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# Diversifying on the Ark: multiple new endemic lineages of dwarf geckos from the Western Ghats provide insights into the systematics and biogeography of South Asian *Cnemaspis* (Reptilia: Squamata)

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## ABSTRACT

The highly speciose gekkonid genus *Cnemaspis* Strauch, 1887 is polyphyletic, with three distantly related and geographically isolated clades from Africa, South Asia (SA), and Southeast Asia. At present, there are 85 known species within SA *Cnemaspis*, although the number continues to increase rapidly with focused surveys and rigorous taxonomic work. Recent studies have provided valuable insights into the diversity and evolutionary history of SA *Cnemaspis*; however, most of these studies lack sufficient sampling in the Western Ghats (WG), where the genus has its greatest diversity. We addressed this research gap by conducting extensive sampling across the WG and re-examining museum specimens, thus providing a systematic account of various extant *Cnemaspis* species along with their distribution and natural history. We described 12 new species and a southern WG endemic clade of SA *Cnemaspis*. Ten of the newly described species are endemic to the forests of the southern WG. We also identified 10 well-supported

subclades that can be separated across morphological, geographic, and phylogenetic axes. A time-calibrated phylogeny and ancestral area reconstructions confirmed the Paleocene origin of SA *Cnemaspis* in the WG and provide insights into its evolutionary history and biogeography. The discovery of multiple endemic and deeply divergent lineages further highlights the evolutionary significance of the WG for lizards.

**Keywords:** Biogeography; *Cnemaspis*; Dwarf geckos; Molecular phylogeny; New species; Osteology; South Asia; Systematics; Western Ghats

## INTRODUCTION

The tropical forests of the Western Ghats (WG) are considered as rainforest refugia for various biota (Prasad et al., 2009). During the Upper Jurassic, the Indo-Madagascar plate is said to have carried biota from Gondwana after their split ~150–160 million years ago (Mya) (Briggs, 2003; Datta-Roy & Karanth, 2009). The Madagascar plate separated from

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the Indian plate ~84–96 Mya, with the isolated Indian plate then drifting northwards towards Asia (Ali & Aitchison, 2008; Briggs, 2003; Datta-Roy & Karanth, 2009). It has been hypothesized that some extant endemic WG fauna, e.g., members of the gekkonid genus *Dravidogecko*, likely dispersed onto the Indian plate through transmarine dispersal from the Palearctic before the India-Asia collision (Agarwal et al., 2014; Chaitanya et al., 2019). Despite the occurrence of widespread extinction on parts of the Indian plate due to Deccan Traps volcanism, several lineages survived in refugia and eventually diversified across India, with some dispersing into Asia (Joshi & Karanth, 2013; Samant & Mohabey 2009). Among the Indian saurian fauna, the genus *Cnemaspis* Strauch, 1887 from South Asia (SA), which originated in the Late Cretaceous-Paleocene, appears to have potential Gondwanan ancestry (Agarwal et al., 2020b).

The Afro-Asian gekkonid genus *Cnemaspis* Strauch, 1887 is one of the most diverse gecko genera in the Old World, with over 170 known species (Uetz et al., 2020). Multiple phylogenetic studies in the last decade have established that the genus is polyphyletic, with three distantly related and geographically isolated clades from Africa, SA, and Southeast Asia (Gamble et al., 2012; Grismer et al., 2014). Due to the highly conservative morphology of members across its range, all species are currently grouped under a single genus.

The diverse SA clade of *Cnemaspis* comprises some 85 known species with disjunct distributions across Peninsular India and Sri Lanka, as well as Myanmar, northeast India, and islands west of Sumatra (Agarwal et al., 2017; Grismer et al., 2014; Khandekar et al., 2020a; Lee et al., 2019; Uetz et al., 2020). In the past two decades, there has been a rapid increase in the discovery of new species of SA *Cnemaspis* in both Sri Lanka and India, primarily due to extensive taxonomic revisions and the use of molecular phylogenies to delimit species (Cyriac et al., 2018, 2020; Karunarathna et al., 2019a, 2019b; Khandekar et al., 2019a; Manamendra-Arachchi et al., 2007; Sayyed et al., 2018). Nevertheless, the diversity of SA *Cnemaspis* is likely to be greatly underestimated.

Within Peninsular India, the WG harbor the highest diversity of *Cnemaspis* (32 known species), while 13 species are currently known from the Eastern Ghats (EG) and the Mysore plateau, and two species do not have proper type localities (Cyriac et al., 2020; Khandekar, 2019; Khandekar et al., 2019a, 2020a; Murthy et al., 2019; Sayyed et al., 2020). Recent studies from regions outside the WG in Peninsular India have also led to the discovery of many new species, with 10 in the last five years alone. In comparison, large parts of the WG remain unexplored in terms of the true diversity of this gekkonid genus (Khandekar et al., 2020a).

Based on museum specimens, Manamendra-Arachchi et al. (2007) revised the Sri Lankan *Cnemaspis*, provided detailed redescrptions for the Indian members described prior to 1984, described three new species from southern India, and synonymized *C. anaikattiensis* Mukherjee, Bhupathy & Nixon 2005 with *C. sisparensis* (Theobald, 1876). Their study and others helped stabilize the taxonomy of some Indian species and provided descriptions of many new ones (Cyriac & Umesh, 2013; Cyriac et al., 2019; Ganesh et al., 2011; Giri et al., 2009a; Khandekar, 2019; Murthy et al., 2019). However,

taxonomic confusion regarding most *Cnemaspis* species from Peninsular India remains due to a lack of information on type localities, distribution, and natural history, as well as incorrectly designated types. For example, a recent study showed that the series of *C. ornata* (Beddome, 1870) paralectotypes designated by Manamendra-Arachchi et al. (2007) actually consists of more than one species (Sayyed et al., 2019). In addition, barring recent preliminary phylogenetic analyses, few studies have reported on the relationships within the highly diverse gekkonid group from Peninsular India, or have failed to include most WG endemics (Cyriac et al., 2020; Khandekar et al., 2019a; Sayyed et al., 2018). It is important, therefore, to use multiple lines of evidence to address taxonomic uncertainty and better estimate species diversity, especially for groups like *Cnemaspis*, which show conserved morphology (Agarwal et al., 2017; Grismer et al., 2014).

The WG escarpment in Peninsular India supports a remarkable diversity of endemic fauna and large evolutionary radiations, primarily due to the eco-climatic and topographic heterogeneity of the mountain range (Chaitanya et al., 2019; Biju et al., 2014a; van Bocxlaer et al., 2012; Vijayakumar et al., 2016). In the last decade, intensive explorations of the WG have resulted in the discovery of many new and evolutionarily distinct lineages, signifying the importance of this biodiversity hotspot (Biju et al., 2014b; Deepak et al., 2018; Garg & Biju, 2019; Mallik et al., 2019; Pal et al., 2018; Robin et al., 2017; Vijayakumar et al., 2019).

Members of the genus *Cnemaspis* are small to medium-sized round-eyed geckos, predominantly restricted to forested habitats. Due to the presence of a circular eye pupil, *Cnemaspis* geckos are often thought to be diurnal and are commonly called “day geckos”, although studies report that at least some are nocturnal (Grismer et al., 2014) and/or crepuscular. Similar to other endemic fauna of the WG, most *Cnemaspis* geckos have limited distribution ranges and microhabitats (Agarwal et al., 2020a; Chaitanya et al., 2019; Cyriac et al., 2018, 2019), and many are known only from the type locality and museum specimens (Manamendra-Arachchi et al., 2007; Murthy et al., 2019). It is important to assess and validate the status of these species by locating extant populations, and to address taxonomic uncertainties and systematic relationships. Understanding the diversity and relationships among these habitat-specialist geckos can also provide insight into the drivers of speciation in the WG.

In this study, we constructed an updated phylogeny of *Cnemaspis* from Peninsular India, including near complete taxon sampling of WG species. We used a multi-criteria approach including molecular phylogeny, genetic distance, morphological comparison, and geographical distribution to delimit species (Mallik et al., 2020; Pal et al., 2018; Vijayakumar et al., 2014). We identified multiple strongly supported clades in *Cnemaspis* from Peninsular India, supported by morphological evidence and geographical distribution. We identified 12 new lineages, which are described herein, and redescrbe several *Cnemaspis* species from the WG, which were previously described before 2000, including information on their natural history and distribution. We also explored the phylogenetic relationships within WG

*Cnemaspis* and other SA species and examined their divergence within WG using a fossil-calibrated time-tree.

## MATERIALS AND METHODS

### Field sampling and specimen collection

We aimed to investigate the diversity of *Cnemaspis* species from the WG and their phylogenetic relationships with other members of the genus from Peninsular India and to address the lack of knowledge of their geographical distribution. To resolve the systematic and taxonomic issues, we used a multi-criteria approach integrating molecular evidence with morphological data and spatial distribution (Shanker et al., 2017; Vijayakumar et al., 2014). The sampling framework was designed to address the topographic, climatic, and habitat heterogeneity within the WG. We stratified elevational gradients across major hill ranges and selected sampling sites across various habitats in each hill range (Pal et al., 2018; Vijayakumar et al., 2014). Extensive surveys were carried out in each selected site over a four-year period to locate existing populations of *Cnemaspis*. We specifically targeted known type localities to sample individuals wherever possible (Figure 1). Specimens were hand-collected, photographed in life, euthanized using halothane following standard animal euthanasia guidelines (Leary et al., 2013), and finally fixed in

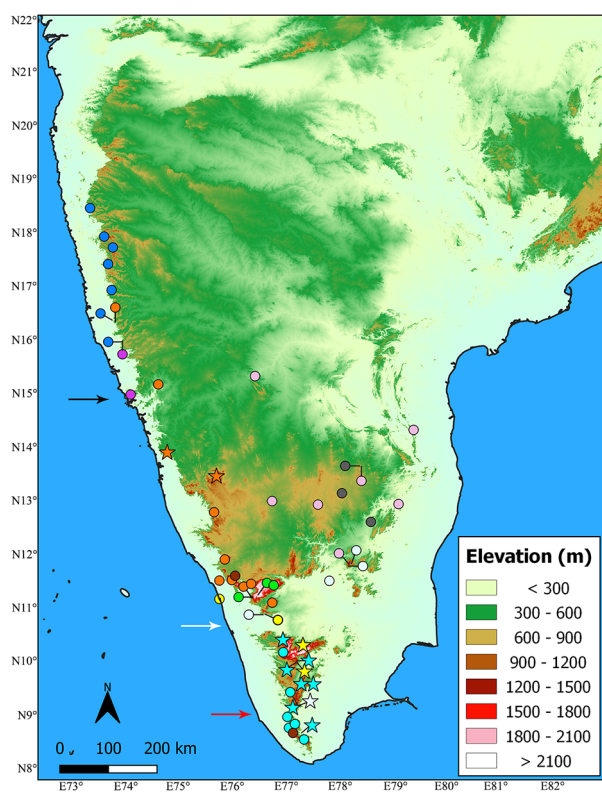
4% formaldehyde for 24 h. Tissues (liver/tail tips) were extracted in 95% ethanol before fixing and subsequently stored at  $-20^{\circ}\text{C}$  for genetic analysis. The fixed specimens were later stored in 70% ethanol and maintained in the herpetological collection at the Centre for Ecological Sciences (CES), Indian Institute of Science (IISc), Bangalore, India. The type specimens were deposited in the collection of the Bombay Natural History Society (BNHS), Mumbai, India, and CES, IISc. All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. All animal sample collection protocols complied with approved permits as per the current laws of India.

### DNA isolation, sequencing, and phylogenetic analyses

Individuals that resembled extant species from type localities with known distribution, as well as additional individuals representing distinct populations from various geographical locations across the WG were selected. In total, 64 individuals belonging to *Cnemaspis* from across the WG and three individuals representing species distributed outside the WG were selected for phylogenetic analysis. Genomic DNA was isolated from the tail and liver tissues for all selected samples using the phenol-chloroform-isoamyl alcohol (Sambrook et al., 1989) and salt extraction method (Aljanabi & Martinez, 1997), then dissolved in 30  $\mu\text{L}$  of 0.1% TE buffer (pH 7.6–8.0, 10 mmol/L TrisHCl, 0.1 mmol/L EDTA) and stored at  $4^{\circ}\text{C}$ . To delimit lineages and estimate species diversity, we amplified the 16S mitochondrial gene for sequencing, both the forward and reverse strands, using primers 16Sar: (5'-CGCCTG TTTATCAAAAACAT-3') and 16Sbr: (5'-CTCCGGTTTGAAC TCAAGATCA-3'), respectively (Simon et al., 1991). For a subset of individuals, we also generated partial sequences of the mitochondrial *NADH dehydrogenase 2* gene (*ND2*) using primers MetF1 (L4437 5'-AAGCTTTCGGGCCCATACC-3') and CO1R1 (H5934 5'-AGRGTGCCAATGTCTTTGTGRTT-3') for polymerase chain reaction (PCR) amplification and sequencing (Macey et al., 1997), carried out commercially at Barcode Biosciences and Medauxin, Bangalore, India. The PCR and sequencing protocols for 16S followed Pal et al. (2018). We combined these with published sequences of 16S and *ND2* representing extant SA *Cnemaspis* species from Peninsular India, Sri Lanka, and Southeast Asia.

The generated sequences were aligned using Muscle in MEGA v7.0 (Kumar et al., 2016). The final alignment of the 16S gene sequences was 638 bp long and comprised a total of 87 individuals of most extant *Cnemaspis* species from the WG as well as three species from outside the WG. The *ND2* gene alignment was 1041 bp long and comprised a total of 77 individuals, including representative species from the WG, Peninsular India outside the WG, and Sri Lanka. The final 1679 bp concatenated dataset (*ND2+16S*) consisted of 117 *Cnemaspis* individuals from SA, including our collection and previously published sequences. All newly generated sequences were uploaded to GenBank under accession Nos. 16S: MZ291569–MZ291621; *ND2*: MZ701801–MZ701834 (Supplementary Table S1 includes details of sequences used in this study).

Maximum-likelihood (ML) and Bayesian inference (BI) analyses of the final concatenated dataset of 16S and codon-



**Figure 1** Map of Peninsular India showing type localities of extant species of *Cnemaspis*

Star denotes new species identified in this study; color corresponds to distinct clades (see details in Figure 2). Arrows indicate major geographical barriers in WG (black: Goa Gap, white: Palghat Gap, and red: Shencottah Gap).

partitioned *ND2* partial sequences were carried out using IQ-TREE (Nguyen et al., 2015) on the PhyloSuite (Zhang et al., 2020) platform and MrBayes v3.2 (Ronquist et al., 2012), respectively. ML analysis was carried out using the GTR+I+G model of sequence evolution, with support assessed through 10 000 ultra-fast bootstrap (UFBoot) replicates. Nodes with ML UFBoot values (UF) of 95 and above were considered strongly supported (Minh et al., 2013). PartitionFinder v2 (Lanfear et al., 2016) was used to determine the best-fit sequence substitution model for the dataset with the “greedy” search algorithm, with branch lengths as “linked” and AICc as model selection criteria (Lanfear et al., 2012). For BI analysis, the dataset was independently run twice for two million generations with a random starting tree, four Markov chains, and sampling every 1 000 generations. Convergence of the two runs was determined by ensuring that the standard deviation of split frequencies was less than 0.01, by confirming that the effective sample size (ESS values) was more than 200, and by checking the trace plots in Tracer v1.6 (Rambaut et al., 2014). Node values with Bayesian posterior probabilities (BPP) of 0.95 and above were considered strongly supported (Huelsenbeck et al., 2001; Wilcox et al., 2002). Uncorrected pairwise sequence divergences were calculated for the 16S dataset in MEGA v7.0 for species delimitation (Table S2). *Lygodactylus miops* Günther, 1891, *Lygodactylus picturatus* (Peters, 1870), *Phelsuma lineata* Gray, 1842, and *Phelsuma ornata* Gray, 1825 were used as outgroups to root the tree for phylogenetic reconstructions (Cyriac et al., 2020; Sayyed et al., 2020).

#### Divergence dating

Divergence dating analysis was carried out in BEAST v2.4.8 implemented through the CIPRES portal (Miller et al., 2010) using an expanded gekkotan dataset with 122 additional taxa (Agarwal et al., 2020b; Chaitanya et al., 2019) (Table S3) along with a single lineage per putative SA *Cnemaspis* species for the *ND2* dataset (83 lineages). We partitioned the dataset by codon position based on the partition scheme selected by PartitionFinder v2 and applied the GTR+I+G model of sequence evolution in BEAST. We used BEAUti v2.4.8 to generate the input xml file with a relaxed lognormal clock model for each partition and a Yule speciation tree prior and constrained the Gekkotan families in the dataset to match the ML tree and previously published phylogenies. Three fossil calibrations with exponential distributions based on mean heights at the nodes and an arbitrary mean of 5, and one geological calibration, were used in line with previous studies (Agarwal et al., 2019, 2020b), and included amber fossils from Myanmar (crown Gekkota; offset 99); New Zealand diplodactylid material (most recent common ancestor (MRCA) New Zealand Diplodactylidae; offset 19); *Pygopus hortulanus* Hutchinson, 1997 (stem calibration for MRCA *Pygopus* Merrem; offset 23); and divergence of *Phelsuma inexpectata* Mertens, 1966 on Reunion from its closest relative in Mauritius *P. ornata* (uniform prior, 0.05–5). Final analyses were run for 100 million generations with sampling every 10 000 generations, and convergence (ESS>200) was determined by examining the log files in Tracer v1.6 (Rambaut et al., 2014). A maximum clade credibility tree (MCC) with median heights was generated using TreeAnnotator v2.4.8. Divergence times

are presented as 95% of the highest posterior densities (HPD) for corresponding nodes in millions of years ago (Mya).

#### Ancestral area reconstruction

The dated BEAST consensus tree was pruned to retain only ingroup taxa that represent SA *Cnemaspis* in RASP v4.2. (Yu et al., 2015). The species were coded with their current distribution as follows: Northern Western Ghats (NWG) region starting from southern Gujarat through Maharashtra to the north of Goa Gap; Central Western Ghats (CWG) region south of the Goa Gap to the north of the Palghat Gap; Southern Western Ghats (SWG) region south of the Palghat Gap; Peninsular India outside the WG (PIO) regions that include the Mysore plateau and EG; and Sri Lanka and Southeast Asia. Ancestral area reconstruction was implemented with the consensus tree using the Bayesian Binary MCMC model and was run with the following constraints: maximum number of areas allowed was 4, number of cycles for the MCMC run was 50 000, with 10 chains sampled every 100<sup>th</sup> iteration and 100 results discarded as burn-in, run with the fixed Jukes Cantor model to account for state frequencies.

