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On a poorly-known, insular endemic pit-viper *Trimeresurus labialis* Fitzinger in: Steindachner, 1867 from the Nicobar Islands

(Reptilia, Viperidae, Crotalinae)

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Trimersurus labialis, a poorly-known, insular endemic pit viper restricted to a single island of the Nicobar archipelago, Car Nicobar, was studied. Four distinct and discrete colour morphs of this species were observed and are described. It was found to be a fairly abundant and strictly nocturnal species. Distribution of *T. labialis* within Car Nicobar was mapped based on the recorded localities and it is suggested to be regarded as an endangered species owing to its restricted distribution, limited to just one island, which does not have any protected areas.

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Introduction

Pit vipers of the genus *Trimeresurus* are represented in the Andaman and Nicobar archipelago by five species namely, *Trimeresurus andersoni* Theobald, 1868, *T. cantori* (Blyth, 1846), *T. davidi* Chandramouli, Campbell & Vogel, 2020, *T. labialis* Fitzinger in Steindachner, 1867 and *T. mutabilis* Stoliczka, 1870 (Vogel et al. 2014). Of these, the well-known species, *T. andersoni* is fairly widespread throughout the Andaman Islands and has also been recorded from Car Nicobar in the Nicobar Archipelago (Whitaker & Captain 2004, Vijayakumar & David 2006). *Trimeresurus cantori* occurs on islands of the central group of the Nicobar Archipelago while *T. davidi* is restricted to Car Nicobar. The other pit viper, *T. labialis* was once considered to occur throughout the northern and central groups of the Nicobar Islands (Whitaker & Captain 2004, Vijayakumar & David 2006) until Vogel et al. (2014) reassessed the taxonomic status of these populations and resurrected the junior synonym *T. mutabilis* for the populations inhabiting the central group of Nicobar Islands. Since this revision, *T. labialis* has been a species restricted to Car Nicobar Island, situated in the northern part of the Nicobar Archipelago. This island is about 125 km^2, with a nearly flat terrain, with a maximum elevation of about 90 m above sea level, covered mostly by evergreen forests and is home to several endemic taxa such as *Cyrtodactylus nicobaricus* Chandramouli, 2020 *Dasia nicobarensis* Biswas & Sanyal, 1967, *Amaurornis phoenicurus leucocephalus* Abdulali 1964, *Accipiter butleri butleri* (Gurney, 1898), *Hypothymis azurea idiochroa* Oberholser 1911 and *Sturnus erythropygius erythropygius* (Blyth, 1846) (Sankaran 1998). Also, it has a fairly dense population of humans with settlements around the fringes. Data on morphology, natural history and distribution of '*T. labialis*' presented by various authors until now (Smith 1943, Whitaker & Captain 2004, Vijayakumar & David 2006) largely pertain to the population now referable to *T. mutabilis*, thereby, leaving the true *T. labialis* population, inhabiting Car Nicobar as a little known species. In this article, data on morphology, intraspecific morphological variation, natural history and distribution of *T. labialis* are elaborately presented.

Methods

Surveys to record the target species were carried out during dusk and by night (between about 18:00 h and 22:00 h) in monsoon and post-monsoon seasons during the years 2016–2017 for about 40 days spread across four bouts. Three people walked through the potential habitats (such as evergreen forests, edges of ephemeral water bodies, secondary forests, plantations etc.) of this species, on existing trails, carefully looking for the target species using flash lights and headlamps for a duration of one hour, in order to determine the encounter rate, an index of abundance of the target species. Upon observing an individual, the habitat type and its behaviour in situ were observed, the snake was photographed and measured with a string and a measuring tape and Vernier calipers to the nearest mm. The following data were recorded: snout-vent length (SVL), tail length (TaL), head length (HL), maximum head width (HW),dorsal scalerows (at neck: at midbody: near vent), ventrals (after Dowling 1951), subcaudals (following Vogel et al. 2014) and sex of the individuals. The snakes were photographed before being released back at the site of observation. Geographic coordinates of the survey localities were recorded with a Garmin GPS MAP 72 and mapped using ARCMAP v.10 (WGS84 datum).

