



Distribution, Morphology, and Natural History of the Medo Pit Viper, *Viridovipera medoensis* (Viperidae, Crotalinae) in Arunachal Pradesh, Northeastern India

Rowland Griffin¹, Gerard Martin², Romulus Whitaker³, and Todd R. Lewis⁴

¹Brooklea, John Beales Hill, Pilton, BA4 4DB, UK. (rowland_griffin@yahoo.co.uk)

²The Gerry Martin Project, 33 Carmelaram Post, Chikkabelandur, Sarjapur Road, Bangalore – 560 035, India

³Pambukudivanam, Thiruvadisulam Village, Chengalpattu, Tamil Nadu, 603108, India

⁴Westfield, 4 Worgret Road, Wareham, Dorset, BH20 4PJ, UK

Photographs by the senior author.

Asian pitvipers of the *Trimeresurus* complex comprise approximately 49 species. They are distributed throughout India, Indochina, China, the Philippines, and Indonesia. The systematics of the group has been confusing; many species are cryptic and almost indistinguishable to the naked eye (David et al. 2001a). In several recent revisions, the green pitvipers of the genus *Trimeresurus* were divided taxonomically based on a combination of morphological (hemipenial/scalation) and molecular features. The accepted genera now include *Cryptelytrops*, *Parias*, *Peltopelor*, *Popeia*, *Trimeresurus*, *Tropidolaemus*, and *Viridovipera* (Malhotra and Thorpe 1997, 2000, 2004; Tu et al. 2000).

The Medo Pit Viper (*Viridovipera medoensis* Zhao and Jiang 1977) is a nocturnal, arboreal pitviper that inhabits wet montane forests (David et al. 2001b). It was, until recently, only known from a restricted area comprising two localities from northern Myanmar, and the type locality in the Xizang Autonomous Region, China (Zhao and Adler 1993, David et al. 2001b). Recently, *V. medoensis* was reported from a single locality in Changlang District, Arunachal Pradesh (N27.440833, E96.915278) on the border with its known range in Myanmar (David et al. 2001b). Very little is known about the species' natural history due to its remote distribution and the political governance of land within its range. *Viridovipera medoensis* is listed as “data deficient” on the IUCN Red List of Threatened Species and is considered rare, with an “unknown” population trend (Zhou and Rao 2012).

Herein we report on the morphology, habitat, and behavior of *Viridovipera medoensis* encountered during a sur-

vey for venomous snakes in Leporiang, Papum Pare District, Arunachal Pradesh (N27.22920, E093.33986; Fig. 1).

Methods

This study was conducted in two parts during April/May 2011 and August 2011. Nocturnal and diurnal visual encounter surveys (VES; McDiarmid et al. 2012) were conducted in targeted areas around Leporiang previously identified by local

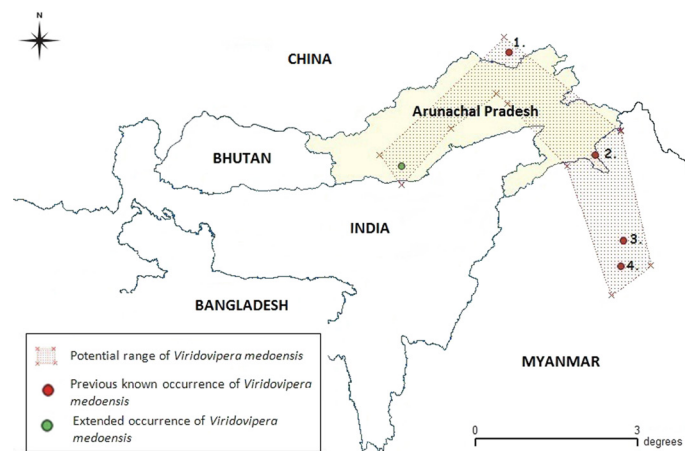


Fig. 1. Map showing actual locations and potential range of *Viridovipera medoensis* in northeastern India, China, and Myanmar. Red dots 1 to 4 indicate localities previously reported in David et al. (2001b); 1 = the type locality at Medog, Xizang Autonomous Region, China. (N 29.3252, E 95.3313). 2 = Gandhigram, Changlang District, Arunachal Pradesh, India (N 27.440833, E 96.915278). 3 = Nam Ti Valley, Kachin State, Myanmar (N 25.85388, E 97.4433). 4 = Myitkyina, Kachin State, Myanmar (N 25.3788, E 97.3880). Green dot = New records for Leporiang, Papum Pare District, Arunachal Pradesh, India (N 27.22920, E 093.33986).