#### Morphological and meristic data

In total, 240 *Cnemaspis* individuals were examined for morphological analyses, including type specimens of the new lineages described herein as well as extant species from Peninsular India, topotypical specimens, type specimens, and other museum specimens listed in the material examined section (Appendix II). Comparative data on the described *Cnemaspis* species from Peninsular India were also taken from published literature (Agarwal et al., 2020b; Cyriac & Umesh, 2013, 2014; Cyriac et al., 2018, 2019, 2020; Das & Bauer, 2000; Giri et al., 2009a, 2009b; Khandekar, 2019; Khandekar et al., 2019a, 2019b, 2020b; Manamendra-Arachchi et al., 2007; Mirza et al., 2014; Mukherjee et al., 2005; Murthy et al., 2019; Sayyed et al., 2016, 2018, 2019, 2020; Srinivasulu et al., 2015). Counts and external observations of morphology and meristic characters were made under a Leica stereo dissecting microscope, and on the left side of the body for symmetrical characters where possible. We considered three body-size classes for *Cnemaspis* from Peninsular India based on snout vent length data, i.e., small (<35 mm), medium (35–45 mm), and large bodied (>45 mm). The following measurements were recorded using a Mitutoyo dial caliper to the nearest 0.1 mm: snout vent length (SVL, from tip of snout to vent); axilla to groin length (AGL, from posterior margin of forelimb insertion to anterior margin of hindlimb insertion); body width (BW, maximum body width); forearm length (FL, from elbow to distal end of wrist); crus length (CL, from knee to heel); tail length (TL, from vent to tip of tail); tail width (TW, widest point of tail); head length (HL, distance between retroarticular process of jaw and snout tip); head width (HW, maximum width of head); head depth (HD, maximum head depth at occiput); eye diameter (ED, greatest horizontal diameter of eye); eye to nares distance (EN, distance between anterior margin of eye and posterior edge of nostril); eye to snout distance (ES, distance between anterior margin of eye and tip of snout); eye to ear distance (EE, distance from anterior edge of ear opening to posterior

margin of eye); ear length (EL, maximum length of ear opening); internarial distance (IN, distance between nares); and interorbital distance (IO, shortest distance between left and right supraciliary scale rows).

The meristic data recorded for all specimens included: number of supralabials (SL) and infralabials (IL) (from rostral and mental, respectively, to posterior-most enlarged scale at angle of jaw); supralabials at midorbital position (SLM) and infralabials at midorbital position (ILM) (from rostral and mental, respectively, to below middle of orbit); dorsal tubercle rows (DTR, number of longitudinal rows of enlarged tubercles around body counted at midbody); paravertebral tubercles (PVT, number of enlarged tubercles between limb insertions counted along straight line immediately left of vertebral column); ventral scales (VS, counted from posterior of mental to anterior border of cloaca); midbody scale rows across belly (MVSR, counted at midbody ventral between lowest rows of dorsal scales); femoral pores (FP); precloacal pores (PP); number of poreless scales between precloacal pores (SBPP); number of poreless scales between femoral pores (SBFP); and number of poreless scales between femoral and precloacal pores (SB, FP, & PP); transverse subdigital lamellae, counted from base of digits to claw, including claw sheath on finger 1 (LamF1), finger 4 (LamF4), toe 1 (LamT1), toe 4 (LamT4), and toe 5 (LamT5). Additional characters evaluated (modified from Grismer et al., 2014) were presence or absence of row of enlarged, widely spaced tubercles and spine-like tubercles between limb insertions along ventrolateral edge of body (flank); general arrangement (i.e., random or more or less linear) of dorsal body tubercles; orientation and shape of femoral and precloacal pores; degree and arrangement of body and tail tuberculation; relative size and morphology of subcaudal scales; presence or absence of postcloacal tubercles (if present then distinct or indistinct) on each side of tail base, number of postcloacal tubercles on each side, when present (PCT); presence or absence of row of enlarged scales under 1<sup>st</sup> toe till end of feet; and presence or absence of whorls of caudal tubercles. Color pattern was recorded from photographs taken in life.

Micro-CT scans were generated for one male and female of *Cnemaspis* cf. *monticola* and one male specimen of *Cnemaspis galaxia* sp. nov. from the *beddomei* clade using a Bruker® Skyscan 1272 (Bruker BioSpin Corporation, USA). Each specimen was placed in polypropylene tube packed with polystyrene to ensure that the specimen was stable during the scan. The head and sacral regions of the specimens were scanned for 90 min at a resolution of 3.5 µm and data were recorded for every 0.5° rotation for 360° with (AL) a 1 mm filter. The source voltage and current for the scan were 65 kV and 153 µA, respectively. Volume rendering was performed with CTvox (Bruker BioSpin Corporation, USA) and images were edited in Adobe Photoshop CS6. The osteological descriptions were based on volume renders retrieved from CTvox following the terminology of the skull described in Evans (2008) and Scherz et al. (2017). Additionally, one male and one female specimen of *Cnemaspis magnifica* were cleared and stained following the protocols of Hanken & Wassersug (1981).

### Species delimitation

We followed a hierarchical approach towards delineating lineages using the concatenated mitochondrial tree to identify clusters and multiple lines of evidence, including phylogenetic position, genetic divergence, morphological difference, and geographic isolation, to delimit distinct species (Shanker et al., 2017; Vijayakumar et al., 2014). Morphological examination and comparison of collected specimens with museum type specimens and topotypical material helped in identifying extant species. First, we identified well-supported subclades and used genetic divergence within members of each subclade to identify distinct lineages. For lineage diagnosis, we used the uncorrected pairwise distance of the 16S mitochondrial gene and classified genetic divergence in the following categories: shallow genetic divergence (1%–2%); moderate genetic divergence (2%–4%); high genetic divergence (4%–6%); and very high genetic divergence (>6%) (Mallik et al., 2020; Shanker et al., 2017; Vijayakumar et al., 2014). We designated lineages with high or very high genetic divergence as species, and further examined shallow and moderately divergent species along morphological and geographical axes. Those that were morphologically distinct and geographically separated (allopatric) were also designated as species. In addition, to confirm the putative lineages, we used the Bayesian implementation of the Poisson Tree Process (bPTP) model for species delimitation (Zhang et al., 2013). The concatenated tree was used as the input tree where outgroup taxa were removed prior to the run. We used the online-based server for bPTP and ran 500 000 MCMC iterations with 100 thinning to obtain convergence (<http://species.h-its.org/ptp/>).

Institutional abbreviations used in this study are as follows: BNHS (Bombay Natural History Society Museum, Mumbai), BMNH (Natural History Museum, London, UK), CES (Centre for Ecological Sciences, Indian Institute of Science, Bangalore), NCBS (National Centre for Biological Sciences, Bangalore), ZSI (Zoological Survey of India, Kolkata), WGRC, ZSI (Western Ghats Regional Centre, Zoological Survey of India, Kozhikode), MNHN (National Museum of Natural History, Paris, France), NMNHI (National Museum of Natural History, New Delhi), and FMNH (Field Museum of Natural History, Chicago). Other abbreviations include meters above sea level (m a.s.l.).

## RESULTS

### Phylogeny

The BI and ML analyses provided strong support for the monophyly of SA *Cnemaspis* and revealed a deep split separating two large well-supported clades (Figure 2). These included a well-supported *C. kolhapurensis* Giri, Bauer & Gaikwad, 2009+*C. wynadensis* (Beddome, 1870) clade (CL I) from NWG and CWG (north of the Palghat Gap) and another clade containing the remaining SA *Cnemaspis* species, similar to previous studies (Agarwal et al., 2020b; Sayyed et al., 2018). The latter clade could be further divided into multiple subclades, with a deep basal split separating a strongly supported *C. beddomei* (Theobald, 1876) clade (CL II)

endemic to SWG (south of the Palghat Gap) and another strongly supported clade, including multiple subclades of the remaining SA members.

Most of the identified subclades showed strong BI and ML support (see subclade composition below), except the split separating CL VII+VIII+IX+X from the other SA *Cnemaspis* species as well as between CL IX and CL X, which were moderately supported in the BI and ML analyses (BPP 0.78/UF 88 and 0.87/91, respectively). Based on our species delimitation protocol, we identified and described 12 new lineages belonging to various subclades (Figure 2), which varied in genetic and morphological divergences and patterns of geographical distribution. Overall, bPTP analysis supported our lineage delimitation, although it slightly overestimated the total number of lineages (Supplementary Figure S1).

**Subclade composition:** Based on phylogenetic analysis using the concatenated dataset, we identified 10 strongly supported clades, each composed of a minimum of two lineages (Figure 2). Most identified clades were supported by a combination of morphological characters and geographical distribution, unique to each clade (Table 1). We assigned names and numbers to these well-supported clades, with the component lineages listed below:

- I. wynadensis clade:** Comprising nine known lineages viz. *C. kolhapurensis*; *C. sisparensis* (Theobald, 1876); *C. kottiyooorensis* Cyriac & Umesh, 2014; *C. heteropholis* Bauer, 2002; *C. anaikattiensis* Mukherjee, Bhupathy & Nixon 2005; *C. wynadensis*; *C. chengodumalaensis* Cyriac, Palot, Deuti & Umesh, 2020; *C. zacharyi* Cyriac, Palot, Deuti & Umesh, 2020; and *C. magnifica* Khandekar, Thackeray, Pal & Agarwal, 2020. We identified two new well-supported, distantly related lineages with moderate support, described here as *Cnemaspis balerion sp. nov.* and *Cnemaspis lithophilis sp. nov.* (Figure 3).
- II. beddomei clade:** Comprising six known lineages viz. *C. beddomei*; *C. aaronbaueri* Sayyed, Grismer, Campbell & Dileepkumar, 2019; *C. anamudiensis* Cyriac, Johnny, Umesh & Palot, 2018; *C. maculicollis* Cyriac, Johnny, Umesh & Palot, 2018; *C. ornata* (Beddome, 1870); and *C. nairi* Inger, Marx & Koshy, 1984. Seven of the newly identified lineages belong to this clade (Figure 2), described here as *Cnemaspis rubraoculus sp. nov.*, *Cnemaspis wallaceii sp. nov.*, *Cnemaspis nimbus sp. nov.*, *Cnemaspis smaug sp. nov.*, *Cnemaspis nigriventris sp. nov.*, *Cnemaspis galaxia sp. nov.*, and *Cnemaspis regalis sp. nov.* (Figure 3).
- III. littoralis clade:** Comprising two known lineages from the WG, including *C. littoralis* and the recently described *C. palakkadensis* Sayyed, Cyriac & Dileepkumar, 2020. Two new lineages belong to this clade, described here as *Cnemaspis flavigularis sp. nov.*, and *Cnemaspis palanica sp. nov.* (Figure 3). This clade includes members of the *C. podihuna* clade from Sri Lanka, as observed in other recent studies (Agarwal et al., 2020b; Khandekar et al., 2019a).
- IV. indica clade:** Comprising three known lineages viz. *C. indica*; *C. nilagirica* Manamendra-Arachchi, Batuwita & Pethiyagoda, 2007; and *C. anandani* Murthy, Nitesh, Sengupta & Deepak, 2019.
- V. bangara clade:** Comprising three known lineages viz. *C.*

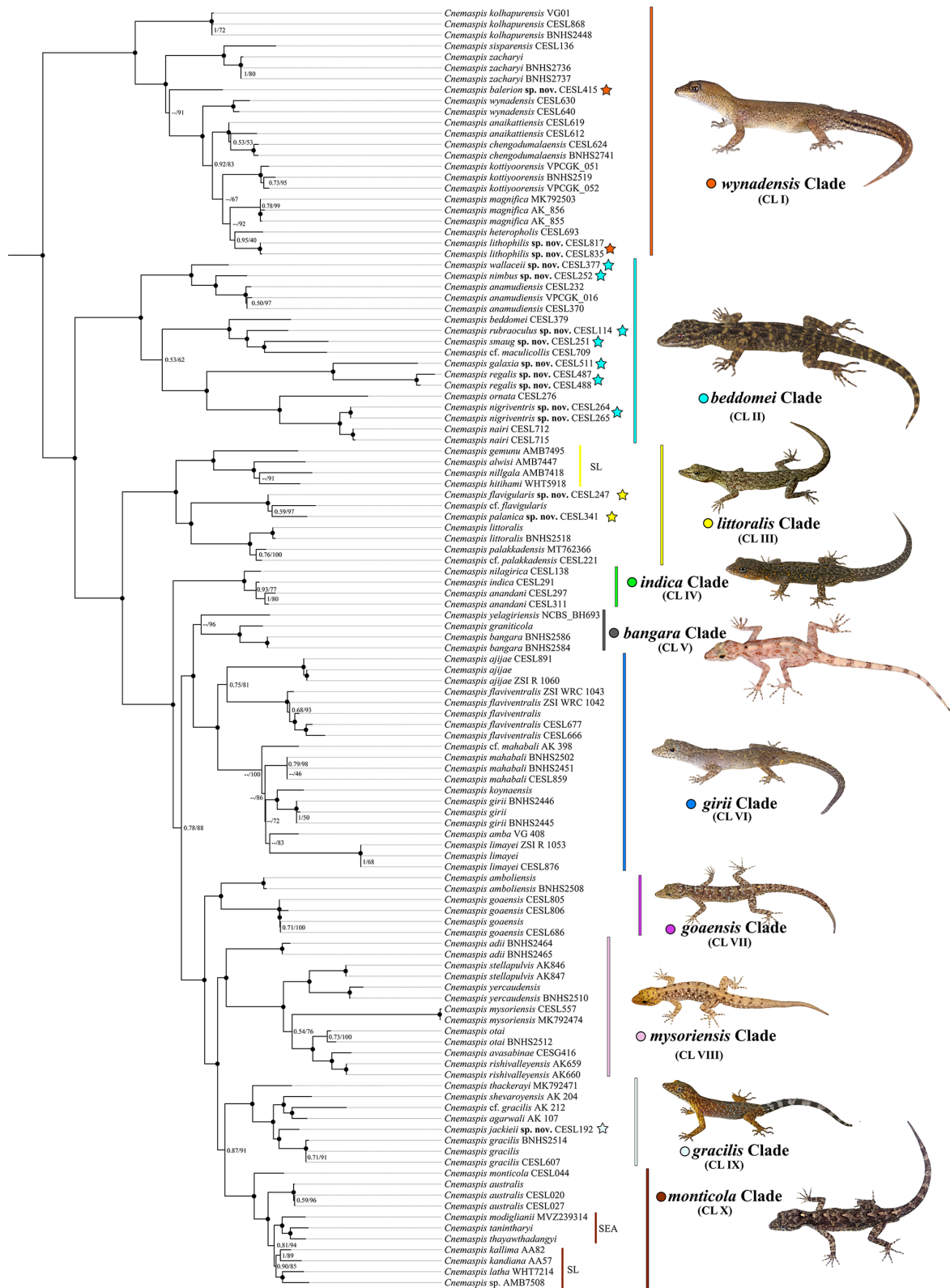
*bangara*; *C. graniticola* Agarwal, Thackeray, Pal & Khandekar, 2020; and *C. yelagiriensis* Agarwal, Thackeray, Pal & Khandekar, 2020.

- VI. girii clade:** Comprising seven known lineages viz. *C. girii*; *C. mahabali* Sayyed, Pyron & Dileepkumar, 2018; *C. limayei* Sayyed, Pyron & Dileepkumar, 2018; *C. ajijae* Sayyed, Pyron & Dileepkumar, 2018; *C. flaviventralis* Sayyed, Pyron & Dahanukar, 2016; *C. amba* Khandekar, Thackeray & Agarwal, 2019; and *C. koynaensis* Khandekar, Thackeray & Agarwal, 2019.
- VII. goaensis clade:** Comprising two known lineages viz. *C. amboliensis* Sayyed, Pyron & Dileepkumar, 2018 and *C. goaensis*.
- VIII. mysoriensis clade:** Comprising seven known lineages viz. *C. mysoriensis* (Jerdon, 1853); *C. otai* Das & Bauer, 2000; *C. yercaudensis* Das & Bauer, 2000; *C. adii* Srinivasulu, Kumar & Srinivasulu, 2015; *C. avasabinae* Agarwal, Bauer & Khandekar 2020; *C. rishivalleyensis* Agarwal, Thackeray & Khandekar 2020; and *C. stellapulvis* Khandekar, Thackeray & Agarwal, 2020.
- IX. gracilis clade:** Comprising four known lineages viz. *C. gracilis*; *C. agarwali* Khandekar, 2019; *C. shevaroyensis* Khandekar, Gaitonde & Agarwal, 2019; and *C. thackerayi* Khandekar, Gaitonde & Agarwal, 2019. A well-supported new lineage is described here as *Cnemaspis jackieii sp. nov.* (Figure 3).
- X. monticola clade:** Comprising two known lineages viz. *C. monticola* and *C. australis* from the WG. This clade also includes members of the *C. kandiana* clade from Sri Lanka and Southeast Asian representatives of SA *Cnemaspis*, as observed in other recent studies (Agarwal et al., 2020b; Khandekar et al., 2019a).

#### Divergence times and biogeography

We combined the newly created *ND2* dataset with earlier published datasets to estimate divergence times for the WG clades. The observed divergence dates overlapped closely with recent studies using overlapping taxon sets (Agarwal et al., 2020b; Chaitanya et al., 2019) (Supplementary Figure S2). We showed that SA *Cnemaspis* likely originated in the WG north of the Palghat Gap ~63 (74–53) Mya during the Paleocene, wherein the ancestors diverged into two clades, one comprising of members inhabiting the NWG and CWG (Clade I) and a second clade with a more complex biogeographic history (Figure 4). The initial diversification of SA *Cnemaspis* coincided with the K-T boundary, in particular the Deccan Traps volcanic eruption followed by the Paleocene-Eocene Thermal Maximum. The ancestors that gave rise to the present diversity of the group seem to have survived these events that otherwise led to mass extinctions (Ali & Aitchison, 2008; Cyriac & Kodandaramaiah, 2017; Datta-Roy & Karanth, 2009; Ivany et al., 2000; Joshi & Karanth, 2013). Clade I (*wynadensis* clade) began to diversify ~28 (35–21) Mya during the mid-Oligocene, leading to the single extant lineage *C. kolhapurensis* in the NWG, and to a clade distributed in the CWG, which began to diversify in the early Miocene ~21 (26–16) Mya.

