsirhinoides* is a common snake, occurring in many of the islands in the Andaman Islands. Though it is often found close to human habitation, it is also common in evergreen and semi–evergreen forests. Individuals were found in leaf–litter, under tree bark, tree holes, and inside rotting logs and lianas. All active individuals were found at night. It is a shy snake that rarely bites when captured.

Despite the fact that the main differences between the Andaman population and the other species are the total length and the colouration of juveniles and adults, there can be no doubt that this population is specifically different from *L. capucinus*, *L. aulicus* and *L. flavicollis*. The differences from *L. aulicus*, and *L. flavicollis* are obvious and need no further explanation (see the discussion).

At the moment, *L. hypsirhinoides* is regarded as an objective synonym of *L. capucinus*. *L. capucinus* is a species with a wide distribution in Asia. It is known from Australia (Cook Islands), Myanmar, Cambodia, Thailand, Vietnam, Singapore, Laos, SE China, India, Indonesia (Sumatra, Java, Bali, Borneo, Sumbawa, Sumba, Komodo, Flores, Lombok, Alor, Sawu, Roti, Timor, Wetar, Babar Islands, Kalao, Salajar, Buton, Sulawesi, Lombok,

Moyo, Adonara, Pantar, Kisar, Semau), West Malaysia, Maldives, Mascarenes, and Philippine Islands (David & Vogel, 1996; How *et al.*, 1996; Uetz, 2012). For comparison, we used specimens of populations from localities being distributed all over the species range as: Java, Borneo, Flores, Lombok, Timor, Thailand, Vietnam and Philippines (Samar). These localities were chosen to get a wide range of variation and to determine whether populations differ from each other in a way the Andaman population differs from them. It was quite astonishing to see that there was hardly any variation in the colouration of the specimens of *L. capucinus*. This was already noted for this species by Leviton on the Philippines (1965), where it is widely distributed and by Mertens (1930) and How *et al.* (1996) for the Lesser Sunda Islands. How *et*

al. (1996) especially noted that there is no variation in colour or pattern by the studied specimens.

Discussion

Lycodon hypsirhinoides differs from *L. aulicus* in colouration (dark–brown against middle/reddish brown), pattern (uniform against banded anteriorly), the missing light collar (present in *L. aulicus*) and a larger body size in males. Further, colouration and pattern of juveniles is different. Juvenile *L. aulicus* resemble adults in colour and pattern, and there is no ontogenic shift in colouration. Juvenile *L. hypsirhinoides* have a speckled dark brown and white appearance (Fig. 3 & 4), which fades and becomes uniform dark brown or nearly black in adults (Fig. 5 & 6).

Table 1: Comparison of most informative morphological characters of three members of the *Lycodon aulicus*–*capucinus* group (Abbreviations, see Material and Methods), TL in mm.

Character \ Taxon		<i>Lycodon hypsirhinoides</i> (n = 13)	<i>Lycodon capucinus</i> (n = 13)	<i>Lycodon aulicus</i> (n = 6)
VEN	♂	188–202, \bar{x} = 195	183–194, \bar{x} = 189	200–205, \bar{x} = 203
	♀	199–210, \bar{x} = 205	193–205, \bar{x} = 199.7	203–211, \bar{x} = 206.8
SC	♂	68–75, \bar{x} = 72	66–72, \bar{x} = 69.5	69–78, \bar{x} = 73.5
	♀	61–68, \bar{x} = 65.5	64–69, \bar{x} = 66.4	59–70, \bar{x} = 66.3
TaL/TL [\bar{x}]	♂	0.202	0.193	0.187
	♀	0.179	0.180	0.171
Juveniles	Light collar	Present	Present	Present
	Body pattern	Reticulated	Reticulated	Banded
	Body color	Brown–white speckled	Middle brown /purplish–brown	Brown
Adults	Light collar	Absent	Present	Present
	Body pattern	Absent	Reticulated	Banded
	Body color	Dark brown/black	Middle brown /purplish–brown	Brown
Adults / juveniles	Upper labials dark centres	No	Yes	Yes/no
	Onto–genetic colour shift	Yes	No	No
Max. TL	♂	717	560	463
	♀	563	599	594
Max.TL	♀/♂	0.785	1.069	1.28



Figure 3: Comparison of the juvenile colouration of *L. hypsirhinoides* (BMNH 1987.889 middle) with two *L. capucinus* (both from Phuket Island, Thailand). Specimens with a similar length and a similar preserving time.



