

# Taxonomy of *Boiga beddomei* (Wall, 1909) Colubridae: Serpentes from Anaikatty Hills, Western Ghats, India

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**Abstract:** *Beddome's Cat Snake, Boiga beddomei* (Wall, 1909) is largely distributed and restricted to the Southern Western Ghats. It is now also reported from Anaikatti Hills, Coimbatore, Tamil Nadu, where this species has been earlier misidentified as *B. flaviviridis*. This species may be taxonomically distinguished from its sympatric congeners by the dorsal scale count (pholidosis): 19: 19: 13; 7–8 supralabials; 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> supralabials in contact with orbit; ventral 241–246 and 95–107 paired subcaudals. The taxonomic identity crisis in this species is hereby resolved by providing a redescription and neotypification as the syntypes at BMNH are all lost. Also, a comparison is provided of different species of *Boiga* distributed in the Southern Western Ghats.

**Keywords:** Taxonomy, Redescription, Colubrids, Deciduous Forest, Western Ghats, India.

## 1. Introduction

The genus *Boiga* was erected by Fitzinger, 1826, the epithet with no etymological explanation, however, the Greek word 'bo<sup>u</sup>s' means 'Ox' or 'bull - headed' as many *Boiga* species when confronted displays aggressive behaviour by biting multiple times at one specific spot. It belongs to one of the speciose Genus of the Family Colubridae with around 37 taxonomically valid taxa distributed largely from Asia up to Australia (Welch 1988, Das 1997, Leviton et al.2003, Das 2003, Whitaker and Captain 2004, Mukherjee 2012, Vogel and Ganesh 2013, Giri et al.2019).17 species have been reported from India so far, of which, six species are reported from the Western Ghats, South Western India (Reptile database 2024). A semi - triangular viper - like head shape, characteristic large eyes with vertical pupil associated with their nocturnal life style, slender & laterally compressed body perhaps indicates an arboreal adaptation, body scales are smooth and vertebral series is more or less enlarged. *Boiga beddomei* is back fanged, Opisthoglyphous mildly venomous species with one or two enlarged grooved posterior maxillary fangs on each side connected to Duvernoy's glands.

Venom is thought to have undergone convergent evolution in multiple Ophidian taxa, arising independently. It is hypothesized that back - fanged snakes may trace their lineage to a shared common ancestry with basal non - venomous colubrids. Adaptation to semi - arboreality in back - fanged species likely resulted from intense competition for terrestrial resources. Furthermore, robust selective pressures, driven by the necessity to capture swiftly moving prey while suspended from tree branches, may have facilitated the gradual transformation of supralabial salivary glands into venom glands, which has further allowed them in resource partitioning.

In the current study area *B. beddomei* have been reported to inhabit in sympatry with *B. trigonata*, *B. nuchalis* and *B. forsteni*.

Although Smith (1943) synonymized *B. beddomei* with *B. ceylonensis*, recent taxonomic studies by Mukherjee (2012), Vogel & Ganesh (2013) and Whitaker & Captain (2004), suggests that *B. ceylonensis* species complex, which also includes *B. beddomei*, *B. nuchalis*, *B. andamannensis* and *B. ceylonensis* are all valid taxa. While *B. andamannensis* is distributed and is restricted to the Andaman Islands and *B. ceylonensis* is another geographically isolated allopatric species which is largely restricted to Sri Lanka; and the previous reports of its occurrence in Western Ghats is largely because of misidentification (Vogel and Ganesh 2013). The taxonomic identity crisis of *B. beddomei* in recent instance is largely due to the loss of *B. ceylonensis* syntype series from British Museum of Natural History (Vogel and Ganesh 2013). Hence, the authors are providing here a taxonomic redescription of the species *B. beddomei*.

### Study Area

Anaikatti Hills (11° 05'30.9" N 76° 47'36.2" E), elevation above 650 msl. Coimbatore Forest Division is a part of the Nilgiri Biosphere Reserve, Tamil Nadu. The major forest type of the area is tropical southern mixed dry deciduous (Champion and Seth 1968, Mukherjee 2012). Trees such as *Acacia leucophloea*, *Zizyphus mauritiana*, *Albizia amara*, *A. lebbek*, *Cassia fistula*, *Santalum album* and *Commiphora caudata* dominate the forest. Bamboo species such as *Bambusa bamboos* and *Dendrocalamus stictus* is also common in riverine habitats of the area.