The remaining clades diverged at a similar time as the initial diversification of SA *Cnemaspis* ~61 (72–51) Mya.



**Figure 2 ML phylogeny illustrating relationships within SA *Cnemaspis* based on concatenated mitochondrial 16S and ND2 dataset**  
 Values along nodes are posterior probabilities (BPP) based on Bayesian analysis followed by ultra-fast bootstraps (UF) of ML analysis. Solid circles represent nodes supported by BPP and UF values >0.95 and >95, respectively; “- -” indicates unresolved relationships. Lineages described in this study are marked by stars. Clades are named, represented by vertical specific-colored bars, and denoted with Roman numerals (CL I–X). Photos: representative species of each clade from Peninsular India; Photos by Saunak Pal.

**Table 1 Major diagnostic characters of *Cnemaspis* clades from Peninsular India**

	<i>wynadensis</i> Clade (CL I)	<i>beddomei</i> Clade (CL II)	<i>littoralis</i> Clade (CL III)	<i>indica</i> Clade (CL IV)	<i>bangara</i> Clade (CL V)
Distribution	NWGs, CWGs	SWGs	CWGs, SWGs	high elv of CWGs	EGs, Mysore plateau
Body size	Medium to large; stout	Medium to large; stout	Small to medium; slender	Small to medium	Medium; slender
Dorsal pholidosis	Homogenous or heterogenous	Heterogenous	Homogenous	Homogenous	Heterogenous
Spine-like tubercles on flank	Absent	Absent	Few, often present, scattered	Few, small, subconical; absent in <i>C. indica</i>	Absent
Femoral Pores	Present (except <i>C. kolhapurensis</i> which has series of precloacal-femoral pores)	Absent	Present; more than 10 on each side	Present	Present
Precloacal Pores	Absent	Present	Absent	Absent	Present
Tubercles forming whorls on tail	Absent	Present or absent	Present or absent; when present reduced	Absent	Present; only on few anterior rows
Postcloacal tubercle	Mostly absent; if present, small, reduced	Present, distinct	Often present; small, reduced	Present, distinct	Present
Sub-caudals	Smooth	Smooth	Smooth	Smooth	Smooth
median sub-caudal scale row	Prominently enlarged	Prominently enlarged	Prominently enlarged	Prominently enlarged	Prominently enlarged
	<i>girii</i> Clade (CL VI)	<i>goaensis</i> Clade (CL VII)	<i>gracilis</i> Clade (CL VIII)	<i>mysorensis</i> Clade (CL IX)	<i>monticola</i> Clade (CL X)
Distribution	NWGs	NWGs	CWGs, SWGs, EGs, Mysore plateau	Mysore plateau	CWGs, SWGs
Body size	Small to medium; slender	Small to medium; slender	Small to medium; slender	Small to medium	Small to medium; slender
Dorsal pholidosis	Heterogenous	Heterogenous	Heterogenous	Heterogenous	Heterogenous
Spine-like tubercles on flank	Absent	Present	Absent	Absent	Present
Femoral Pores	Present	Present	Present	Present (except <i>C. avasabinae</i> )	Present
Precloacal Pores	Absent	Present	Present	Present	Present
Tubercles forming whorls on tail	Absent	Present	Present	Present	Present
Postcloacal tubercle	Mostly present, small	Present	Present	Present	Present
Sub-caudals	Smooth	Smooth or weakly keeled	Smooth	Smooth	Smooth or keeled
median sub-caudal scale row	Not enlarged	Slightly enlarged	Prominently enlarged	Not to slightly enlarged	Enlarged

NWGs: Northern Western Ghats; CWGs: Southern Western Ghats; EGs: Eastern Ghats.

Diversification within Clade II began ~46 (56–37) Mya, during the Eocene to early Oligocene. Members of this clade are endemic to the SWG, and display diversification based on hill ranges and climatic regimes. The Shencottah Gap may have played a crucial role in the diversification of at least some members of this clade with lineages diverging across this gap during the early Miocene, as seen in *Cnemaspis galaxia* **sp. nov.** and *Cnemaspis regalis* **sp. nov.**, as well as *Cnemaspis smaug* **sp. nov.** and *C. cf. maculicollis* (Figure 4).

Clades III (*littoralis* clade) and IV–X diverged ~48 (57–39) Mya during the mid-Eocene. Clade III comprises wet zone species that dispersed into Sri Lanka during the early to mid-Oligocene (40–26 Mya), potentially facilitated by lower sea levels (Bossuyt et al., 2004), while diversification within the Indian members began ~27 (34–19) Mya. The western part of the WG receives much higher annual rainfall, which may have influenced an east-west diversification, as seen in *Cnemaspis palanica* **sp. nov.** and *Cnemaspis cf. flavigularis*. Clades IV–X started to diversify during the early Oligocene, with multiple

dry and wet zone lineages. Clade IV (*indica* clade) is a unique clade endemic to the Nilgiri Hills in the CWG which diverged from the other clades in the early Oligocene ~34 (41–28) Mya, with recent diversification giving rise to closely related species. Clade X (*monticola* clade) began to diversify ~11 (14–9) Mya, with a single lineage dispersing out of India during the Late Miocene and colonizing Sri Lanka and Southeast Asia. The Southeast Asian representatives of SA *Cnemaspis*, i.e., *C. modiglianii* Das, 2005; *C. tanintharyi* Lee, Miller, Zug & Mulcahy, 2019, and *C. thayawthadangyi* Lee, Miller, Zug & Mulcahy 2019, split from the Sri Lankan members of Clade X (*kandiana* clade) ~7 (9–6) Mya.

The lineage-through-time plot suggests that since the Late Pliocene Thermal Maximum and the Deccan Traps volcanism ~50 Mya, *Cnemaspis* has been diversifying gradually, with two distinct plateaus and a slight increase post the Oi-1 glaciation event and a further rise during the Miocene. There is no evidence for a rapid burst in diversification at any point (Supplementary Figure S4).





**Figure 3** Coloration in life of all 12 holotypes

A: *Cnemaspis balerion* sp. nov.; B: *Cnemaspis lithophilis* sp. nov.; C: *Cnemaspis rubraoculus* sp. nov.; D: *Cnemaspis nimbus* sp. nov.; E: *Cnemaspis wallaceii* sp. nov.; F: *Cnemaspis smaug* sp. nov.; G: *Cnemaspis regalis* sp. nov.; H: *Cnemaspis galaxia* sp. nov.; I: *Cnemaspis nigriventris* sp. nov.; J: *Cnemaspis flavigularis* sp. nov.; K: *Cnemaspis palanica* sp. nov.; L: *Cnemaspis jackieii* sp. nov.. Photos by Saunak Pal.

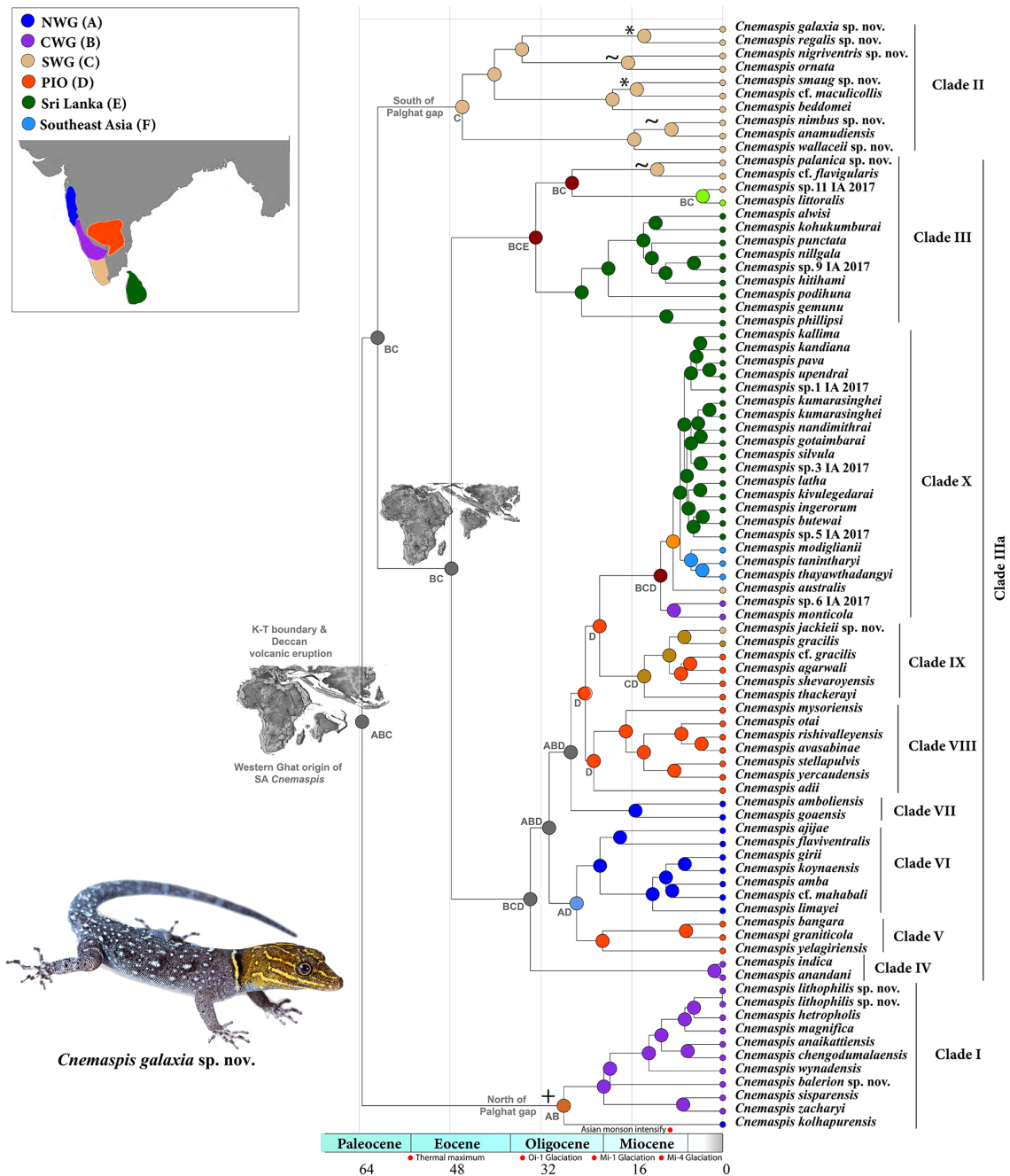
### Osteology

The skull in *Cnemaspis* is depressed dorsoventrally and wedged shaped in the lateral view (Figure 5). The skull is lightly built and not robust like *Hemidactylus* (Mirza et al., 2018). Calcification near the orbit is poor and details are lost when scanned under high-energy CT, especially in males (Figures 5; Supplementary Figure S5). The short subtriangular ascending nasal process of the premaxilla and the premaxillae on either side border the nasal anteriorly; the nasal has a 'V'-shaped indentation on its anterior border, in which the ascending nasal process of the premaxilla resides; the nasal bears a longitudinal suture along its length in some species (Figure 5); the frontal is elongated with a broad posterior width, and appears fused anteriorly with the nasal, prefrontal, and premaxilla, with a distinct suture between it and the parietal; the parietal is broad with a median suture; the maxilla bears sharply pointed isodont teeth ranging from 20 to 25 in number; the prefrontal is strongly curved and bound to the posterior border of the maxilla until it contacts the frontal on the dorsum; the jugal is elongated and slender and extends from the posterior process of the maxilla outwards as a

process clearly evident in some species of the genus in dorsal view (*beddomei* clade) to barely visible (*monticola* clade). The postorbitofrontal is thin, in broad contact with the frontal along its posterolateral border and extends to the end of the parietal along its lateral edge. The epipterygoid is oriented diagonally backwards, hinged at its base to the pterygoid, which meets the jugal anteriorly. The quadrate is robust, lacking any fossa in the *beddomei* clade, but bears a large fossa at its basal end, more pronounced in females, as seen in the *monticola* clade (Supplementary Figure S5). The squamosal is thin and highly curved, running from the posterior border of the parietal to the paroccipital process. Twenty-five presacral and two sacral vertebrae are present (Supplementary Figure S6). The phalangeal formula for both manus and pes is 2–3–4–5–3. A single pair of postcloacal bones is present only in males (Supplementary Figure S7).

### Systematics and taxonomy

In this study, we included most known *Cnemaspis* species from Peninsular India, except for *C. boiei* (Gray, 1842) and *C. jerdonii* (Theobald, 1868), for which a precise type locality is



**Figure 4 Geographical ancestral area reconstruction of time-calibrated phylogeny of SA *Cnemaspis* produced using RASP, showing most likely ancestral areas**

Maps at nodes show relative position of Indian plate at that time. Inset on top left shows color codes for ranges of species. See Supporting Material (Figures S3, S4) for RASP phylogeny tree with all possible ancestral ranges at nodes and lineage-through-time plot. “\*” denotes separation by Shencottah Gap, “~” for east-west separation, and “+” for separation by Goa Gap). Photo by Saunak Pal.

currently unknown. The type specimens of *C. jerdonii* deposited in ZSI are damaged and cannot be used for morphological observations (Manamendra-Arachchi et al., 2007, pers. obs.). Despite considerable effort during fieldwork, we were unable to discover any *Cnemaspis* population that matched the descriptions of *C. jerdonii* and *C. boiei*. Thus, for now, the status of these two species and their relationship with other members from Peninsular India remain unknown.

For species diagnosis and description, we compared individual lineages identified through our delimitation protocol with all other members of their respective clades from Peninsular India (Supplementary Tables S7–S10). We were unable to establish the phylogenetic position of the newly described *C. aaronbaueri* Sayeed, Grismer, Campbell & Dileepkumar, 2019, but assigned the species to Clade II based on distinct morphological characters and geographical

distribution. We provide a morphological description, distribution, and taxonomic history for each identified subclade with a combination of defining characters. We also describe the newly identified lineages and redescribe poorly known species from each clade (See Appendix I in the Supplementary Material for clade descriptions, new species accounts, and species redescrptions).

## DISCUSSION

### Evolution and biogeography of SA *Cnemaspis*

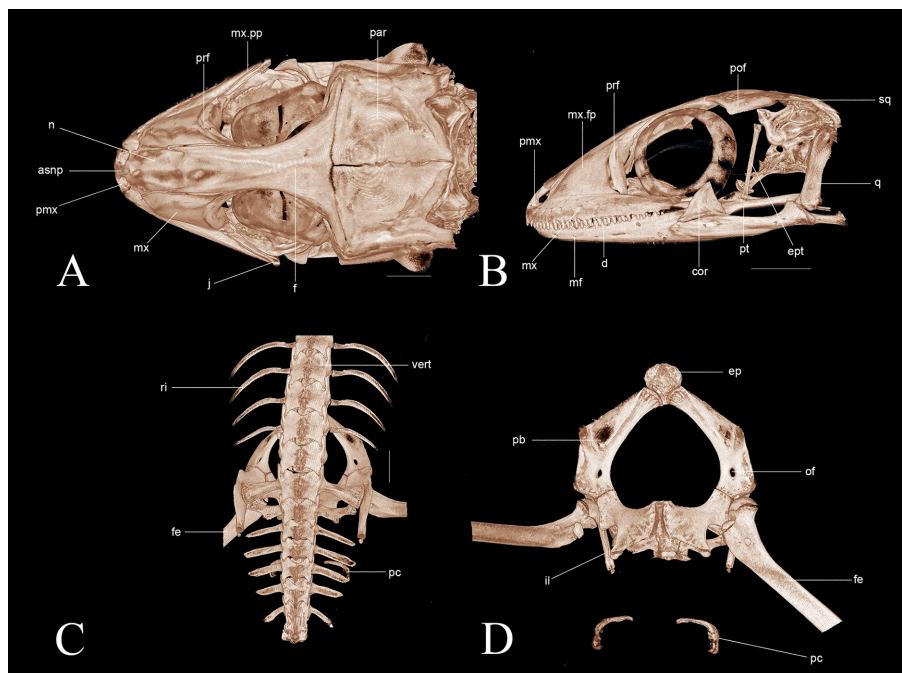
Several recent studies have explored the phylogenetic relationships within SA *Cnemaspis* (Agarwal et al., 2017, Cyriac et al., 2018, 2020, Khandekar et al., 2019a, 2019b) as well as the evolutionary origin of lineages within the group (Agarwal et al., 2020b). However, these previous studies did not adequately sample the WG, where the genus is most diverse. Therefore, we addressed this considerable gap in *Cnemaspis* phylogeny with dedicated sampling across the WG, resulting in the discovery of several species and a deeply divergent clade endemic to the SWG. The discovery of this highly diverse clade, which dates to the Paleocene and contains multiple new endemic species, signifies the importance of the SWG in the diversification of SA *Cnemaspis*. These results provide important insights into the origin and *in-situ* diversification of SA *Cnemaspis* in the WG.

As demonstrated earlier and confirmed here, SA *Cnemaspis* is one of the oldest extant vertebrate groups in Peninsular India, which began to diversify when the Indian plate was an island, before its collision with Asia. Notably, the *wynadensis*

clade split from the other clades ~63 Mya, thus suggesting a putative Gondwanan origin or trans-oceanic dispersal into India. The ancestors of SA *Cnemaspis* survived the K-T mass extinction event as well as the Deccan Traps volcanic eruptions.