Figure 4: Juvenile of *L. hypsirhinoides* (Theobald, 1868) from South Andaman Island.



Figure 5: Adults of *Lycodon aulicus–capucinus* complex. (Top) A, *L. aulicus* from Bangalore, India; B, *L. hypsirhinoides* from Andaman Islands; C, *L. capucinus* from Phuket, Thailand; D, *L. capucinus* from Java. (Bottom) Comparison of the head of *L. capucinus* (upper) and *L. hypsirhinoides* (lower). Notice the distinct widening of the occipital region and the lack of dark spots in the middle of the supralabials in *L. hypsirhinoides*. Both specimens are of similar SVL.



Figure 6: Adult *Lycodon hypsirhinoides* (Theobald, 1868) from Wandoor, South Andaman Island.

From *L. capucinus* it differs in colouration (dark–brown against middle brown or purplish–brown) pattern (uniform against reticulate), the faint/absent light collar and a larger body size in males. The upper labials of *L. capucinus* usually have dark centres (Fig. 5, 7); these are missing in *L. hypsirhinoides*. The colouration and pattern of juveniles is also different. The

males are larger than the females in *L. hypsirhinoides*, in *L. capucinus* the size of the sexes is more or less the same (How *et al.* 1996). There is no or nearly no ontogenetic shift in colour in *L. capucinus*, while it is distinct in *L. hypsirhinoides* (see also Smith 1943 and Fig. 3, 7).



Figure 7: *Lycodon capucinus* from Southeast Asia: **A**, Pulau Perhentian Kecil, East coast of West–Malaysia (Photo: Tom Charlton); **B**, Komodo, Indonesia (Photo: Tom Charlton); **C**, Mainland West Malaysia; **D**, Mindoro, Philippines



Figure 8: **A**, Juvenile *L. capucinus* (SMF 55285, Pulau Menjangan Kecil, Indonesia); **B**, juvenile *L. aulicus* (SMF 64484, Lahore, Pakistan). Scale, 1 cm.

From *L. flavicollis* it differs in the smaller number of ventrals (191– 210 against 213– 224), a larger snout–vent length (598 against 440, both males) and a different colouration and pattern, especially in the missing yellow band in the neck in full grown adults.

From *L. tiwarii* Biswas & Sanyal, 1965, it differs in a relatively smaller tail with the relative tail length of 0.192 against 0.164, a smaller number of ventrals (191– 210 against 218–237) and a smaller maximum number of subcaudals with 75 against 102. The juveniles of *L. tiwarii* have a light dorsal head colouration against a dark head in *L. hypsirhinoides*.

The populations of *L. capucinus* bear a striking resemblance to each other (Fig. 8). This suggests a recent colonisation of at least part of the distribution area, most probably by anthropogenic effects. Nevertheless without doubt a part of the investigated populations stem from the original distribution area.

There are two other species of *Lycodon* reported from Andaman and Nicobar Islands. These are *Lycodon tiwarii* Biswas & Sanyal, 1965 and *Lycodon subcinctus* Boie, 1827 (Biswas & Sanyal, 1965; Das, 1999; Vijayakumar & David, 2005; Harikrishnan *et al.*, 2010). The holotype of *Lycodon tiwarii* is from Mayabunder in Middle Andaman, a locality within the range of *Lycodon hypsirhinoides*. All subsequent records of *L. tiwarii* including the paratype are from Nicobar Islands. *L. subcinctus* is also known only from Great Nicobar Island and not in the Andaman Islands. If one considers the possibility of erroneous type locality for *L. tiwarii*, the three species of wolfsnakes in the Andaman Islands will have mutually exclusive distribution ranges i.e. *L. hypsirhinoides* in the Andaman Islands, *L. tiwarii* in the Car Nicobar and Nancowry group of islands and *L. subcinctus* in the Great Nicobar Island (Fig. 9).

In 1827 F. Boie described *Lycodon unicolor* based on the manuscript of H. Boie and Russell's plate 39 (1810). The manuscript of H. Boie was never published. The accompanying text of Russell gives for the specimen on plate

39 the following data: 265 ventrals + 67 subcaudals, length 4 feet 10 inches. Of the subcaudals apparently 36 are divided, 28 entire and the last 3 divided again. The locality is Bengal and the specimen was received from Alexander Russell of Calcutta in June 1788. The identity of this specimen cannot be resolved at this moment, but due to the high ventral count, it cannot belong to one of the three species treated.