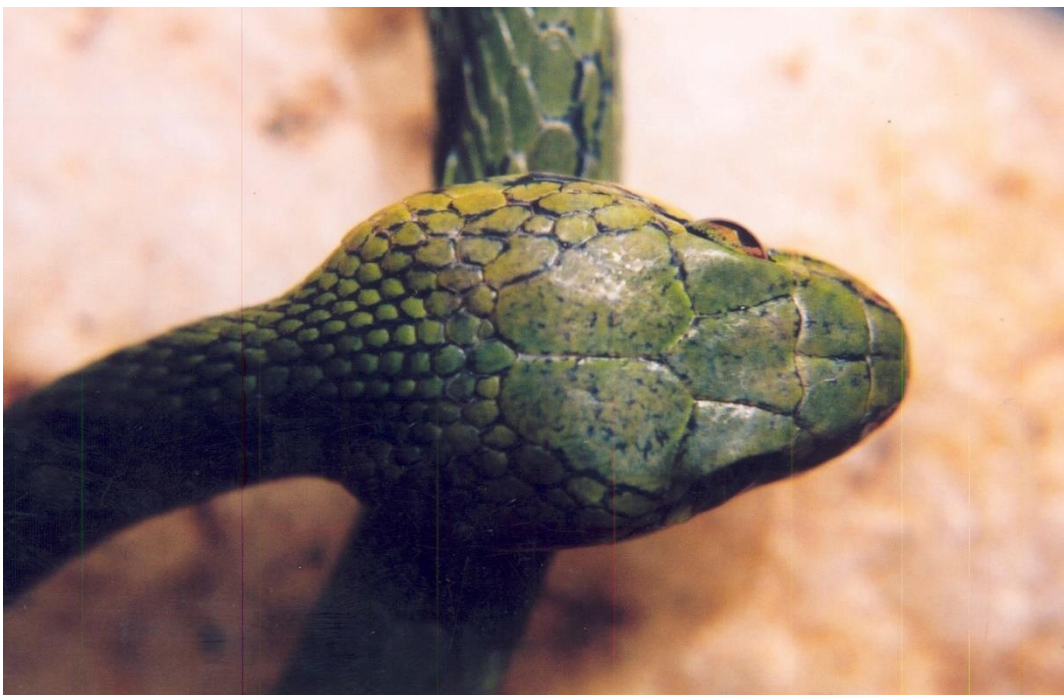
## 2. Materials and Methods

Snakes were photographed live and the voucher specimens were preserved in 6% formaldehyde. Prior to fixing, following measurements were taken: SVL (snout - vent length): tip of the snout to vent; TL (tail length): vent to the tip of tail; HL (head length): angle of jaws to tip of the snout; HW (head width): at angle of jaws; ED (eye diameter): greatest horizontal diameter of right eye; E-N (eye to nostril

distance) anterior corner of the right eye to posterior edge of nostril; E-S (eye to snout distance) anterior corner of right eye to tip of snout; IO (inter orbital distance) between anterior corner of orbit. SVL and TL were measured using a flexible tape and all other linear measurements were taken using Mitutoyo ® Dial vernier calipers (accuracy - 0.02 mm). Ventral scale count and description of hemipenial morphology was examined and modified from Dowling (1951) and Dowling and Savage (1960) respectively.



**Figure 1:** Photograph of a Beddome's Cat Snake — *Boiga beddomei* appears dark brownish colour in bright day light.



**Figure 2:** Photograph showing *B. beddomei* turning greenish in the night

### 3. Description

Snout - vent and tail length of four specimens ranged 386–640 mm and 86–180 mm respectively. Head distinct from neck; HL and HW varied from 12.20–16.40 mm and 7.86–8.96 mm respectively; eyes with vertical pupil, ED 2.86–3.46 mm; IO 4.50–6.40 mm, wider than ES (4.18–6.08 mm) and EN (2.60–3.60 mm); rostral wider than high, barely visible from above; a pair of internasals, prefrontals, supraoculars and parietals; frontal single; nuchal scales not well defined; maxillary teeth 9–10, with posterior one or two enlarged, Palatine teeth 3–4, posterior one or two teeth enlarged, Pterygoid teeth 3–4, dentary teeth 12–14.