The SWG (south of the Palghat Gap) region has long been considered as a refugium for wet-zone species during the Late Cretaceous (Bansal & Karanth, 2013; Datta-Roy & Karanth, 2009; Joshi & Karanth, 2013; Mani, 1974). However, the basal SA *Cnemaspis* Clade I hints at a potential origin north of the Palghat Gap. This finding is noteworthy as it adds to our growing knowledge of the biogeography of the WG as well as *Cnemaspis*. Lineages within Clade I only started to diversify in the mid-Oligocene, while those in Clade II began to diversify in the mid-Eocene, with deeply divergent lineages. The independent diversification of Clades I & II (*wynadensis* & *beddomei*) on either side of the Palghat Gap highlights the significance of the gap as a biogeographic barrier for SA *Cnemaspis*. Late Paleocene diversification of these clades suggests that the Palghat Gap served as an ancient barrier in the WG, predating the Indo-Asian plate collision.

In addition to the Palghat Gap, the lineages are closely associated with major hill ranges and their elevational gradients, as well as climatic regimes. The Shencottah Gap potentially drove allopatric speciation in certain *Cnemaspis* species (e.g., *Cnemaspis regalis* sp. nov. vs. *Cnemaspis galaxia* sp. nov., *C. nairi* vs. *Cnemaspis nigriventris* sp. nov., and *Cnemaspis smaug* sp. nov. and *C. cf. maculicollis*), while rainfall drove east-west diversification (e.g., *Cnemaspis wallaceii* sp. nov., *Cnemaspis nimbus* sp. nov., and *C.*



**Figure 5** Micro-CT images of male paratype CESL 513 *Cnemaspis galaxia* sp. nov.

A: Dorsal view of skull; B: Lateral view of skull; C: Dorsal view of pelvic girdle; D: Ventral close up of pelvic girdle showing pair of cloacal bones. asnp: ascending nasal process of premaxilla, cor: coronoid, d: dentary, ept: epipterygoid, ep: epipubis, f: frontal, fe: femur, il: ilium, j: jugal, mf: mental foramen, mx: maxilla, mx.fp: facial process of maxilla, mx.pp: posterior process of maxilla, n: nasal, of: obturator foramen, par: parietal, pb: pubis, pc: post cloacal bone, pmx: premaxilla, pof: postorbitofrontal, prf: prefrontal, pt: pterygoid, q: quadrate, ri: ribs, sq: squamosal, vert: vertebrae.

*anamudiensis* across the Anamalai landscape). The existence of locally endemic, deeply divergent lineages across different massifs suggests the possibility of multiple micro-refugia across the WG. Two independent colonization events from the WG into drier parts of Peninsular India in the late Oligocene followed by range restriction during the Miocene aridification may explain the occurrence of the dry zone granite-associated clades in Peninsular India outside the WG.

Other gekkonid genera such as *Hemidactylus*, *Hemiphyllodactylus*, and *Cyrtodactylus* (*Geckoella*), which exhibit high diversity in regions outside the WG (e.g., EG and Mysore plateau), show much lower diversity in the WG. Studies have suggested that these geckos entered Peninsular India much more recently than *Cnemaspis*, dating back to the Eocene-Oligocene (Agarwal & Karanth, 2015; Agarwal et al., 2019, 2020b; Lajmi & Karanth, 2020). It is possible that the high *Cnemaspis* gecko diversity in the WG played a role in the lower diversity of these geckos in the region. The WG endemic genus *Dravidogecko* is the only other gekkonid genus known to have a late Paleocene origin; however, in contrast to *Cnemaspis*, these geckos started diversifying much later in the Miocene (Chaitanya et al., 2019).

Of the major clades identified in this study, Clades I and II, which started diversifying in the Oligocene and Eocene, show strong geographic separation, restricted to north and south of the Palghat Gap, respectively. Within members of these clades, there is apparent separation across elevational and rainfall gradients, as well as microhabitats and habits, with some species restricted to the forest floor and other scansorial species found on rocks and boulders in moist forests.

Clades III and X have a much more widespread distribution, with both found across the Palghat Gap and showing independent dispersal into Sri Lanka. Members of these two clades are distributed across different elevational gradients and forest types, ranging from low-elevation deciduous forests to high-elevation evergreen forests. Tolerance to different habitats and elevations may have helped them to diversify across the Palghat Gap and into Sri Lanka.

Clade IV (*indica* clade), which originated in the early Oligocene, is endemic to the Nilgiri Hills and contains three closely related species. Clade members show an east-west divide, with *C. anandani* and *C. nilagirica* occurring on either side of the Nilgiri Hills (Cyriac et al., 2019; Murthy et al., 2019). Clades V and VIII are both restricted to the drier parts of Peninsular India outside the WG, while clade IX is the only clade distributed across both the drier parts of Peninsular India as well as the WG. Most members of these clades display scansorial habits and frequent rocks and boulders in forested habitats. Clades VI and VII are restricted to the NWG, with members of Clade VI (*girii* clade) known mainly from moist semi-evergreen forest patches and those in Clade VII more widespread across different habitats and commensal at least in parts of their distribution (Khandekar et al., 2019b; Sayyed et al., 2018). Hence, multiple factors, such as the existence of ancient barriers, complex topography, and climatic gradients, coupled with highly specific habitat requirements, may have led to geographic isolation and the immense diversity of this ancient group of lizards in Peninsular India.

### Taxonomy and systematics of SA *Cnemaspis*

Based on multiple criteria, our study shows a significant increase in the number of new lineages of *Cnemaspis* in the WG. We describe 12 of these newly identified lineages, which can be diagnosed as species on the basis of strong phylogenetic support, genetic distance, and geographical and morphological separation (Figures 2, 4). Seven belong to the SWG endemic *beddomei* clade. Amongst these, *Cnemaspis regalis* **sp. nov.** and *Cnemaspis galaxia* **sp. nov.** are sister species that show high genetic divergence, distinct morphology, and geographic separation. These species are from the eastern slopes of the Agasthyamalai and Megamalai hills in the SWG, respectively, and are separated by the Shencottah Gap. *Cnemaspis nigriventris* **sp. nov.** is the only newly identified lineage that shows shallow divergence from its sister species *C. nairi* but strong morphological differentiation. These species are also separated by the Shencottah Gap, with *C. nairi* restricted to south of the gap and *Cnemaspis nigriventris* **sp. nov.** restricted to the north (Supplementary Figure S14). Allopatric species showing shallow divergence with strong morphological and geographical separation have also been reported in other WG taxa (Mallik et al., 2020; Vijayakumar et al., 2014, 2016). The other four newly identified species from the *beddomei* clade show moderate to high divergence from the other clade members and morphological separation. These species are also geographically separated from close relatives, being restricted to high elevation areas on isolated hills in the SWG.

We also describe two new species from the *wynadensis* clade, distributed north of the Palghat Gap (Supplementary Figure S8). *Cnemaspis balerion* **sp. nov.**, although superficially similar to *C. wynadensis*, shows high genetic divergence from all members of its clade and is geographically isolated in the high-elevation montane forests of the Baba Budan Hills in the CWG. *Cnemaspis lithophilis* **sp. nov.**, from mid-elevation forests of the Sharavati valley in the CWG, is closely related to *C. heteropholis*, *C. magnifica*, and *C. kottiyorensis*, but differs from these species on the basis of moderate genetic divergence, distinct morphology, and wide geographic separation. *Cnemaspis palanica* **sp. nov.** and *Cnemaspis flavigularis* **sp. nov.** from the *littoralis* clade are both endemic to the high-elevation forests of the SWG (Palani and Cardamom hills, respectively) (Supplementary Figure S14). Rainfall gradients may have influenced the east-west diversification of these two closely related species.

*Cnemaspis jackieii* **sp. nov.**, from mid-elevation regions of the SWG, is the second member of the *gracilis* clade to be described from the WG. Other than *C. gracilis* and *Cnemaspis jackieii* **sp. nov.**, all other members of this clade are known from outside the WG. *Cnemaspis jackieii* **sp. nov.** shows moderate divergence, distinct morphological differences, and wide geographic separation from the closely related *C. gracilis*.

Most extant species from Peninsular India were included in this study due to wide-scale sampling across the WG, studying existing type specimens from various museums, and including results from multiple new studies. We also recovered extant populations of certain species, such as *C. australis* and

*C. monticola*, which were known only from their type specimens collected over 130 years ago. Based on fresh collections obtained near the type locality, as well as morphological distinction, phylogenetic position, and genetic distance, we established *C. anaikattiensis* as a valid species, not a synonym of *C. sisparensis* as considered earlier (Cyriac et al., 2020; Manamendra-Arachchi et al., 2007). However, the taxonomic status and phylogenetic position of *C. jerdonii* and *C. boiei* await further research. As the precise type localities for these species are not known, and the type specimens of *C. jerdonii* are badly damaged, accurate species assessment is not currently possible. Although the type specimens of *C. boiei* exist in the BMNH collections, we were unable to find populations in the WG that matched those specimens. Given the advancement of genetic studies of museum specimens, DNA extraction from these specimens may help in identifying their phylogenetic status.

There has long been taxonomic ambiguity regarding the identification of most *Cnemaspis* species from the WG. Based on our multi-criteria approach, we identified 10 distinct clades of *Cnemaspis* in Peninsular India, which can be separated on the basis of morphological characters and geographic distribution. By defining these clades, we provide insights that will enable further taxonomic studies as well as field-based identification and documentation of *Cnemaspis* in Peninsular India. The redescription of extant species, including information on diagnostic characters, phylogenetic position, ecology, and distribution, will assist in future studies on the evolution and biogeography of this highly diverse and evolutionarily distinct group of geckos.

We also present preliminary results regarding the osteology of this group of geckos. Das and Bauer (2000) reported the presence of two pairs of postcloacal bones, one crescentic cloacal bone, and a pair of bony nodules near the base of the postcloacal spur in *C. yercaudensis*, *C. otai*, and *C. indica*. However, only a single pair of crescentic cloacal bones was observed via Micro-CT scanning and clear staining of related species in the current study. A more detailed sampling of SA *Cnemaspis* is necessary to establish the osteological basis of group separation within *Cnemaspis sensu lato* as suggested by Das and Bauer (2000).

## CONCLUSIONS

Despite being one of the world's "hottest biodiversity hotspots", the WG have undergone substantial habitat loss and degradation due to changes in land-use patterns (Jha et al., 2000; Myers et al., 2000; Reddy et al., 2013). It has been suggested that significant parts of the WG will be urbanized by 2030 due to population expansion and development (Seto et al., 2012). The recent discoveries of new evolutionarily distinct lineages from the WG highlight the biogeographic and evolutionary significance of this region as well as the importance of sampling strategies to detect endemic lineages while conducting broad-level phylogenetic studies (Britz et al., 2020; Chaitanya et al., 2019; Dinesh et al., 2020; Mallik et al., 2019; Pal et al., 2018; Robin et al., 2017; Vijayakumar et al., 2019). The recognition of 10 new morphologically distinct and geographically isolated species of *Cnemaspis* from the SWG

also highlights our lack of knowledge regarding the immense diversity of this region and its potential to harbor more unknown species. Recent discoveries of species that are morphologically similar to extant species within their respective clades (e.g., *C. palakkadensis* and *C. littoralis*; *C. nilagirica* and *C. anandani*, *C. nairi* and *Cnemaspis nigriventris* **sp. nov.**) further emphasize the potential for unexplored cryptic diversity in the WG. Most of the recently described evolutionarily distinct lineages, as well as those identified in this study, are range-restricted and have very specific microhabitat requirements. It is therefore important to identify these unique habitats within the landscape and focus efforts on the conservation of unique lineages with diverse evolutionary histories.

In the last decade, there has been a surge in the discovery of new species of *Cnemaspis* from Peninsular India, especially from regions not known to harbor high *Cnemaspis* diversity, such as the southern edge of the Mysore Plateau and the NWG. The molecular data generated in this study not only include new species, but also species previously known only from type localities or specimens, and thus provide a baseline for future taxonomic research. The discovery of a highly diverse SWG endemic clade (Clade II) and a dry zone granite-associated clade (Agarwal et al., 2020b) suggest that more effort is required to elucidate the diversity within SA *Cnemaspis*. Additionally, our findings stress the importance of spatial sampling and geographical distribution of species, along with molecular phylogenetic, and morphological methods, in uncovering deeply divergent lineages.

## NOMENCLATURAL ACTS REGISTRATION

The electronic version of this article in portable document format represents a published work according to the International Commission on Zoological Nomenclature (ICZN), and hence the new names contained in the electronic version are effectively published under that Code from the electronic edition alone (see Articles 8.5–8.6 of the Code). This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information can be viewed through any standard web browser by appending the LSID to the prefix <http://zoobank.org/>.

Publication LSID:

urn:lsid:zoobank.org:pub:6C6F83BA-1CEA-4E4A-A6BC-1B005957E856

***Cnemaspis balerion* sp. nov.**

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***Cnemaspis lithophilis* sp. nov.**

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***Cnemaspis rubraoculus* sp. nov.**

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***Cnemaspis nimbus* sp. nov.**

urn:lsid:zoobank.org:act:569F701C-BF0F-43B0-88F8-8BB1E16F5646

***Cnemaspis wallaceii* sp. nov.**

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***Cnemaspis smaug* sp. nov.**

urn:lsid:zoobank.org:act:AE84224E-1617-451D-A240-51F54756429F

***Cnemaspis regalis* sp. nov.**

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***Cnemaspis galaxia* sp. nov.**

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***Cnemaspis nigriventris* sp. nov.**

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***Cnemaspis flavigularis* sp. nov.**

urn:lsid:zoobank.org:act:AA987699-DD41-4C02-87C0-3E6D24995223

***Cnemaspis palanica* sp. nov.**

urn:lsid:zoobank.org:act:11E23EC6-5C55-4F2E-8345-CA7E68A5C0B2

***Cnemaspis jackieii* sp. nov.**

urn:lsid:zoobank.org:act:A7DB6E6A-4F98-4044-B0B4-3CA6A119C71C

**SCIENTIFIC FIELD SURVEY PERMISSION INFORMATION**

Fieldwork, including the collection of animals in the field, was conducted with permissions from, and following guidelines of, the responsible authorities in the State Forest Departments (Fieldwork research permits: No. WL 12-6574/2006, No. PS.CWL.CR-60/2006-07, C. No. WL5/74223/2010, No. 2/21/GEN/WL & ET (S)/2012-2013/591; D-22 (8)/Research/4520/2012-13 Permit No. 127, No. 1/16/WL & ET 12-13/184; Permit No. 67/2018).

**SUPPLEMENTARY DATA**

Supplementary data to this article can be found online.

**COMPETING INTERESTS**

The authors declare that they have no competing interests.

**AUTHORS' CONTRIBUTIONS**

S.P. conceived and designed the study, carried out data analysis and fieldwork, participated in laboratory work, prepared the manuscript, authored and reviewed drafts of the paper, and approved the final draft; Z.A.M. carried out data analysis and fieldwork, participated in laboratory work, assisted in writing the manuscript, authored and reviewed drafts of the paper, and approved the final draft; P.D. carried out molecular analyses, participated in laboratory work, assisted in writing the manuscript, authored and reviewed drafts of the paper, and approved the final draft; K.S. helped design and coordinate the study, acquired funding, contributed reagents/materials/analysis tools, assisted in writing the manuscript, authored and reviewed drafts of the paper, and approved the final draft. All authors read and approved the final version of the manuscript.

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# APPENDICES

## **Diversifying on the Ark: multiple new endemic lineages of dwarf geckos from the Western Ghats provide insights into the systematics and biogeography of South Asian *Cnemaspis***

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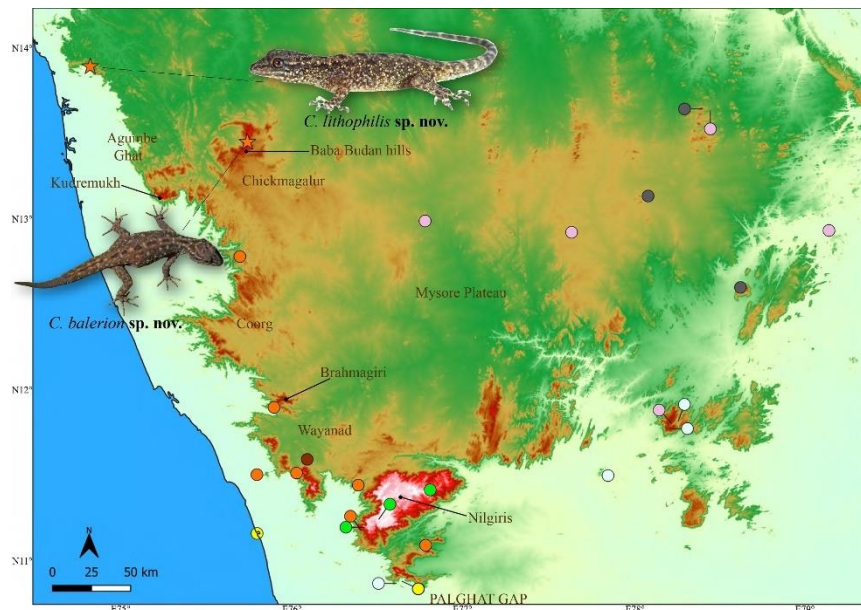
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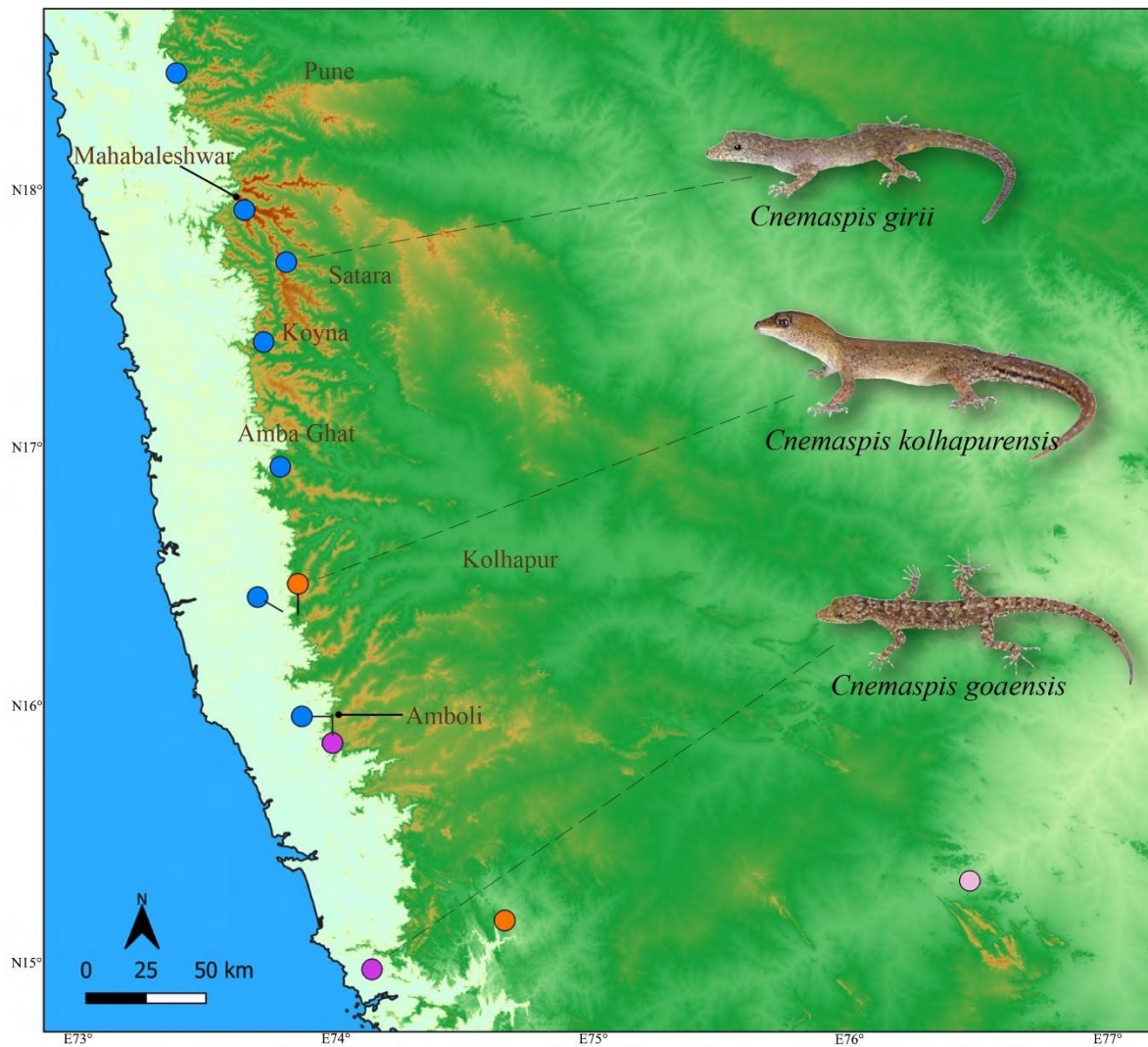
## APPENDIX I: Clade descriptions and species accounts