It is important to note the distinctness of the population from the Andamans. It cannot be ruled out, that in near future *L. capucinus* might reach the Andamans and even displace the population of *L. hypsirhinoides*. Perhaps it is already there, but unnoticed due to limited collection or taxonomic confusions. It is the main concern of this paper to work against this.

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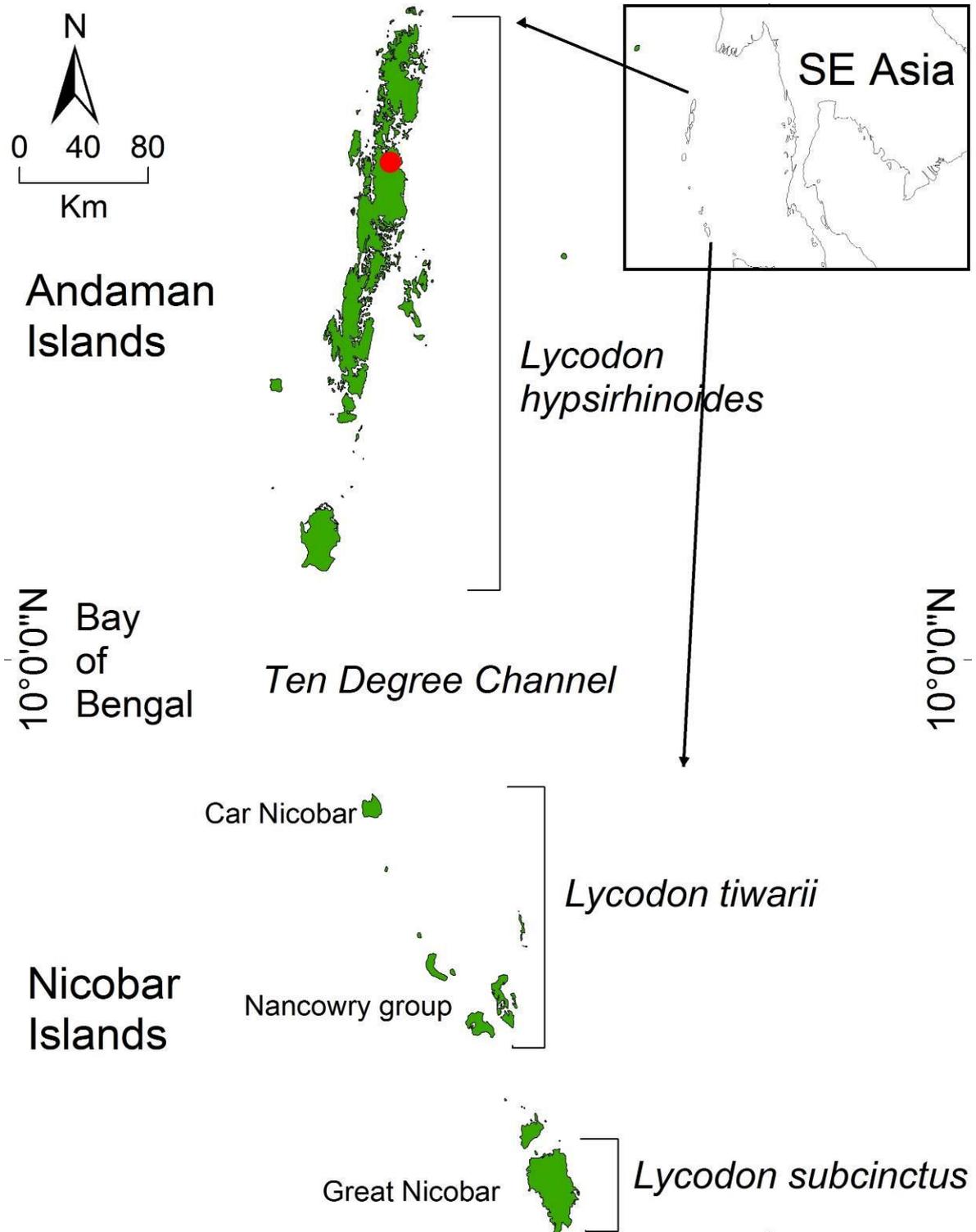


Figure 9: The distribution of three *Lycodon* species known from Andaman and Nicobar Islands. The type locality of *Lycodon hypsirhinoides* is “Andamans, in the Bay of Bengal”. The holotype of *L. tiwarii* is from Mayabunder (indicated by a red dot), North Andaman, Andaman Islands, while the paratype is from Car Nicobar Island in the Nicobar Islands.