Cephalic shields include 7–8 Supralabials, sixth one the largest; first and second supralabials in contact with nasal; third, fourth and fifth supralabials in contact with orbit; a single elongated preocular contacting second and third supralabials, loreal and prefrontal shields present; post oculars paired; temporals in two - three rows 2+3 or 2+3+3 or 3+2+2; 10–11 infralabials, first to third or first to fifth in contact with anterior genials, fourth and fifth or fifth and sixth in contact with posterior genials; scales between posterior genials and the first ventral variable and undifferentiated; mental small compared to rostral, mental groove present; genials in pairs, posterior ones larger than the anterior; dorsal scales smooth, 19: 19: 13 in oblique rows, apical pits 1–2 or absent, vertebral scales enlarged compared dorsolateral scales; dorsal scale reduction occurred on both sides, first (19–17) at 151 ventral scale count, second (17–15) at 153 and the third (15–13) reduction at 183 ventral, scale reduction figure 19: 17: 15: 13; total 241–246 ventrals, angulate laterally, anal single; 95–107 subcaudals in pair.

Hemipenis: Subcylindrical, weakly bilobate, distal half round had enlarged calyces; the proximal part was smooth and lacking spines.

Colour: This species is capable of changing colour, green to reddish brown or in inverse this frequent physiological mode of colour change is known as metachrosis; head scales green with black brown dots, an oblique black streak from post ocular to the angle of the jaws on either side; supralabials pale yellow and throat white, ventral yellowish white. green to brown or partially reddish brown. In dry forests with less canopy cover a brownish colour may be more favourable for camouflage in day time while green colour in night is more advantageous for predating.

#### Comparison with closely allied species

*Boiga beddomei* may be closely related to *B. flaviviridis* however its type locality is restricted to Orissa, in the Eastern Ghats. Four rows of temporals in *B. flaviviridis* (vs two to three rows in *Boiga beddomei*), ventral scale count in *B. flaviviridis* 248–259 (vs 241–246 in *B. beddomei*). *B. beddomei* significantly differs from sympatric *B. nuchalis* in Anaikatti hills by body scale count 21: 21: 15 (vs 19: 19: 13 in *B. beddomei*), ventral 238–240 (vs 241–246 in *B. beddomei*), dorsum purplish brown to pale greyish brown with transverse bars on the nape in *B. nuchalis* (vs reddish brown in the day and greenish in the night). The voucher specimens of SACON (Salim Ali Centre for Ornithology and Natural History, Coimbatore, Tamil Nadu) — SACON/VR -

7a - b, both labeled as *B. flaviviridis* by Ganesh et. al., 2020 has been thoroughly reexamined and suggested to correct the name and label the two specimens as *B. beddomei*.

*Boiga beddomei* differs from *B. trigonata* in 19: 19: 13 dorsal scale rows (vs 21: 21: 15 in *B. trigonata*), ventrals 241–246 (vs 206–256 in *B. trigonata*), subcaudals 95–107 (vs 75–96 in *B. trigonata*). *Boiga beddomei* differs from *B. forsteni* in dorsal scale rows 19: 19: 13 (vs 25–27: 27–29–31: 17–15 in *B. forsteni*), supralabials 7–8 (vs 8–11 in *B. forsteni*), ventrals 241–246 (vs 254–273 in *B. forsteni*). *Boiga thackerayi* a species largely restricted in its distributional range in Northern Western Ghats, Maharashtra differs from *B. beddomei* in 19: 19: 13 (vs 19: 19: 17–15 rows of dorsal scales in *B. thackerayi*), temporals two - three rows (vs two rows in *B. thackerayi*), ventrals 241 - 246 (vs 211–221 in *B. thackerayi*). *B. dightoni* an extreme southern Western Ghats species differs from *B. beddomei* in 19: 19: 13 (vs 23: 23: 15 dorsal scale rows in *B. dightoni*), temporals in two - three rows (vs two rows in *B. dightoni*) and ventrals 241–246 (vs 228–241 in *B. dightoni*).

It seems that the phenotypic variations among many *Boiga* species perhaps reflect their wide geographic range of distribution.

#### Ecology and Natural history

Beddome's Cat Snake inhabiting the Anaikatti hills has been largely reported from southern mixed dry deciduous forests. The nocturnal camouflage of a green body colour is theorized to constitute a sophisticated Müllerian mimetic survival strategy. This strategy likely serves to emulate the visual appearance of the venomous green bamboo pit viper, *Craspedocephalus gramineus*, with which it shares both habitat and nocturnal activity patterns.