### *wynadensis* clade

Members of this clade are characterised by a medium to large stout body; absence of spine like tubercles on flanks; bright yellow-orange ring around pupil; dorsal aspect of tail homogenous, composed of small, smooth, imbricate scales, without whorl of enlarged like tubercles; postcloacal tubercle mostly absent, if present then small, subconical; median row of subcaudals enlarged; adult males with femoral pores (except *C. kolhapurensis* which has a series of precloacal-femoral pores); no sexual dichromatism; distributed in the Northern Western Ghats (NWG) and Central Western Ghats (CWG) (north of the Palghat gap) (Table 1) (Supplementary Figure S9, S8). The *wynadensis* clade shows 2.0%–10.6% genetic divergence within its members and 11.1%–19.2% genetic divergence from all other SA *Cnemaspis* at the 16S rRNA gene. Members of this clade are predominantly crepuscular to nocturnal geckos, mostly found on flat or vertical surfaces of rocks and boulders, while some are ground dwelling. *C. kolhapurensis* and *C. kottiyooorensis* were described in the past decade from the WG (Cyriac & Umesh, 2014; Giri et al., 2009b). *C. heteropholis* was described based on a single female specimen from Gund, Karnataka (Bauer, 2002). Khandekar et al. (2020b) presented a thorough redescription of *C. heteropholis* based on collections from the type locality and adjoining areas along with a description of *C. magnifica* (Khandekar et al., 2020b). Cyriac et al. (2020) recently described *C. chengodumalaensis* and *C. zacharyi* belonging to this clade and also discussed the status of *C. anaikattiensis* (Cyriac et al., 2020). We describe two new lineages belonging to this clade based on their phylogenetic position, genetic divergence and morphological characters. Additionally, we redescribe *C. sisparensis*, *C. anaikattiensis* and *C. wynadensis* and provide diagnostic characters, distribution and natural history information based on existing as well as fresh collections.



**Supplementary Figure S8.** Map of the CWG and adjoining region in Peninsular India depicting type localities of known species (circles) and two new species (stars). Colours of symbols correspond to respective clades (refer Figure 2). Labels indicate major physiographic features referred to in the text.



**Supplementary Figure S9.** Map of the NWG depicting type localities of known species (circles). Colours of symbols correspond to respective clades (refer Figure 2). Labels indicate major physiographic features referred to in the text.

## *Cnemaspis balerion* sp. nov.

(Figure 3A, S8, S10, S11; Supplementary Table S4, S5, S7)

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**Holotype:** BNHS 2623, adult male, (Figure 3A) collected from the buttress of a tree inside the forest, Dattathreyapeeta, Baba Budan Hills, Karnataka (13.450 °N, 75.751°E; 1410 m asl) by Saunak Pal and team on 23<sup>rd</sup> September 2011.

**Paratypes:** CESL 416, adult male and CESL 417, adult female; collected along with the holotype.

**Etymology:** The species is named after “Balerion”, a famous dragon from George R. R. Martin’s epic fantasy novel series, ‘A song of Ice and fire’. The dragon was also known as ‘the black dread’ due to presence of black scales. Like Balerion, this new species shows the presence of distinct clusters of black scales forming spots on the dorsum.

**Suggested common name:** Balerion forest gecko.

**Lineage diagnosis:** *Cnemaspis balerion* sp. nov. can be readily discerned on a phylogenetic tree and is nested within the *wynadensis* clade with uncertain sister relationships (BPP --/UF 91) (Figure 2). It is characterized by high genetic divergence at the 16s rRNA gene of 5.2–5.7% from *C. wynadensis*, 5.7–5.9% from *C. anaikattiensis*, 5.9–6.2% from *C. lithophilis* sp. nov., 5.7–6.2% from *C. kottiyooensis*, and very high genetic divergence (> 6.2%) from other members of the *wynadensis* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A medium sized, robust *Cnemaspis* species (SVL up to 45.0 mm) characterised by the presence of granular, homogeneous dorsal scales; gradually increasing in size on the dorsolateral aspect of flanks, juxtaposed; absence of spine like tubercles on flank; ventrals smooth, subimbricate, 121–127 longitudinal scales from mental to cloaca, 22–24 midventral scales; two to three pairs of postmentals, first pair separated by a single enlarged scale, each postmental surrounded by five to six scales including median scale; males with eight to nine elongated femoral pores separated by 14–16 poreless scales, precloacal pores absent; postcloacal spur absent; subcaudals smooth, median row enlarged, a large subpentagonal scale alternating with slightly smaller subtriangular scale; seven to eight supralabials to the angle of jaw; 19–20 lamellae on digit IV of manus and 22–23 lamellae on digit IV of pes.

*Cnemaspis balerion* sp. nov. can be distinguished from other members of the *wynadensis* clade by a combination of the following characters: smaller body size, SVL up to 45 mm (*versus* max SVL more than 50 mm in *C. anaikattiensis*, *C. sisparensis*, *C. zacharyi* and *C. magnifica*); dorsal scales homogeneous (*versus* dorsal scales heterogenous in *C. heteropholis*, *C. kottiyooensis*, *C. magnifica*, *C. chengodumalaensis* and *C. lithophilis* sp. nov.); males with 8–9 femoral pores (*versus* 4–6 in *C. kottiyooensis*; 5–6 in *C. heteropholis*, *C. zacharyi*, 6–7 in *C. magnifica* and *C. lithophilis* sp. nov., and a continuous series of 24–28 precloacal-femoral pores in *C. kolhapurensis*); 22–23 lamellae on digit IV of pes (*versus* 26–29 in *C. anaikattiensis* and *C. sisparensis*; 20–23 in *C. kottiyooensis*, 24–25 in *C. heteropholis*, 23–27 in *C. zacharyi*, 24–28 in

*C. magnifica* and 27–29 in *C. lithophilis* **sp. nov.**) 22–24 midventral scales (*versus* 28–32 in *C. anaikattiensis*, 27–30 in *C. sisparensis*, 25–28 in *C. zacharyi*, 24–26 in *C. magnifica* and 24–28 in *C. lithophilis* **sp. nov.**), 121–127 longitudinal scales from mental to cloaca (*versus* 147–153 in *C. anaikattiensis*, 139–143 in *C. sisparensis*, 119–123 in *C. heteropholis* and 13–160 in *C. magnifica*). *C. balerion* **sp. nov.** superficially resembles *C. wynadensis* in general morphology from which it can be distinguished by the presence of 22–23 lamellae on digit IV of pes (*versus* 16–19 in *C. wynadensis*), 22–24 midventral scales (*versus* 18–21), 121–127 longitudinal scales from mental to cloaca (*versus* 113–118) first pair of postmentals separated by a single large scale (*versus* first pair of postmentals separated by 2–3 small scales) and males with 8–9 femoral pores (*versus* 4–5 femoral pores in *C. wynadensis*) (Supplementary Table S7).

**Description of holotype:** BNHS 2623, a medium sized (SVL 45.0 mm) adult male (Supplementary Figure S10). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.71), not strongly depressed (HH/ HL = 0.43) distinct from neck. Snout long (SE/ HW = 0.63) longer than eye diameter (OD/ SE = 0.47); scales on snout and forehead granular, scales on snout smooth, larger than those on interorbital region and forehead; scales on the temporal region small, granular; on the occipital region larger, rounded (Supplementary Figure S10 C). Eyes small (OD/ HL = 0.21), pupil rounded; orbit with extra-brillar fringe composed of small scales, largest anteriorly. Ear opening small, oval (EL/ HL = 0.08); eye to ear distance much greater than diameter of eyes (EE/ OD = 1.82) (Supplementary Figure S10 E). Rostral half as long as wide, divided by a median groove and in contact with first supralabial, enlarged supranasals and median internasal. Nostrils circular, each surrounded by a postnasal, supranasal and rostral, supranasals separated by a single oval internasal scale; three rows of scales separate orbit from supralabials.

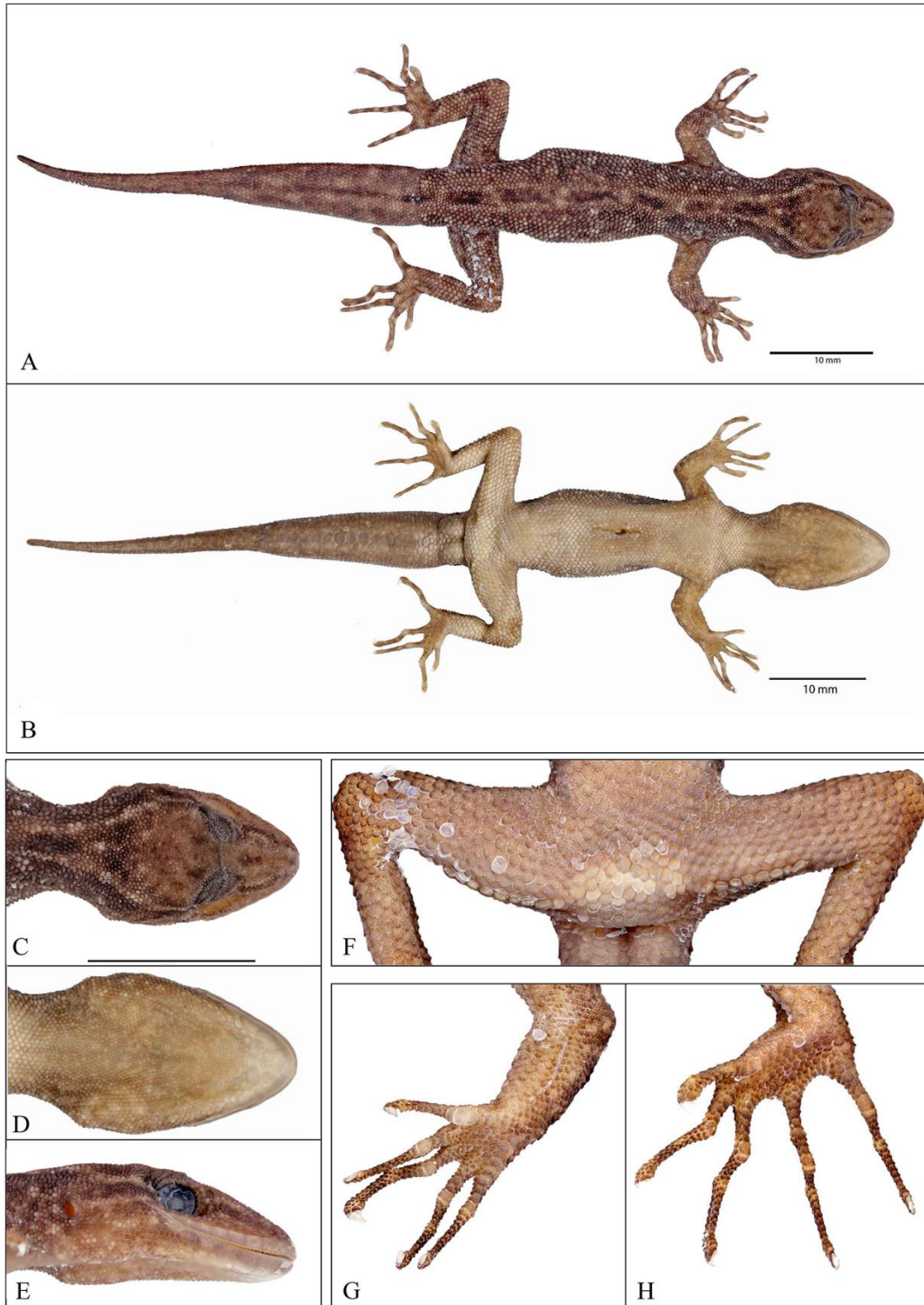
Mental roughly triangular, nearly as long as wide, paired postmentals quadrate, smaller than mental and medially separated from each other by a single roughly pentagonal scale; each postmental bounded by five to six smooth scales, including median scale; seven supralabials to the angle of jaw, sixth at midorbital position, eight infralabials to the angle of jaw, sixth at midorbital position.

Body robust (BW/ TRL = 0.54), not elongate (TRL/ SVL = 0.44). Dorsal scales on trunk fairly homogenous, granular, small weakly keeled scales, gradually increasing in size towards the flanks, juxtaposed. Scales on nape rounded, smooth, smaller than scales on dorsum. Ventral scales smooth, subimbricate, slightly larger than dorsal scales; gular scales small, granular, those on the neck subimbricate, slightly smaller than ventrals; 24 midbody scale rows across belly, 123 scales between mental to anterior border of cloaca; a triangular patch of glossy scales at the precloacal region; eight femoral pores on each side separated by 14 poreless scales.

Forelimbs short, robust; forearms short (FL/ SVL = 0.15); hind limbs relatively long; tibia short (CL/ SVL = 0.20). Scales on palm and sole smooth, granular; dorsal scales of forelimb and hindlimb rounded, smooth. Ventral scales of forelimb smooth, granular and that of hindlimb smooth, much larger than forelimb. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 10, digit II: 15, digit III: 18, digit IV: 20, digit V: 16; of left pes, digit I: 10, digit II: 17, digit III: 22, digit IV: 22, digit V: 19; a row of enlarged scales from the base of I<sup>st</sup> digit of pes till end of feet



present.



**Supplementary Figure S10.** *Cnemaspis balerion* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing femoral pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

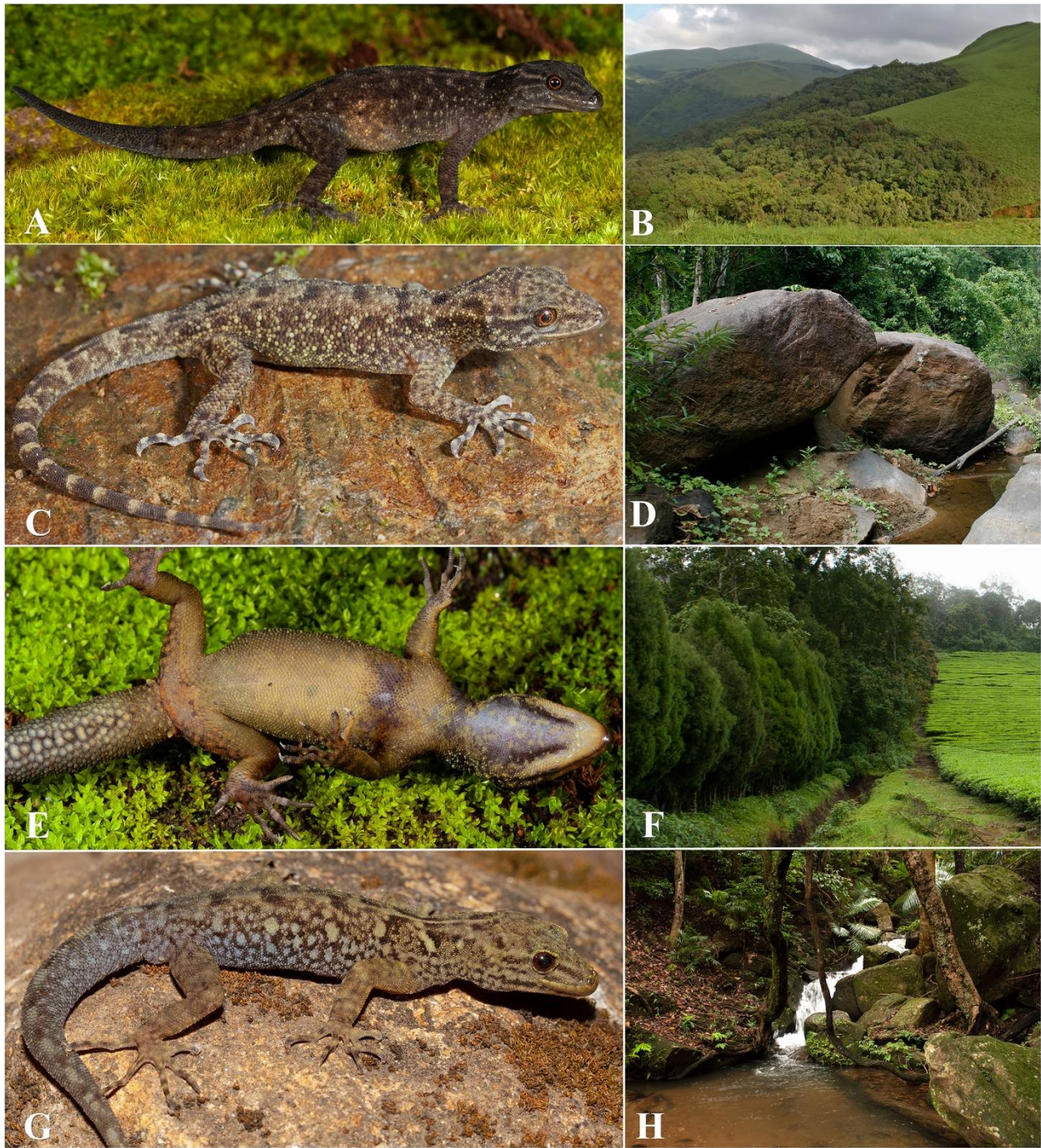
Tail partially regrown, entire, slightly longer than body length (TL/SVL = 1.07); tail base swollen. Dorsal scales on tail base small, granular; dorsal scales on the tail small, smooth, subimbricate. Subcaudal scales smooth, median row enlarged, composed of large roughly subpentagonal scale alternating with a slightly smaller subtriangular scale.