Results

Morphological variation. Females (n = 7) larger than males (n = 13); longest female recorded during this study measured 450 mm SVL + 70 mm tail (total length: 520 mm); longest male 352 mm SVL + 55 mm tail (total length: 407 mm). Females (mean SVL 372 mm ± 56.86) longer than males (mean SVL 324 mm ± 39.5). Head slightly longer in males (mean HL : SVL 0.05) than in females (mean HL : SVL 0.04); more broader than long in males (mean HL : HW 1.5) than in females (mean HL : HW 1.3); eyes relatively larger in females (mean ED : HL 0.17) than in males (mean ED : HL 0.15); tail shorter in females (mean TaL : TL 0.145) than in males (mean TaL : TL 0.185). Ventrals 171–185 (mean 176 ± 6) in females and 164–176 (mean 170 ± 8) in males; subcaudals 52–55 (mean 52 ± 1) in females; 53–62 (mean 55 ± 4) in males.

Coloration. Four distinct and discrete colour morphs of *T. labialis* were recorded during the present study.

Morph 1 (n = 5; 1 ♀, 4 ♂): Dorsal coloration dark, reddish brown with small, dark brown alternating spots on the dorsum. A white ventro-lateral stripe extending from the snout tip to the tail; more pronounced on the head and the tail; feeble on the body between head and vent, one scale wide, extending throughout the lateral row, bordering ventrals. The white lateral streak on the head bordered internally by a dark brown stripe on the head; a large, brown spot on the upper lip between the loreal pit and the eye; ventrals dull brown to cream coloured with intermittent dark bands as broad as a single ventral scale; underside of the tail dark brown with white spots (Fig. 1, 5A).

Morph 2: (n = 7; 2 ♀, 5 ♂) Dorsal coloration pale creamy brown, with fairly large, dark brown blotches extending all over the dorsum from neck up to the tail, sometimes paired; small brown spots along the lateral sides of the body. Top of head with large, dark brown spots. The white lateral line along the body is replaced by a series of dark brown, discontinuous spots from the neck up to the tail tip. A large brown subocular spot present in addition to the brown spot on the upper lip between the loreal pit and the eye, ventral scales ashy-grey with brown patches towards their lateral margins; posterior ventrals and subcaudals completely dark brown (Fig. 2, 5B). This morph sometimes had a greenish tinge, giving it an olive green appearance.

Morph 3: (n = 4; 3 ♀, 1 ♂) Dorsum uniform creamy yellow, without any distinct pattern; top of the head and body completely devoid of spots or blotches; tip of the tail with faint brown bands. Both subocular and labial spots absent on the upper lip; labials creamy white without any specific pattern. White lateral stripe faintly visible on the head along the upper lips but absent on the body and tail. Ventrals uniform cream without any spotted, speckled or blotched pattern. This morph sometimes had scattered and indistinct, feeble brown spots on the dorsum (Fig. 3, 5C).

Morph 4: (n = 4; 1 ♀, 3 ♂) Dorsum dark brown with indistinct, large irregularly shaped brown blotches from neck to tail. Top and sides of the head uniform dark brown and unpatterned. Labial spots or stripes not discernible. Lateral white line along the body and head absent. Ventrals, subcaudals and undersurface of the head uniform dark brown coloured without any pattern (Fig. 4, 5D).

Abundance. A fairly common species with an encounter rate of 0.25 individuals/man-hour, making it a rather abundant species on this island, to which it is endemic. This species is relatively more commonly seen during monsoon than post-monsoon season. On one occasion, seven individuals were observed within an hour duration on a rainy night in a small patch of forest.

Habitat. During this study, *Trimeresurus labialis* was observed in a variety of habitats ranging from human habitation (n = 3), coconut plantation (n = 2), evergreen forests (n = 12) and secondary/disturbed

forests (n = 3). Individuals were observed to occupy an array of microhabitats ranging from the ground on a footpath (n = 2), leaf-litter (n = 6), rocky walls of old buildings (n = 2), low lying shrubs (n = 6) to branches of trees (n = 4) up to a height of 3 m above the ground.

Behaviour. Nocturnal and never seen active during the daytime. *Trimeresurus labialis* is normally seen foraging for prey soon after the sunset, quite often waiting in a likely spot such as on the ground, near puddles, on the surface of rocks, on tree trunks and on small shrubs. On several occasions, potential prey species such as frogs (*Fejervarya limnocharis* and *Bijurana nicobariensis*, *Hylarana erythraea)*, lizards (species of the genera *Coryphophylax*, *Bronchocela*, *Gehyra* and *Cytrodactylus*) were observed in close quarters near about 2–3 m within the vicinity where the snake was spotted.