Fig. 2. A Medo Pit Viper (*Viridovipera medoensis*) in Papum Pare District, Arunachal Pradesh.

residents as having pitvipers. Data recorded included environmental conditions and morphometrics; weight (g), snout-vent length (SVL), total length (TL), sex, habitat, and perch height (PH) when possible. Locations of individuals were recorded using a Garmin eTrex™ GPS and mapped using Quantum GIS Ver. 1.8.0.

Survey and morphometric measurements were carried out under research permits granted by the Arunachal Pradesh Forest Department. In the interest of conservation of the species, and despite a lack of preserved specimens in known

collections globally, no specimens were collected. Spearman Rank correlation coefficients (r_s) were conducted in Statistica Ver. 7™ and MINITAB Ver. 16™ and were used to investigate morphological characteristics and habitat.

Results and Discussion

A total of 38 surveys were conducted over two periods (April/ May – 12 days; August – 10 days). Late April to early May is near the end of the wet season in the Papum Pare District of Arunachal Pradesh. August is considered a drier month.

Table 1. Morphometric data for the Medo Pit Viper (*Viridovipera medoensis*) at Leporiang, Papum Pare District, Arunachal Pradesh.

Specimen Number	Sex	Date	SVL (mm)	TL mm (mm)	Weight (g)	Supra-labials	Scales between Supra-Oculars	Scale Rows	Ventrals	Sub-caudals	Habitat	Perch Height (cm)
VM3	Juv F	30 Apr	282	335	10	—	—	17	—	—	River	250
VM4	Juv	01 May	217	262	5	—	—	17	—	—	River	50
VM2	F	02 May	623	747	—	8	—	17:17:13	142	53	Riparian	170
VM1	M	02 May	484	627	—	8	9	17:17:13	141	41	Riparian	100
J001	F	24 Aug	—	582	70	9	9	17:17:13	145	49	Riparian	200
R003	F	25 Aug	—	673	60	8	12	17:17:13	145	58	Forest	0
R004	M	25 Aug	466	580	45	8	9	17:17:13	146	61	Road	100
L002	M	26 Aug	516	634	40	8	10	17:17:13	141	58	Agricultural	—
L003	F	28 Aug	—	—	—	9	10	17:17:13	142	56	Riparian	152



Fig. 3. A Medo Pit Viper (*Viridovipera medoensis*) in Papum Pare District, Arunachal Pradesh.

Temperature and humidity were recorded at the site of each encounter. Temperature was 22.8 ± 4.17 °C (range 18.9–27.2 °C) and humidity $85.05 \pm 9.98\%$ RH (range 74.0–93.4% RH). Weather at times of capture ranged from dry and warm to cloudy and overcast.

We encountered a total of nine *Viridovipera medoensis*, four adult females (J001, L003, R003, and VM2), three adult males (L002, R004, and L002), and two juveniles (VM3 [female] and VM4; Table 1 and Figs. 2–5). Two individuals (L002 and L003) were brought alive to our base camp by local villagers. All snakes were encountered at a mean altitude of 1131.8 ± 84.1 m (range 1077–1312 m), concurrent with the elevational range reported by Whitaker and Captain (2004).

Snakes were identified by two morphological diagnostics: Scale rows 17:17:13 and nasal undivided and completely separated by a suture from the first supralabial (Leviton et al. 2003, Whitaker and Captain 2004). Hemipenial structure is also a diagnostic feature (Peng and Fuji 2000), but was not examined during this study. The cloacal scute was entire and subcaudals divided for all specimens. Only counts on mid-body rows were recorded for juvenile identification due to the small size of the snakes and their potential susceptibility to stress during handling. The following mean scalation data were collected from the adults (Table 1): supralabials; males 8.0 (n = 3) and females 8.5 (n = 4) scales between supraoculars; males 9.33 (n = 3) and females 8.5 (n = 3) ventrals; males



Fig. 4. A Medo Pit Viper (*Viridovipera medoensis*) in vegetation overhanging a small stream in Papum Pare District, Arunachal Pradesh.



Fig. 5. A Medo Pit Viper (*Viridovipera medoensis*) in riparian habitat in Papum Pare District, Arunachal Pradesh.