**Colouration in life** (Figure 3A): Dorsal colour of head, body, limbs and tail overall grey, patterned with darker and lighter cluster of scales along the dorsum; head uniform pale grey with few dark brown to black spots. Mid dorsum with six black spots alternating with six narrow pale buff bars longitudinally from nape to base of tail, the first central black spot on nape being most distinct. The black spots and narrow buff bars continue on the tail as a narrow stripe and indistinct pale bands. Regrown section of tail uniform grey brown. Lateral part of trunk grizzled with pale buff to yellow cluster of scales intermixed with few scattered dark scales. Head with a broken pale white to buff stripe from the nostril to anterior margin of eye. It continues behind the eye as a distinct stripe all the way along the head to the dorsum forming parallel stripe like pattern. Another small stripe from the lower posterior corner of the eye till above ear opening. Labial scales glossy, amber to dirty brown, supralabials lighter than infralabials. A small angular stripe from junction of jaw to lower margin of ear. Pupil dark black surrounded by thin yellowish orange iris edged with black. Limbs uniform, weakly striated with lighter and darker markings; digits alternating with light and dark bands. Ventrals uniform pale grey speckled towards the pectoral region with faint yellow scales, throat paler marbled with pale yellow scattered spots. Femoral pores distinct amber yellow, scales in the precloacal region glossy pale amber forming a roughly triangular patch. Ventral surface of the tail uniform grey with slightly darker enlarged median row of subcaudals.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 22–24 midventral scale rows and 121–127 ventrals; 10–11 lamellae on digit I and 20 on digit IV of manus, 10 lamellae on digit I and 22–23 lamellae on digit IV of pes; 7–8 labial scales; CESL 416 with eight femoral pores on the left and nine on the right, separated by 16 poreless scales. Overall colouration similar in both sexes with adult female CESL 417 being exactly similar to the holotype, differing only in the absence of femoral pores and glossy scales in the precloacal region.

**Distribution:** *Cnemaspis balerion* **sp. nov.** is currently known from a single locality in the high elevation (ca. 1400 m asl) montane forests of Baba Budan Hills in the CWG. During this study, it was collected from near Dattathreyapeeta, Baba Budan Hills, Karnataka.

**Ecology and natural history:** *Cnemaspis balerion* **sp. nov.** is most probably a nocturnal ground dwelling forest gecko, restricted to high elevation montane forests (Supplementary Figure S11 B). During this study, individuals were found to be moving actively on the buttress of a tree (ca. 1 m) above the ground inside the forest at night (ca. 2200 hrs). Another individual, a gravid female, was found near an abandoned broken hut inside the forest (Supplementary Figure S11 A). The occurrence of a gravid female in the month of September signifies that monsoon might be a breeding season for this gecko. No other geckos were observed from the habitat.



**Supplementary Figure S11.** Life colouration and habitat of new lineages. A. uncollected gravid female of *Cnemaspis balerion* **sp. nov.**, from type locality, B. habitat near Dattathreyapeeta, Baba Budan Hills, Karnataka, C. uncollected juvenile of *Cnemaspis lithophilis* **sp. nov.**, D. habitat at type locality near Kollur, Mookambika Wildlife Sanctuary, Karnataka, E. ventral view of holotype of *Cnemaspis rubraoculus* **sp. nov.**, BNHS 2612, F. habitat at type locality in Upper Manalar, Periyar Tiger Reserve, Megamalai, Kerala, G. paratype of *Cnemaspis nimbus* **sp. nov.**, CESL 252, H. habitat at type locality in Mathikettan Shola National Park, Cardamom Hills, Kerala.

## *Cnemaspis lithophilis* sp. nov.

(Figure 3B, S8, S11, S12; Supplementary Table S4, S5, S7)

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**Holotype:** BNHS 2624, adult male, (Figure 3B) collected from a boulder next to a stream near Kollur, Mookambika Wildlife Sanctuary, Karnataka (13.893°N, 74.833°E; ca. 450 m asl) by Saunak Pal and team on 8<sup>th</sup> September 2012.

**Paratypes:** BNHS 2625, CESL 819, adult female and CESL 820, adult male, collected along with the holotype; CESL 835, adult female, collected from the crevice of a tree trunk near Jog falls, CWG, Karnataka by Saunak Pal and team on 15<sup>th</sup> September 2012.

**Etymology:** The species epithet is derived from the combination of the Greek word ‘*lithos*’ meaning stone and ‘*philia*’ meaning fondness, due to the close association of this species with rocks.

**Suggested common name:** Sharavati rock gecko.

**Lineage diagnosis:** *Cnemaspis lithophilis* sp. nov. can be readily discerned on a phylogenetic tree and shows 0.2% intraspecific genetic divergence at the 16s rRNA gene. It is sister to *C. heteropholis*

with moderate support (BPP 0.95/UF 40) (Figure 2). It is characterized by moderate genetic divergence of 2.4–2.8% from *C. anaikattiensis*, 2.6–2.8% from *C. heteropholis*, 2.8–3.1% from *C. kottiyooensis*, 3.5–3.8% from *C. wynadensis* and 3.5–3.8% from *C. chengodumalaensis*, and high to very high genetic divergence (> 5.7%) from other members of the *wynadensis* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 49.9 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with irregularly arranged, partially keeled larger rounded to conical scales; absence of spine like tubercles on the flank; ventrals smooth, subimbricate, 126–129 longitudinal scales from mental to cloaca, 24–28 midventral scales; two to three pairs of postmentals, first pair separated by one to two scales, each postmental surrounded by five to six scales including median scale; males with six to seven elongated femoral pores separated by 12–13 poreless scales, precloacal pores absent; postcloacal spur absent; subcaudals smooth, median row enlarged; eight to nine supralabials to the angle of jaw; 25–26 lamellae on digit IV of manus and 27–29 lamellae on digit IV of pes.

*Cnemaspis lithophilis* sp. nov. can be distinguished from other members of the *wynadensis* clade by a combination of the following characters: larger body size, SVL up to 49.9 mm (*versus* max SVL less than 45 mm in *C. wynadensis*, *C. kottiyooensis*, *C. heteropholis* and *C. kolhapurensis*; SVL more than 55 mm in *C. anaikattiensis*, *C. sisparensis*, *C. zacharyi* and *C. magnifica*); dorsal scales heterogenous (*versus* dorsal scales homogeneous in *C. anaikattiensis*, *C. sisparensis*, *C. wynadensis*, *C. kolhapurensis*, *C. zacharyi* and *Cnemaspis balerion* sp. nov.); males with 6–7 femoral pores separated by 12–13 poreless scales (*versus* 4–6 in *C. wynadensis* and *C.*

*kottiyooorensis*; 8–9 in *C. balerion* **sp. nov.**; 5–6 femoral pores separated by 21–24 poreless scales in *C. zacharyi*, 7–8 femoral pores separated by 15–16 poreless scales in *C. anaikattiensis*, 7–8 femoral pores separated by 17–19 poreless scales in *C. sisparensis*; and a continuous series of 24–28 precloacal-femoral pores in *C. kolhapurensis*; 27–29 lamellae on digit IV of pes (*versus* 16–19 in *C. wynadensis*, 20–23 in *C. kottiyooorensis*, 24–25 in *C. heteropholis* and 22–23 in *C. balerion* **sp. nov.**), 24–28 midventral scales (*versus* 18–21 in *C. wynadensis*, 22–24 in *C. balerion* **sp. nov.** and 28–32 in *C. anaikattiensis*), 126–129 longitudinal scales from mental to cloaca (*versus* 147–153 in *C. anaikattiensis*, 113–118 in *C. wynadensis*, 119–123 in *C. heteropholis* and 139–143 in *C. sisparensis*) (Supplementary Table S7).

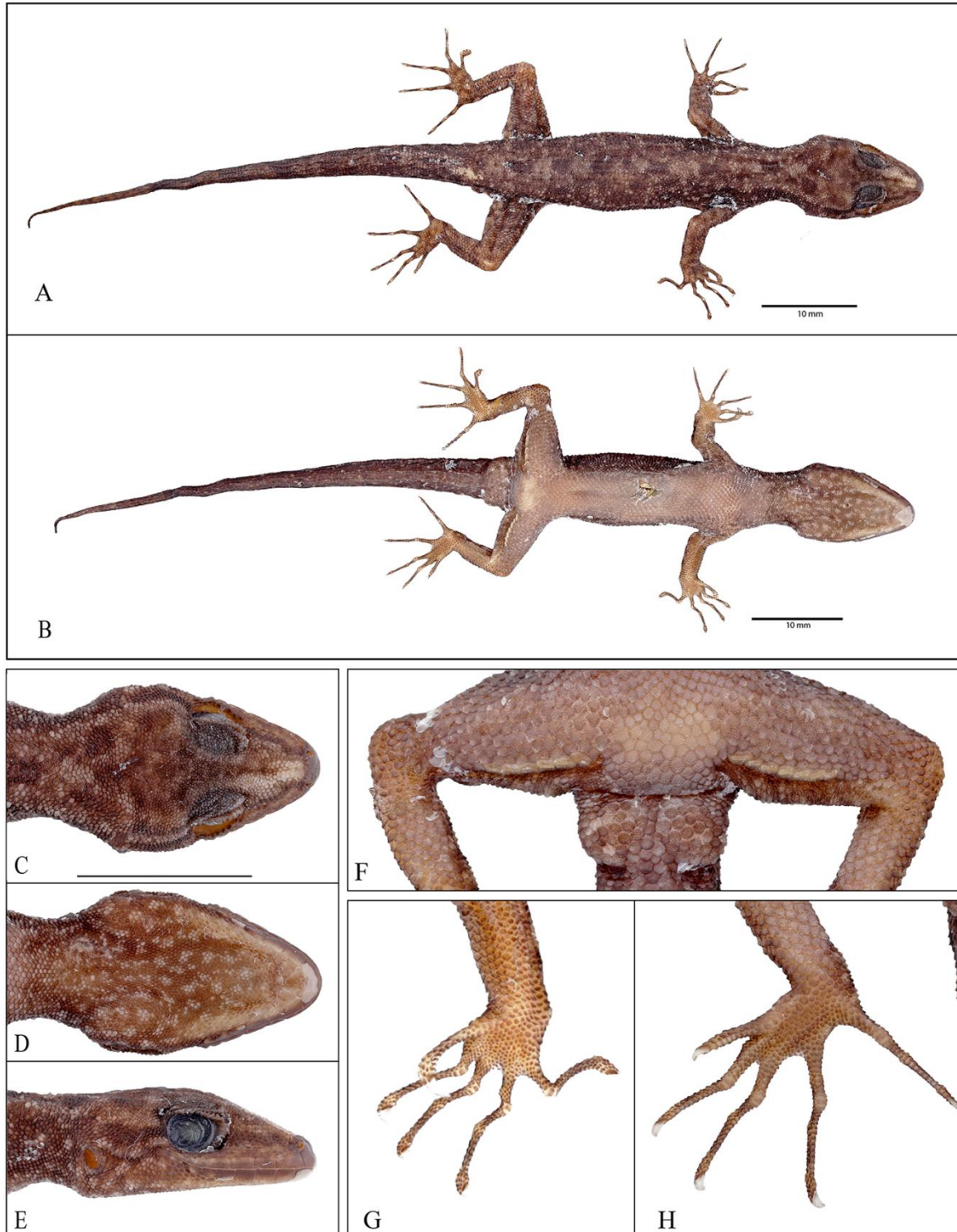
*C. lithophilis* **sp. nov.** closely resembles *C. chengodumalaensis* and *C. magnifica* in overall morphology from which it can be distinguished by smaller body size, SVL up to 49.9 mm (*versus* SVL up to 58 mm in *C. magnifica*); males with 6–7 femoral pores separated by 12–13 poreless scales (*versus* males with 5–8 femoral pores separated by 14–16 poreless scales in *C. chengodumalaensis*, 6–7 femoral pores separated by 15–16 poreless scales in *C. magnifica*); 25–26 lamellae on digit IV of manus and 27–29 lamellae on digit IV of pes (*versus* 20–24 on digit IV of manus and 21–26 on digit IV of pes in *C. chengodumalaensis*, 22–25 on digit IV of manus and 24–28 on digit IV of pes in *C. magnifica*); 24–28 midventral scales (*versus* 19–23 in *C. chengodumalaensis*) and 126–129 longitudinal scales from mental to cloaca (*versus* 147–152 in *C. chengodumalaensis*, 133–160 in *C. magnifica*).

**Description of holotype:** BNHS 2624, a medium sized (SVL 44.9 mm) adult male (Supplementary Figure S12). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.70), not strongly depressed (HH/ HL = 0.42) distinct from neck. Snout long (SE/ HW = 0.64) longer than eye diameter (OD/ SE = 0.55), scales on snout and forehead, smooth, slightly larger than those on the interocular region; occipital and temporal region with smaller granular scales lacking tubercles (Supplementary Figure S12 C). Eyes small (OD/ HL = 0.25), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly.

Ear opening oval, small and oblique (EL/ HL = 0.09); eye to ear distance greater than diameter of eyes (EE/ OD = 1.37) (Supplementary Figure S12 E). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial and enlarged supranasals, supranasals broadly in contact with each other. Nostrils circular, each surrounded by postnasal, supranasal and rostral; two rows of scales separate orbit from supralabials. Mental subtriangular, longer than wide, paired postmentals sub-quadrate, smaller than mental and medially separated by a single large median scale; posteriorly each postmental bounded by five smooth scales, including median scale. Eight supralabials to the angle of jaw, sixth reaches the midorbital position, eight infralabials to the angle of jaw, seventh at midorbital position.

Body relatively robust (BW/ TRL = 0.46), not elongate (TRL/ SVL = 0.42). Dorsal scales on trunk heterogeneous, small, granular scales intermixed with unevenly scattered, larger rounded keeled tubercles. Tubercles in approximately 15 rows at mid-body, irregularly arranged. Keeled scales and tubercles more prominent towards the dorsolateral aspect of trunk. Scales on nape rounded, slightly smaller than scales on dorsum, not keeled. Ventral scales smooth, sub-imbricate, slightly larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 24 midbody

scale rows across belly, 128 scales between mental to anterior border of cloaca; a roughly triangular patch of glossy scales at the precloacal region; seven femoral pores on the left, six on the right, separated by 13 poreless scales.



**Supplementary Figure S12.** *Cnemaspis lithophilis* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing femoral pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Forelimbs short, robust; forearms short (FL/ SVL = 0.15); hind limbs relatively long; tibia short (CL/ SVL = 0.20). Scales on palm and sole smooth, granular; scales on inner surface of fore and hind limb smooth, granular; on the dorsal surface granular, conical, larger than the ventral ones. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 12, digit II: 19, digit III: 24, digit IV: 25, digit V: 19; of left pes, digit I: 12, digit II: 23, digit III: 26, digit IV: 28, digit V: 23.

Tail moderately long (TL/ SVL = 1.20); tail base distinctly swollen. Scales on tail base imbricate; enlarged tubercles absent. Dorsal tail scales imbricate; postcloacal spur absent; subcaudal scales smooth, median row enlarged, irregularly arranged.

**Colouration in life** (Figure 3B): Dorsal colour of head, body, limbs and tail overall yellowish brown, patterned with black spots on the dorsum, clouded with dark brown and olive yellow markings towards the lateral side; head uniform brown speckled with light and dark spots, distinct stripes towards the sides. Mid dorsum with six black spots alternating with pale white, longitudinally from nape to base of tail, the first central black spot on nape most distinct. The black and white blotches continue on the tail as alternating dark and lighter bands. Lateral part of trunk clouded with pale olive yellow larger scales intermixed brown to grey scales; a broad black stripe on the lateral side of nape from the ear opening till above the shoulder, on both sides. Head with two parallel buff stripes from the nostril and supralabial to anterior margin of eye. Both the stripes continue behind the eye, the upper all the way, behind the head and the lower one ending above the ear opening. A cluster of black scales between the two stripes. Top of the head speckled with few black spots and pale buff striations. Labial scales glossy, dirty yellow; a pale stripe continues from labials to lower margin of ear. Pupil dark black surrounded by a thin yellowish orange iris edged with black. Limbs buff, reticulated with lighter and darker markings; digits alternating with light and dark bands. Ventrals uniform pale grey, throat pale, speckled with dirty yellow spots. Femoral pores distinct amber, scales in the precloacal region glossy forming a roughly triangular patch. Ventral surface of the tail uniform dirty grey with few lighter scattered spots.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 24–28 midventral scale rows and 126–129 longitudinal scales from mental to cloaca; 12–13 lamellae on digit I and 25–26 on digit IV of manus, 12–13 lamellae on digit I and 27–29 lamellae on digit IV of pes; 7–9 labial scales; CESL 820 and CESL 835 with two scales separating the first pair of postmentals; CESL 820, adult male with six femoral pores on the left and seven on the right, separated by 12 poreless scales. BNHS 2625, CESL 819 and CESL 835, adult females with overall similar colouration as the males, differing only in the absence of femoral pores and glossy scales in the precloacal region.