Status and threats. The conservation status of *T. labialis* has not yet been assessed by the IUCN. However, considering its restricted geographic distribution limited to one small island (~125 km^2) in the Nicobar Archipelago and the threats faced by it due to anthropogenic activities and human-mediated mortality, it should be regarded as an endangered species following the criteria B1 (extent of occurrence < 5000 km^2) and B2 (area of occupancy < 500 km^2) of the IUCN guidelines. Killing by people out of fear and mortalities due to road traffic are also major threats to this species (Fig. 6).

Discussion

Much of the data as well as the photographs of *Trimeresurus labialis* available in the literature (e. g. Whitaker & Captain 2004, Vijayakumar & David 2006) actually pertain to the population now referred to *T. mutabilis* (after Vogel et al. 2014). Hence, the data presented herein, which pertain to the species *T. labialis* sensu stricto are significant. One of the adult females recorded during the present study measured 450 mm SVL + 70 mm tail (520 mm total) vs. the up to date maximum length of 442 + 69 (511 total) in the syntype NMW 18813:2 (Vogel et al. 2014). Likewise, the ventral counts of 171–185 in females and 164–176 in males are out of the hitherto known range when compared to those reported by Vogel et al. (2014): 168–171 in females and 168–172 in males. Vijayakumar & David (2006) suggested that '*T. labialis*' (inclusive of *T. mutabilis* from central Nicobar Islands) could be diurnal based on their observation of individuals active during the day time. However, during the present study, not a single individual of *T. labialis* was observed active during

Fig. 1. A morph 1 colour form of *Trimeresurus labialis* from Mus.

Fig. 2. A morph 2 colour form of *Trimeresurus labialis* from Big Lapathy.

Fig. 3. A morph 3 colour form of *Trimeresurus labialis* from Chukchuka.

Fig. 4. A morph 4 colour form of *Trimeresurus labialis* from Tapoiming.

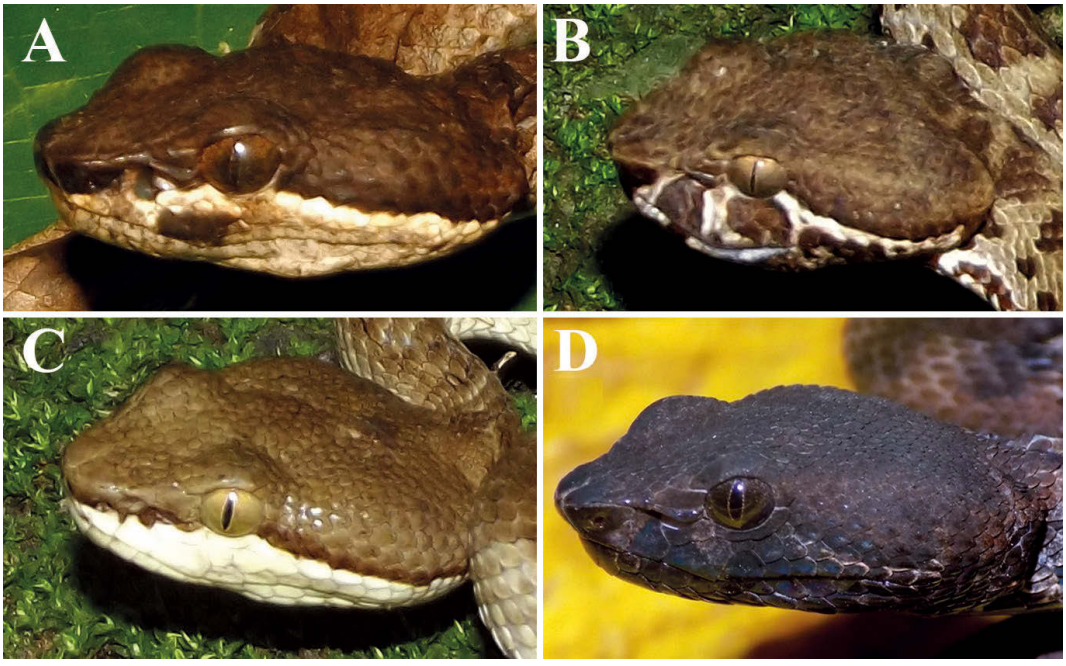

Fig. 5. Head colour and pattern of different colour morphs of *T. labialis*.