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Appendix I. Examined materials

Lycodon hypsirhinoides: ZSIC 8145 (holotype), Andamans, (In the Bay of Bengal, India) ; BM 1987.889 Sippighat, South Andaman; BM 1940.3.7.11 Andamans; BM 1940.3.7.12 Andamans; HC 040 Wandoor, South Andaman Island; HC 137 Tarmugli Island, HC 177 Krishnanallah, Little Andaman Island, HC 216 Neil Island, HC 218 Wandoor, South Andaman Island; NMW 21686:1&2 Andamans; NMW 14479 Andamans.

Lycodon capucinus: BM 97.12.30.35, Atapupu, West Timor; BM 1969.824, Bangkok; BM 1977.845 Semarang, Java; BM 1977.846, Semarang, Java; SMF 55285 Pulau Menjangan Kecil, Kepulauan Karimunjawa, Indonesia; ZFMK 88296, Son Tra, Vietnam; ZFMK 86832 Son Tra, Vietnam; ZFMK 32255, Java; ZFMK 32256, Java; ZFMK 84097, Flores, Indonesia; ZFMK 32254, Borneo; ZFMK 49252, Lombok; ZFMK 63607, Samar, Philippines; ZFMK 70447, Samar, Philippines; ZMB 65689, Java.

Lycodon aulicus: BM 82.8.26.22, Kinelly Hills, India; BM 1984.1216, Royal Chitwan, Nepal; BM 1921.6.15.3, Bangalore, India; CAS–SU 12263, Birsampur, Jharkhand State, India; CAS 20500, Pleasant Beach Resort, Rakhine State, Myanmar; CAS 215387, Yin Ma Bin Township, Yinpaungtaing Village, Sagaing division, Myanmar; CAS 219800, Bogalay Township, Meinmahla Kyun Wildlife Sanctuary, Mi Gyaung Gaung Pok Camp, Pyapone District, Ayeyarwady Division, Myanmar; CAS 245960, Yebyu Township, Tanintharyi Nature Reserve, vicinity of Khotama military camp, along Khotama stream, Dewei District, Tanintharyi Division, Myanmar; NMW 21697:2, Madras, India; NMW 37406:2, Ahmednagar, Maharashtra, India; SMF 32463, Agra, India; SMF 64484, Lahore, Pakistan; ZFMK 29976, Mauritius; ZFMK 21766, Mascarenes, Reunion, Manapany; ZFMK 29977, Mauritius; ZMB 1791, “Bengal”.

Lycodon cf. striatus: ZFMK 52511, Kitulgala, Sri Lanka; ZFMK 52137, Kitulgala, Sri Lanka; ZFMK 52510, Sri Lanka.

Lycodon cf. osmanhilli: ZFMK 32253, Sri Lanka.

Lycodon tiwarii: ZSI 20849 (holotype), Mayabunder, North Andaman Island; ZSI 20851, donated by Govt. Hospital, Car Nicobar.

Lycodon subcinctus: ZSI (Port Blair) 10643, Govind Nagar, Great Nicobar Island

Appendix II. Characters used (for abbreviations, see material and methods)

Morphometry: Snout–vent length (mm); Tail length (mm); Total length (mm); Relative tail length TaL/TL; Head length (mm); Head width at the widest part; Eye diameter (mm).

Scalation: Dorsal scale rows at neck (at 1 head length behind head)/ at midbody/ before vent; Ventral plates; Number of preventrals; Subcaudal plates; Cloacal (anal) plate: (1) single and (2) divided; Number of loreal scales at left/right; Number of supralabials at left/right; Numbers of the supralabials entering orbit at left/right; Number of infralabials at left/right; Total number of infralabials; Number of infralabials in contact with anterior chin shield; Number of preoculars at left/right; Number of postoculars at left/right; Number of anterior temporals at left/right; Number of posterior temporals at left/right; Total number of preoculars.

Pattern: Body colour; Existence of reticulations; Existence of a band in the neck region; Existence of bands on body; Upper labials with light margins or not; Upper labials totally white or not.