**Distribution:** *Cnemaspis lithophilis* sp. nov. is currently known from a few sites in the low to mid elevation (ca. 300–700 m asl) forests near Mookambika Wildlife Sanctuary and Sharavati valley in the CWG. During this study, it was collected from near Kollur and Jog falls in Karnataka.

**Ecology and natural history:** *Cnemaspis lithophilis* **sp. nov.** is a nocturnal rock dwelling forest gecko, found in the low to mid elevation forests of the CWG. During this study, multiple individuals were observed to be moving actively on rock cliffs and boulders near and along forested streams in the late evening and at night (ca. 2030–2300 hrs) (Supplementary Figure S11 D). A gravid female was found hiding inside the crevice of a tree in the day (ca 1030 hrs). The presence of gravid females in the month of September signifies that monsoon might be a potential breeding season. *Hemidactylus prashadi* Smith, 1935 and *Cyrtodactylus albofasciatus* (Boulenger, 1885) were the other gecko species recorded observed from the habitat during this study.

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### *Cnemaspis sisparensis* (Theobald, 1876)

(Supplementary Figure S8, S13 A; Supplementary Table S6, S7)

*Gymnodactylus maculatus* Beddome, 1870

*Gymnodactylus sisparensis* Theobald, 1876

**Original description:** *Gymnodactylus maculatus* Beddome, 1870. Description of some new reptiles from the Madras Presidency. Madras Monthly Journal of Medical Science, ii: 173.

**Holotype:** BMNH 74.4.29.383 (male) (fragmented, in pieces), collected from “Sholakal, the foot of Sispara Ghat,” by Colonel Beddome.

**Taxonomic comments:** *Cnemaspis sisparensis* was initially described as *Gymnodactylus maculatus* based on specimens collected from under logs and stones “at Sholakal, foot of Sispara Ghat” by coll. R.H. Beddome (Beddome, 1870). Theobald in 1876 replaced the name as *G. sisparensis*, since *G. maculatus* was pre-occupied (Theobald, 1876). Given this information, the type locality is situated in the high elevation western slopes of the Nilgiri Hills. Based on our analysis, *C. sisparensis* is nested within the *wynadensis* clade. Manamendra-Arachchi et al. (2007) provided a thorough description of the holotype which conforms to our study of additional collections from near the type locality. They also synonymized *C. anaikattiensis* with *C. sisparensis* citing variable morphological characters and geographical similarities (Cyriac et al., 2020; Manamendra-Arachchi et al., 2007). Annandale described *Gonatodes bireticulatus* (ZSI 17970) from “Kavalai, Cochin state” (present Kochi, Kerala), which was later synonymized with *C. sisparensis* (Annandale, 1915; Smith, 1935). This location is more than 100 km south of the type locality and lies in a different hill range. Given the huge geographic gap, there is a chance that the population from the forests around Kochi might be a distinct lineage. The validity of this synonym needs to be re-examined based on morphological and molecular studies on fresh collections. We provide additional information on diagnosis within members of the *wynadensis* clade, colouration, distribution and natural history information based on our studies of the holotype and fresh collections from near the type locality in the Nilgiri Hills.

**Suggested common name:** Sispara forest gecko or Sispara rock gecko



**Additional materials examined:** CESL 136 and CESL 137 adult males; collected from rocks along streams in an evergreen forest near Wallakad, on the way to Sispara, Silent Valley National Park, Kerala by Saunak Pal and Mrugank Prabhu.

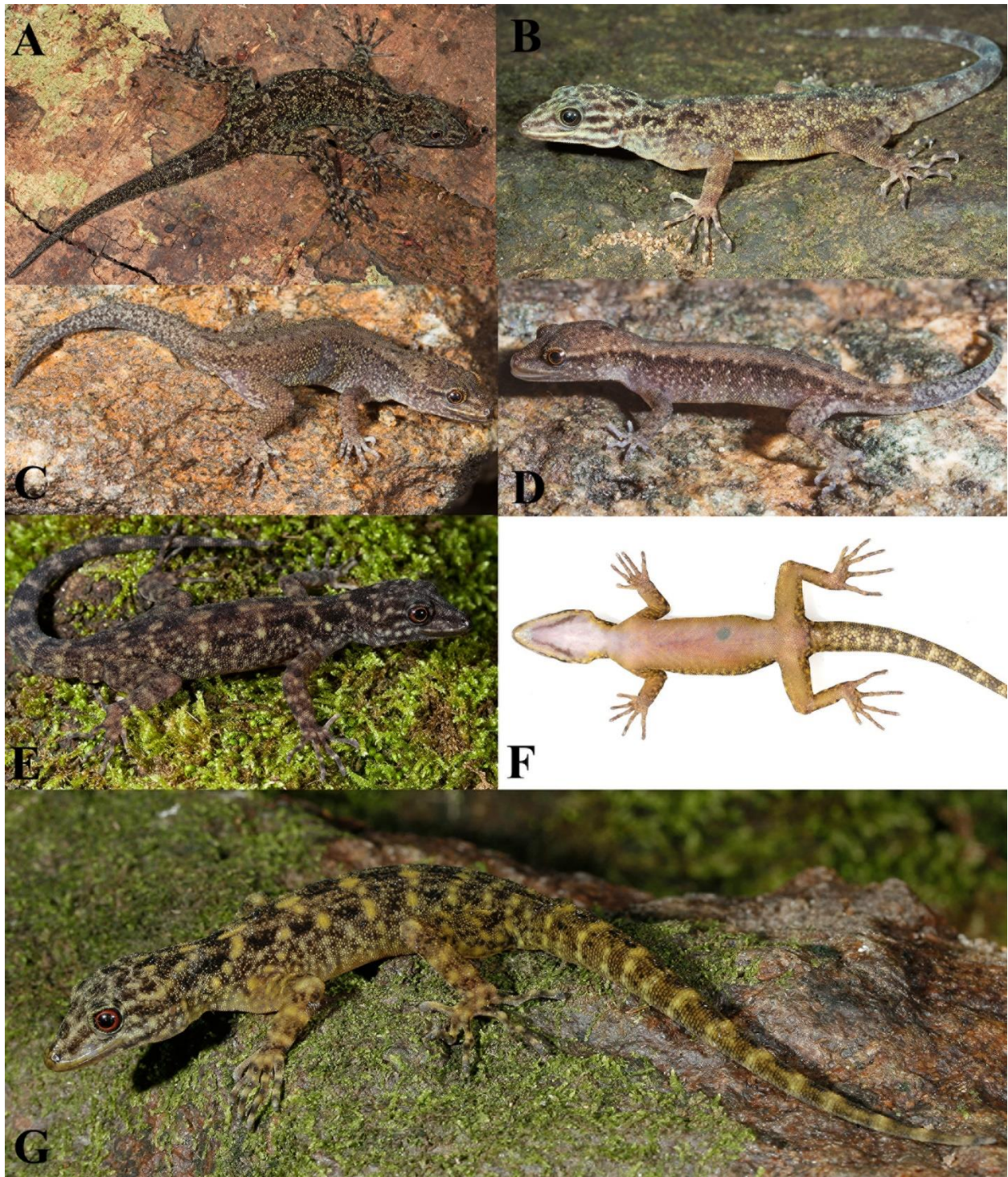
**Lineage diagnosis:** *Cnemaspis sisparensis* can be readily discerned on a phylogenetic tree (Figure 2) and is characterized by high genetic divergence at the 16s rRNA gene of 4.3–4.5% from its closest sister lineage *C. zacharyi* and very high genetic divergence (>6.4%) from other members of the *wynadensis* clade. (Supplementary Table S2) *C. sisparensis* and *C. zacharyi* are together sister to the sub-clade including *C. balerion* **sp. nov.**, *C. anaikattiensis*, *C. heteropholis*, *C. kottiyooorensis*, *C. wynadensis*, *C. chengodumalaensis*, *C. magnifica* and *C. lithophilis* **sp. nov.**.

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 68.6 mm) characterised by the presence of granular, fairly homogeneous, rounded mid-dorsal scales, scales gradually enlarged on dorsolateral aspect of flanks, juxtaposed, not keeled; absence of spine like tubercles on the flank; ventrals smooth, subimbricate, 139–143 longitudinal scales from mental to cloaca, 27–30 midventral scales; first pair of postmentals separated by 2–3 small scales, each postmental surrounded by 4–5 scales including median scale; males with 7–8 elongated femoral pores separated by 17–19 poreless scales, precloacal pores absent; postcloacal spur absent; subcaudals smooth, median row enlarged, with individual large scales alternating between pair of slightly smaller ones; 7–8 supralabials to the angle of jaw; 26–27 lamellae on digit IV of manus and 26–29 lamellae on digit IV of pes.

*Cnemaspis sisparensis* can be distinguished from other members of the *wynadensis* clade by a combination of the following characters: larger body size, SVL up to 68.6 mm (*versus* max SVL less than 50 mm in *C. kolhapurensis*, *C. kottiyooorensis*, *C. wynadensis*, *C. heteropholis*, *C. chengodumalaensis*, *C. lithophilis* **sp. nov.** and *C. balerion* **sp. nov.**); mid-dorsal scales fairly homogeneous, smooth (*versus* mid-dorsal scales heterogenous in *C. heteropholis*, *C. kottiyooorensis*, *C. chengodumalaensis*, *C. magnifica* and *C. lithophilis* **sp. nov.**); males with 7–8 femoral pores separated by 17–19 poreless scales (*versus* 4–6 femoral pores in *C. wynadensis*, *C. kottiyooorensis*; 5–6 femoral pores in *C. heteropholis* and a continuous series of 24–28 precloacal-femoral pores in *C. kolhapurensis*; 6–7 femoral pores separated by 15–16 poreless scales in *C. magnifica*, 6–7 femoral pores separated by 12–13 poreless scales in *C. lithophilis* **sp. nov.** and 8–9 femoral pores separated by 14–16 poreless scales in *C. balerion* **sp. nov.**); 26–29 lamellae on digit IV of pes (*versus* 16–20 in *C. wynadensis*, 20–23 in *C. kottiyooorensis*, 24–25 in *C. heteropholis*, 22–23 in *C. balerion* **sp. nov.** and 21–26 in *C. chengodumalaensis*); 27–30 midventral scales (*versus* 22–25 in *C. heteropholis*, 19–23 in *C. chengodumalaensis*, 24–26 in *C. magnifica* and 24–28 in *C. lithophilis* **sp. nov.**); 139–143 longitudinal scales from mental to cloaca (*versus* 119–123 in *C. heteropholis* and 126–129 in *C. lithophilis* **sp. nov.**).

*Cnemaspis sisparensis* resembles *C. anaikattiensis* in overall size, and general morphology from which it can be distinguished by the presence of fairly homogenous, granular mid-dorsal scales, slightly enlarged on the dorsolateral aspect of flanks, rounded, smooth (*versus* enlarged scales on dorsolateral aspect of flank conical, keeled, in *C. anaikattiensis*); 139–143 longitudinal scales from mental to cloaca (*versus* 147–153 longitudinal scales from mental to cloaca in *C. anaikattiensis*); femoral pores separated by 17–19 poreless scales (*versus* femoral pores separated by 15–16 poreless scales in *C. anaikattiensis*); nostril not in contact with the first supralabial (*versus* nostril

in contact with supralabial in *C. anaikattiensis*) and internasal scale absent (*versus* internasal scale present in *C. anaikattiensis*). *C. sisparensis* closely resembles its sister lineage, the newly described *C. zacharyi* in dorsal scalation, size and colour but can be distinguished by the presence of 139–143 longitudinal scales from mental to cloaca (*versus* 155–162 longitudinal scales from mental to cloaca in *C. zacharyi*) and 7–8 femoral pores separated by 17–19 poreless scales (*versus* 5–6 femoral pores separated by 21–24 poreless scales in *C. zacharyi*).



**Supplementary Figure S13.** Life colouration of known lineages. A. *Cnemaspis sisparensis* dorsal view, B. *Cnemaspis anaikattiensis* dorsal view, C. *Cnemaspis wynadensis* adult male, dorsal view, D. *C. wynadensis* juvenile, E. *Cnemaspis beddomei* darker male, F. ventral view of male, G. *C. beddomei* adult male.

**Colouration in life** (Supplementary Figure S13 A): Dorsal colour of head, body, limbs and tail overall yellow to olive, blotched with dark brown to black marking on the dorsum, limbs and tail, head with lighter striations of greenish yellow; 5–6 light greenish yellow blotches longitudinally along mid vertebral from nuchal region to base of the tail alternating with black blotches. Rounded scales towards the lateral part of trunk pale olive yellow intermixed with black ones forming speckled pattern. The blotches continue on the tail forming obscure alternating light and dark bands. Head lighter with a pale stripe from above the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye to back of the head; another small broken stripe from below the nostril to ventral margin of eye; another angular stripe from junction of jaw towards the throat, partially reaching below the ear opening. Labial scales glossy grey to brown, some supralabials edged with pale white on the top. Pupil black surrounded by thin yellowish orange iris edged with reddish black. Limbs with patches of black and light olive-green markings; digits alternating with light and dark bands. Ventrals pale grey, throat white marbled with dark brown to black speckles, a thick band from behind postmental to neck parallel to the infralabials on both sides. Ventral surface of the tail darker, with few scattered light and dark spots towards the sides. Overall colouration similar in both the sexes.

**Distribution:** *Cnemaspis sisparensis* is currently known from high elevation evergreen forests (above 1000 m asl) on the western slopes of the Nilgiri Hills in the CWG. During this study, it was recorded from near Wallakad, on a path towards Sispara in Silent Valley National Park, Kerala.

**Ecology and natural history:** *Cnemaspis sisparensis* is a nocturnal rock dwelling gecko, restricted to high elevation evergreen forests. During this study, individuals of *C. sisparensis* were observed to be active on vertical surface of huge boulders along a forest stream at night. They were also observed frequenting rocky caves and crevices in boulders. Individuals of *C. sisparensis* were found to have loose skin that would easily tear when caught. During the day, one individual was found hiding under a fallen tree trunk on the forest floor. No other gecko was found sharing the microhabitat with *C. sisparensis* although *C. cf. monticola* and *C. cf. wynadensis* were observed from tree trunks and the forest floor in similar habitat.

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## *Cnemaspis anaikattiensis* Mukherjee, Bhupathy and Nixon, 2005

(Supplementary Figure S8, S13 B; Supplementary Table S6, S7)

**Original description:** *Cnemaspis anaikattiensis* Mukherjee, Bhupathy and Nixon, 2005. A new species of day gecko (Squamata, Gekkonidae, *Cnemaspis*) from the Anaikatti Hills, Western Ghats, Tamil Nadu, India. Current Science, 89 (8): 1326–1328.

**Holotype:** ZSI 25601, adult male, collected from Anaikatti Hills (11°05'30.9"N; 76°47'36.2"E), Coimbatore district, Tamil Nadu, India by A.M.A. Nixon and Debanik Mukherjee on 17 September 2003.

**Paratype:** ZSI 25602, adult female; collection details same as that of the holotype.

**Taxonomic comments:** *Cnemaspis anaikattiensis* was described from Anaikatti Hills (Mukherjee et al., 2005). Manamendra-Arachchi et al. (2007) considered it as a junior synonym of *C. sisparensis* based on the description provided by Mukherjee et al. (2005) citing use of variable characters for diagnosis, relatively close type localities and mistaken holotype comparison, but failed to study the type specimens of *C. anaikattiensis*. Cyriac et al. (2020) also considered *C. anaikattiensis* and *Gonatodes bireticulatus* as junior synonyms of *C. sisparensis* citing morphological similarities in the type specimens of *C. anaikattiensis* and the holotype of *Gonatodes bireticulatus*, but failed to study the holotype of *C. sisparensis* although they referred to the description and illustrations of *C. sisparensis* provided by Manamendra-Arachchi et al. (2007). We found some significant differences when comparing our observations of the holotype of *C. sisparensis* and the description and illustration provided by Manamendra-Arachchi et al. (2007) with the type specimens of *C. anaikattiensis*, mainly in the dorsal scales. The holotype of *C. sisparensis* shows the presence of fairly homogenous, smooth, granular mid-dorsal scales with gradually larger, rounded scales towards the flanks while the type specimens of *C. anaikattiensis* show the presence of enlarged, keeled, conical scales, pronounced on dorsolateral aspect of flank. Also, even though the type locality of both *C. sisparensis* and *C. anaikattiensis* are relatively close from each other they comprise very different habitat. *C. sisparensis* occurs in the high elevation rainforests of the Nilgiri Hills while *C. anaikattiensis* was found in rocky streambeds in mid elevation, tropical dry deciduous forests on the eastern slopes of the Nilgiri Hills, Western Ghats (Mukherjee et al., 2005). Based on close observations of the type specimens and results of molecular and morphological studies of fresh collections from near the type localities of both species, we consider *C. anaikattiensis* as a valid species, nested within the *wynadensis* clade. Here we provide additional information on diagnosis within members of the *wynadensis* clade, colouration, distribution and natural history information.

**Suggested common name:** Anaikatti rock gecko

**Additional materials examined:** CESL 610 and CESL 613 adult males; CESL 612, adult female; collected from roadside boulder, on the way to Anaikatti, near Attappadi, Kerala by Saunak Pal and Varun Torsekar.