Fig. 6. A road-killed individual of *T. labialis* from Tamaloo.

the daytime. All of the individuals observed were after 18:30 h despite surveys during the day time as well and the majority of them were observed to be actively foraging between 19:00 and 21:00 h. Hence, the diurnal habit of this species suggested by Vijayakumar & David (2006) does not apply to the 'true' *T. labialis* found in Car Nicobar. The plausible reason behind such a high degree of colour polymorphism in this species is not clear as the colour morphs were neither associated to sexes, nor their microhabitats. There are two more sympatric congeners namely *T. andersoni* Theobald, 1868 and *T. davidi* Chandramouli, Campbell & Vogel, 2020. The former is more of a microhabitat generalist, occurring on a range of microhabitats ranging from the ground, undergrowth to low lying shrubs and bushes while the latter is more arboreal, preferring shrubs and trees. *T. labialis* occurs on both these strata, i. e., terrestrial and arboreal. Apart from these congeners, another small, nocturnal snake, *Lycodon tiwarii* Biswas and Sanyal, 1965 feeding on similar prey such as small lizards and frogs co-occurs with *T. labialis*. The bite from *T. labialis* causes localized pain and swelling of the bitten area, and there have been times when the victim recovered a day or two after having been bitten, with just the indigenous medication (Edmond pers. comm.). However, the local people usually kill these snakes out of fear, when they are encountered. Although *T. labialis* recorded during this study was quite abundant and it falls under the Schedule IV of the Indian Wildlife (Protection) Act, 1972, the restricted distribution (Fig. 7) of this species, coupled with its venomous nature render it extremely vulnerable. It is noteworthy that there are no declared protected areas such as Wildlife Sanctuaries or National Parks within this small island and the existing forests are also facing threats due to exploitation.

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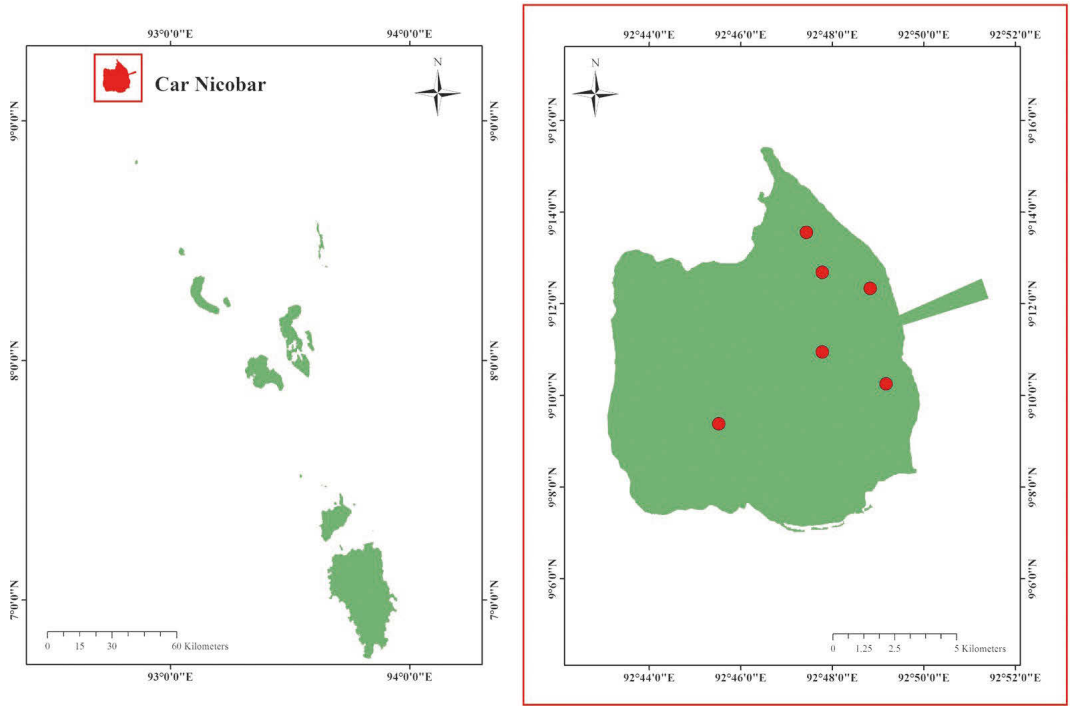

Fig. 7. Distribution (left) and locality records (right) of *T. labialis*.

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