Conversely, other sympatric species such as *Boiga trigonata* have been documented engaging in mimicry of the venomous saw - scaled viper, *Echis carinatus carinatus*, potentially as a mechanism to deceive potential predators. Additionally in the semi - arid scrublands and dry forests of northwest India, observations indicate that *B. trigonata* mimics the visual characteristics of *Echis carinatus sochureki*.

### 4. Conclusion

The mainland Indian Cat snakes perhaps initially evolved through sympatric speciation largely driven by ecological and environmental factors. These factors have given adaptative changes among them to the newly formed niches in diversified habitats which played crucial roles in the evolution of new taxa. The *B. ceylonensis* species complex as described by Smith may be sibling species exhibiting minimal morphological differentiation.

The current taxonomic uncertainties and instability of closely related *Boiga beddomei*, *B. flaviviridis* and *B. nuchalis* may be attributed to lack of definitive type specimens or the improper preservation and damaged museum specimens. Syntypes in zoological taxonomy are usually designated to address a wide range of variations within a species complex and it seems that the syntype of *B. ceylonensis* which includes *Boiga beddomei* and other two valid taxa are either damaged or lost. In these circumstances, it is taxonomically ethical to

designate a neotype for *Boiga beddomei* from SACON's voucher specimens and the neotype with additional voucher specimens should be deposited and catalogued in any authorized national Museums such as Zoological Survey of India, Calcutta or Bombay Natural History, Bombay or National Museum of Natural History, New Delhi which may serve taxonomic and nomenclatural stability for future scientific endeavors in this field of research.

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### References

- [1] Smith, M. A.1943., The fauna of British India, Ceylon and Burma, including the whole of the Indo - Chinese region. Vol III - Serpentes. London. Taylor and Francis.
- [2] Das, I.1997. A new species *Boiga* (Serpentes: Colubridae) from the Nicobar Archipelago. *J. south Asian nat. Hist.*3 (1): 59 - 67
- [3] Das, I.2003. Growth of knowledge on the reptiles of India, with an Introduction to Systematics, Taxonomy and Nomenclature. *J. Bombay Nat. Hist. Soc.*100 (2&3): 446 - 501.
- [4] Dowling, H. G.1951. A proposed standard system of counting ventrals in snakes. *British J. Herpetol.*11: 97 - 99.
- [5] Dowling, H. G. and J. M. Savage.1960. A guide to the snake hemipenes: a survey of basic structure and systematic characteristics. *Zoologica*, 45 (1): 17 - 28
- [6] Champion, H. G. and S. K. Seth 1968. A revised survey of the forest types of India. Government of India press, Nasik.
- [7] Leviton, A. E., G. O. Wogan, M. S., Koo, G. R., Zug, R. S., Lucas and J. V. Vindum.2003. The Dangerously Venomous Snakes of Myanmar Illustrated Checklist with keys. *Proc. California. Acad. Sc.*54. (22 - 27). Pp 407.
- [8] Welch, K. R. G.1988. Snakes of the Orient: a checklist. Robert E. Krieger, *Malabar*.83p.
- [9] Whitaker R. and Captain A.2004. Snakes of India – The field guide, DRACO Books, Chennai, India.
- [10] Vogel, G. and S. R. Ganesh.2013. A new species of cat snake (Reptilia: Serpentes: Colubridae: *Boiga*) from dry forests of eastern peninsular India. *Zootaxa* 3637 (2): 158 - 168
- [11] Giri, Varad B., V. Deepak., A. Captain., S. Pawar and F. Tillack.2019. A new species of *Boiga* Fitzinger, 1826

(Serpentes: Colubridae) from northern Western Ghats of India. *J. Bombay Nat. Hist. Soc.*116: 1 - 11

- [12] Mukherjee, D.2012. Community Ecology of Reptiles in Anaikatty Hills, Western Ghats, India. LAP Lambert Academic AG & Co. KG Dudweiler Landstr. Saarbrucken, Germany.
- [13] Ganesh, S. R., S. Bhupathy, P. Karthik, G. Babu Rao and S. Babu.2020. Catalogue of Herpetological specimens from peninsular India at the Salim Ali Centre for Ornithology and Natural History (SACON), India. *Journal of Threatened Taxa*.12 (9): 16123 - 16135