142.67 (n = 3) and females 143.50 (n = 4) subcaudals; males 53.33 (n = 3) and females 54.00 (n = 4).

Mean TL of males was 613.67 mm (n = 3), of females 667.33 mm (n = 3), and of juveniles 298.5 (n = 2). Mean SVL of males was 488.67 mm (n = 3), of females 623.00 mm (n = 1); and of juveniles 249.50 mm (n = 2). Mean weight of males was 42.50 g (n = 2), of females 65.00 g (n = 2), and of juveniles 7.50 g (n = 2) (Table 1 and Fig. 6). Female L003 weighed 140 g and was not included in these calculations due to the large meal she had ingested. The largest previously recorded *Viridovipera medoensis* was 677 mm (Whitaker and Captain 2004). Female VM2 measured in this study represents a new maximum length of 744 mm for the species.

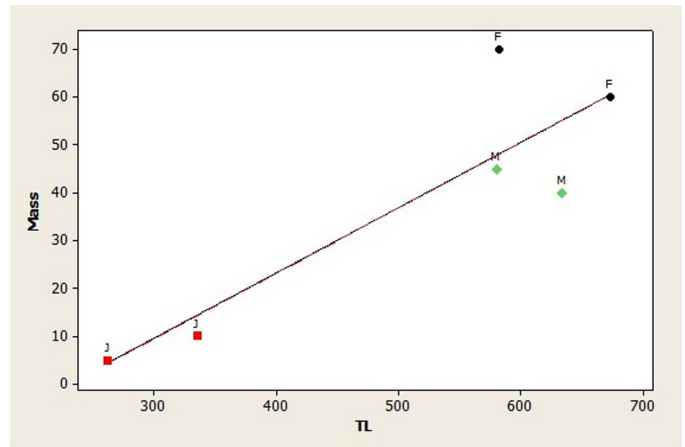


Fig. 6. Total length and mass of Medo Pit Vipers (*Viridovipera medoensis*) at Leporiang, Papum Pare District, Arunachal Pradesh.

Four of the snakes encountered during the survey were detected diurnally (1320–1445 h) and the other three nocturnally (1900–2030 h). Five were encountered perched between 0.5 m and 2.5 m on branches either next to or on paths near streams and rivers. No correlations between perch height, weight, and habitat were significant for any of the observations (r_s range: -0.226 – 0.714 , all $P > 0.05$), likely reflecting the small sample size. Two individuals, R003 and R004, were moving at the time of initial observation. R003 was moving on the ground in secondary deciduous forest 500 m on a slope above a nearby stream at 1320 h. It subsequently moved rapidly downhill to evade capture at which point it attempted to conceal itself in leaf litter. When it detected our presence, it climbed the nearest tree to a branch at a height of 1.75 m above the ground before being captured. This escape evasion behavior was an interesting and swift response for a traditionally arboreal species. Similar escape behaviour by *Trimeresurus malabaricus* in the Western Ghats has been postulated to be in response to predation by King Cobras (*Ophiophagus hannah*; R. Whitaker pers. comm.).

Viridovipera medoensis has been reported to have a strong association with bamboo (*Bambusa* spp.) stands, and in Arunachal Pradesh, has been found hibernating in upright dead bamboo (David et al. 2001b, Leviton et al. 2003, Whitaker and Captain 2004). This study confirms a range of habitat usage for *V. medoensis* that includes forest and riparian vegetation alongside streams and rivers (Figs. 7 and 8). Interestingly, R004 was discovered in a tree on an embankment alongside a main road between Leporiang and the nearby town of Sagalee, suggesting that the species can be found in secondary and human-altered environments as well as in natural areas.

Our new records of *Viridovipera medoensis* are an important finding and represent a significant range extension of



Fig. 7. Subtropical forest habitat of the Medo Pit Viper (*Viridovipera medoensis*) in Papum Pare District, Arunachal Pradesh.

approximately 400 km within Arunachal Pradesh (Fig. 1). Medo Pit Vipers have a patchy distribution and the paucity of known localities across India, Myanmar, and China highlights the need for more surveys across the species' entire range. Further investigations also are needed to decipher the species' population ecology and natural history to help assess its conservation status.

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Fig. 8. The Papum Pare River in Papum Pare District, Arunachal Pradesh.

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