**Lineage diagnosis:** *Cnemaspis anaikattiensis* can be readily discerned on a phylogenetic tree (Figure 2) and shows 0.7% intraspecific genetic divergence at the 16s rRNA gene. It is characterized by moderate genetic divergence of 2.1–2.6% from its closest sister lineage *C. chengodumalaensis*, 2.4–2.8% from *C. lithophilis* **sp. nov.**, 2.8–3.3% from *C. wynadensis*, 3.3–3.8% from *C. kottiyoorensis* and 3.5–3.8% from *C. heteropholis*, and high to very high genetic divergence (> 5.5%) from other members of the *wynadensis* clade. (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 60.6 mm) characterised by the presence of granular, roughly homogeneous, rounded mid-dorsal scales; with enlarged conical, keeled scales on dorsolateral aspect of flanks; absence of spine like tubercles on the flank; ventrals smooth, imbricate, 147–153 longitudinal scales from mental to cloaca, 28–32 midventral scales; 3 pairs of postmentals, first pair separated by 3 small scales, each postmental surrounded by 4–5 scales including median scale; males with 7–8 elongated femoral pores separated by 15–16 poreless scales, precloacal pores absent; postcloacal spur absent;

subcaudals smooth, median row enlarged, much wider than long; 7–8 supralabials to the angle of jaw; 26–27 on digit IV of manus and 26–29 lamellae on digit IV of pes.

*Cnemaspis anaikattiensis* can be distinguished from other members of the *wynadensis* clade by a combination of the following characters: larger body size, SVL up to 60.6 mm (*versus* max SVL less than 50 mm in *C. kolhapurensis*, *C. kottiyoorensis*, *C. wynadensis*, *C. heteropholis*, *C. chengodumalaensis*, *C. lithophilis sp. nov.* and *C. balerion sp. nov.*); mid-dorsal scales homogeneous (*versus* mid-dorsal scales heterogenous in *C. heteropholis*, *C. kottiyoorensis*, *C. magnifica* and *C. lithophilis sp. nov.*); males with 7–8 femoral pores separated by 15–16 poreless scales (*versus* 4–5 femoral pores in *C. wynadensis*, 4–6 in *C. kottiyoorensis*; 5–6 femoral pores separated by 16–18 poreless scales in *C. heteropholis*, 5–6 femoral pores separated by 21–24 poreless scales in *C. zacharyi*, 6–7 femoral pores separated by 12–13 poreless scales in *C. lithophilis sp. nov.* and a continuous series of 24–28 precloacal-femoral pores in *C. kolhapurensis*); 26–29 lamellae on digit IV of pes (*versus* 16–20 in *C. wynadensis*, 20–23 in *C. kottiyoorensis*, 24–25 in *C. heteropholis*, 21–26 in *C. chengodumalaensis* and 22–23 in *C. balerion sp. nov.*); 28–32 midventral scales (*versus* 18–21 in *C. wynadensis*, 21–23 in *C. kottiyoorensis*, 22–25 in *C. heteropholis*, 19–23 in *C. chengodumalaensis*, 25–28 in *C. zacharyi*, 24–26 in *C. magnifica* and 24–28 in *C. lithophilis sp. nov.*); 147–153 longitudinal scales from mental to cloaca (*versus* 119–123 in *C. heteropholis*, 133–160 in *C. magnifica* and 126–129 in *C. lithophilis sp. nov.*). *C. anaikattiensis* resembles *C. sisparensis* in overall size, colouration, and general morphology; for comparison, see section above.

*C. anaikattiensis* closely resembles its sister lineage *C. chengodumalaensis* in general morphology from which it can be distinguished by a larger body size, SVL up to 58.7 mm (*versus* SVL up to 49.0 mm in *C. chengodumalaensis*), mid-dorsal scales homogeneous (*versus* mid-dorsal scales heterogenous in *C. chengodumalaensis*) and 28–32 midventral scales (*versus* 19–23 midventral scales in *C. chengodumalaensis*).

**Colouration in life** (Supplementary Figure S13 B): Dorsal colour of head, body, limbs and tail overall grey to brown, blotched with dark brown to black marking on the dorsum and nape; head with white to pale yellow striations mixed with darker blotches; 5–6 pale grey indistinct spots longitudinally along mid dorsum from nuchal region to base of the tail alternating with black blotches. Conical enlarged scales towards the lateral part of trunk pale yellow intermixed with few darker ones. The blotches continue on the tail forming obscure alternating light and dark bands, much paler than the dorsum. Head lighter with a pale yellow to white stripe from the nostril to above eye, continuing on the forehead forming roughly reticulated pattern; another stripe from below the nostril to ventral margin of eye extending behind the eye as two distinct parallel stripes above the ear opening; labial scales glossy white to pale yellow, a thick stripe extending from labials till lower margin of ear opening. Pupil dark black surrounded by thin yellowish orange iris edged with black. Limbs paler, striated with black and light pale yellow to grey markings; digits alternating with light and dark bands. Ventrals grey speckled with pale yellow scales, throat paler marbled with dark grey to black speckles, a thick ‘V’ shaped band bordering the throat. Ventral surface of the tail darker, slate grey with few scattered light and dark spots. Overall colouration similar in both the sexes.

**Distribution:** *Cnemaspis anaikattiensis* is currently known from low to mid elevation deciduous forests (up to 650 m asl) in the eastern foothills of the Nilgiri Hills in the CWG. During this study, it was recorded from multiple sites on a road to Anaikatti, near Attappadi, Kerala.

**Ecology and natural history:** *Cnemaspis anaikattiensis* is a crepuscular to nocturnal rock dwelling gecko, restricted to low to mid elevation deciduous forests. They inhabit rocky stream beds in mixed dry deciduous forests and were found to be active at dawn and dusk. During this study, individuals were observed to be on the vertical surface of boulders, along a road through a dry forest in the evening. Some individuals were also found hiding under a culvert above a dried stream at night. *C. cf. gracilis* and *Hemidactylus frenatus* are the other gekkonid lizards observed from same habitat during the study.

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### *Cnemaspis wynadensis* (Beddome, 1870)

(Supplementary Figure S8, S13 C-D; Supplementary Table S6, S7)

**Original description:** *Gymnodactylus wynadensis* Beddome, 1870. Description of some new reptiles from the Madras Presidency. Madras Monthly Journal of Medical Science, i: 32.

**Lectotype:** (Designated by Manamendra-Arachchi *et al.*, 2007) BMNH 74.4.29.355 (male) SVL 33.4 mm; collected by coll. R.H. Beddome from ‘moist forests of Wynaad’ (present Wayanad, Kerala).

**Paralectotype:** (Designated by Manamendra-Arachchi *et al.*, 2007) BMNH 74.4.29.356 (male), SVL 36.6 mm; BMNH 74.4.29.357 (male), SVL 34.2 mm; BMNH 74.4.29.358 (male), SVL 39.4 mm; BMNH 74.4.29.359 (male), SVL 40.3 mm; BMNH 74.4.29.360 (male), SVL 30.7 mm; BMNH 74.4.29.361 (male), SVL 31.3 mm; BMNH 74.4.29.362 (male), SVL 40.6 mm; BMNH 74.4.29.363 (male), SVL 38.9 mm; BMNH 74.4.29.364 (male), SVL 34.3 mm; BMNH 74.4.29.365 (male), SVL 33.7 mm; BMNH 74.4.29.366 (female), SVL 42.1 mm; BMNH 74.4.29.367 (female), SVL 41.2 mm; BMNH 74.4.29.368 (female), SVL 40.8 mm; BMNH 74.4.29.369 (subadult male), SVL 25.3 mm; BMNH 74.4.29.370 (subadult female), SVL 25.5 mm; BMNH 74.4.29.371 (juvenile), SVL 18.4 mm; collection details same as that of the lectotype.

**Taxonomic comments:** *Cnemaspis wynadensis* was initially described as *Gymnodactylus wynadensis* based on specimens collected from ‘moist forests of Wynaad, found under stones in the day time’ by coll. R.H. Beddome (Beddome, 1870). Given this information, the type locality is most likely to be somewhere in the mid to high elevations wet forests of Wayanad Plateau, Kerala. Based on our analysis of specimens collected from Wayanad, we find *C. wynadensis* to be nested within the *wynadensis* clade. Manamendra-Arachchi *et al.* (2007) designated a lectotype and a series of paralectotypes based on specimens collected by Beddome from Wayanad and provided a thorough description of the lectotype. Closer observation of the type specimens revealed some discrepancies within the lectotype and some of the paralectotypes. The dorsal pholidosis of some of the paralectotypes is composed of heterogenous scales, similar to that of the recently described *Cnemaspis kottiyoorensis* (Cyriac & Umesh, 2014). It is possible that the paralectotype series is composed of more than one species of *Cnemaspis*, and hence we restrict

our observations for this study to the lectotype alone. The lectotype description provided by Manamendra-Arachchi et al. (2007) is similar to our observations of fresh collections from around Wayanad. We provide additional information on diagnosis within members of the *wynadensis* clade, colouration, distribution and natural history information based on fresh collections.

**Suggested common name:** Wayanad forest gecko

**Additional materials examined:** CESL 640, adult male, CESL 641, subadult, from Chethalayam waterfalls, Wayanad wildlife Sanctuary; CESL 629 and CESL 630, adult females from near Mepadi, Kerala; by Saunak Pal, S.R. Chandramouli, K.P. Dinesh and Varun Torsekar.

**Lineage diagnosis:** *Cnemaspis wynadensis* can be readily discerned on a phylogenetic tree (Figure 2) and shows 0.9% intraspecific genetic divergence at the 16s rRNA gene. It is characterized by moderate genetic divergence of 2.8–3.3% from *C. anaikattiensis*, 3.5–3.8% from *C. lithophilis* **sp. nov.**, 3.5–4.0% from *C. chengodumalaensis* and 3.8–4.5% from *C. heteropholis*, high genetic divergence 4.0–4.8% from *C. kottiyoorensis*, and high to very high genetic divergence (>5.5%) from other members of the *wynadensis* clade. (Supplementary Table S2).

**Morphological diagnosis and comparison:** A medium sized, robust *Cnemaspis* species (SVL up to 36.1 mm) characterised by the presence of granular, homogeneous dorsal scales; gradually enlarged towards the dorsolateral aspect of flanks, juxtaposed; absence of spine like tubercles on the flank; ventrals smooth, imbricate, 113–118 longitudinal scales from mental to cloaca, 18–21 midventral scales; 3 pairs of postmentals, first pair separated by 2–3 small scales, each postmental surrounded by 4–5 scales including median scale; males with 4–5 elongated femoral pores separated by 13–16 poreless scales, precloacal pores absent; postcloacal spur absent; subcaudals smooth, median row enlarged, subpentagonal; 5–6 supralabials to the angle of jaw; 14–16 lamellae on digit IV of manus and 16–19 lamellae on digit IV of pes.

*Cnemaspis wynadensis* can be distinguished from other members of the *wynadensis* clade by a combination of the following characters: smaller body size, SVL up to 36.1 mm (*versus* max SVL more than 45 mm in *C. anaikattiensis*, *C. sisparensis*, *C. chengodumalaensis*, *C. zacharyi* and *C. magnifica*); dorsal scales homogeneous (*versus* dorsal scales heterogenous in *C. heteropholis*, *C. kottiyoorensis*, *C. chengodumalaensis*, *C. magnifica* and *C. lithophilis* **sp. nov.**); males with 4–5 femoral pores (*versus* 7–8 in *C. anaikattiensis* and *C. sisparensis*, 6–8 in *C. chengodumalaensis*, 6–7 in *C. magnifica* and *C. lithophilis* **sp. nov.**, and a continuous series of 24–28 precloacal-femoral pores in *C. kolhapurensis*); 16–19 lamellae on digit IV of pes (*versus* 26–29 in *C. anaikattiensis* and *C. sisparensis*, 20–23 in *C. kottiyoorensis*, 24–25 in *C. heteropholis*, 21–26 in *C. chengodumalaensis*, 23–27 in *C. zacharyi*, 24–28 in *C. magnifica* and 27–29 in *C. lithophilis* **sp. nov.**); 18–21 midventral scales (*versus* 28–32 in *C. anaikattiensis*, 27–30 in *C. sisparensis*, 22–25 in *C. heteropholis*, 25–28 in *C. zacharyi*, 24–26 in *C. magnifica* and 24–28 in *C. lithophilis* **sp. nov.**); 113–118 longitudinal scales from mental to cloaca (*versus* 147–153 in *C. anaikattiensis*, 139–143 in *C. sisparensis*, 119–123 in *C. heteropholis*, 133–160 in *C. magnifica* and 126–129 in *C. lithophilis* **sp. nov.**). *C. wynadensis* superficially resembles *C. balerion* **sp. nov.** in general morphology; for a comparison, see section above.

**Colouration in life** (Supplementary Figure S13 C): Dorsal colour of head, body, limbs and tail



overall pale brown, speckled with dark brown to black scales along the dorsum and nape; head uniform pale brown with few darker scattered spots. Mid dorsum with few faint, indistinct spots longitudinally forming a pale broken stripe like appearance. Lateral part of trunk grizzled with pale buff to yellow enlarged scales intermixed with few scattered dark scales. Tail paler than the dorsum with obscure alternating light and dark patches, forming indistinct bands towards the end. Head with a broken pale yellow to buff stripe from the nostril to anterior margin of eye; extra-brillar fringe yellow to buff, extending behind the eye as a prominent short stripe, border below by black stripe; labial scales glossy, amber to dirty brown. A small dark brown to black nuchal spot present. Pupil dark black surrounded by thin orangish red iris edged with black. Limbs uniform, weakly striated with lighter markings; digits alternating with light and dark bands. Ventrals uniform pale grey speckled towards the sides with faint yellow scales, throat paler marbled with dark grey to black speckles. Ventral surface of the tail darker, few scattered light and dark spots. Overall colouration similar in both the sexes. Juveniles (Supplementary Figure S13 D) with much lighter mid dorsum and head in contrast to darker laterals, forming a thick band like pattern from head to tail. Nuchal spot much prominent than in adults.

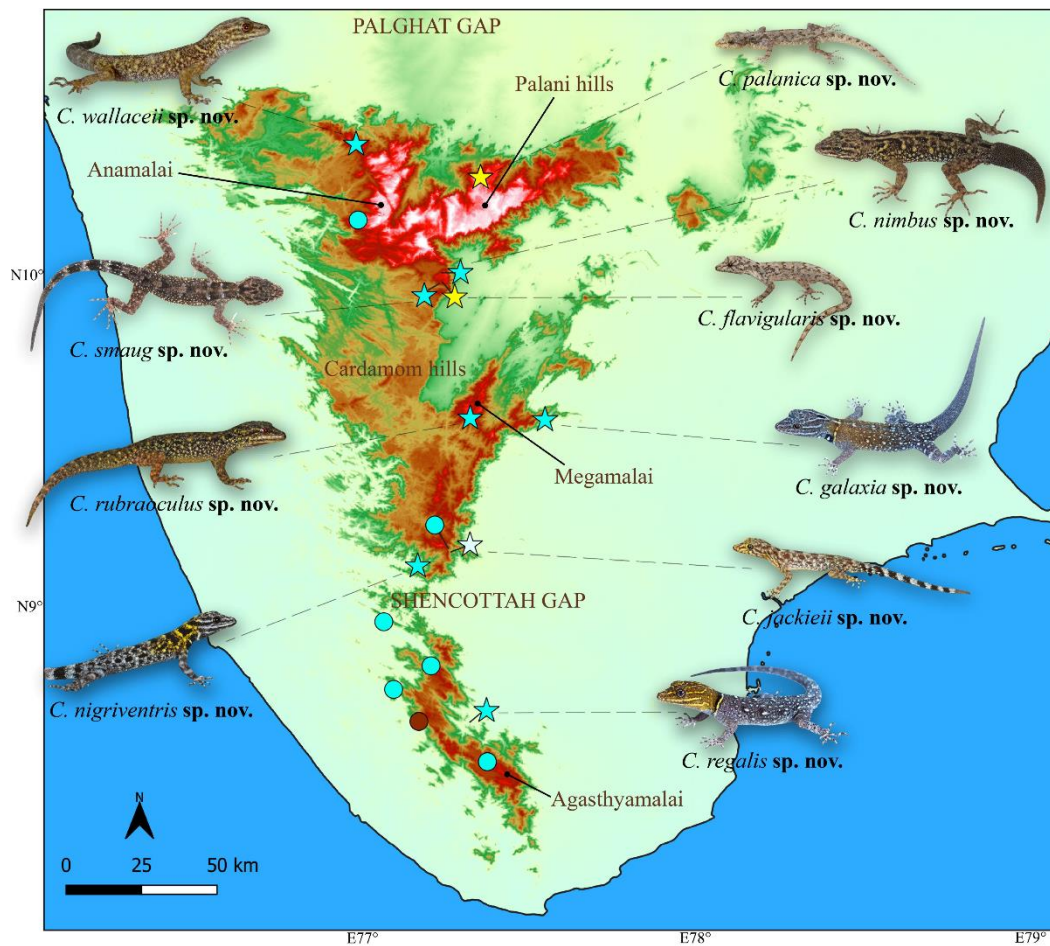
**Distribution:** *Cnemaspis wynadensis* is currently known from the mid to high elevation (up to 1000 m asl) moist forests of Wayanad Plateau in the CWG. During this study, it was recorded from multiple sites in and around Wayanad, Kerala.

**Ecology and natural history:** *Cnemaspis wynadensis* is a nocturnal ground dwelling gecko, restricted to mid to high elevation moist forests. They have been recorded from under rocks and fallen logs during the daytime. During this study, individuals were observed to be hiding under decaying tree trunks on the forest floor. Some individuals were also found to be moving actively on the buttress of trees (ca. 1 m) above the forest floor. A gravid female was found hiding within a crevice of exposed roots of a tree in the month of June, signifying monsoon as a potential breeding season. *C. monticola* was the other gekkonid lizard observed from similar habitats during the study.

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## *beddomei* clade

Members of this clade are characterised by a medium to large, stout body; heterogenous dorsal scales; spine-like tubercles on the flank absent; presence of distinct postcloacal spur on the tail base; males with precloacal pores, femoral pores absent; sexual dichromatism mostly present; distributed in the Southern Western Ghats (SWG) (south of the Palghat gap) (Table 1) (Supplementary Figure S14). The *beddomei* clade shows 2.0%–14.8% genetic divergence within its members and 10.3%–19.2% genetic divergence from all other SA *Cnemaspis* at the 16S rRNA gene. Members of this clade are either diurnal, crepuscular or nocturnal in habit and are predominantly rock dwelling, inhabiting flat rocks, small boulders, and tree crevices, while some are ground dwelling, found mostly inside shaded forests. We describe seven new lineages belonging to this clade based on their phylogenetic position, genetic divergence and morphological characters. *C. anamudiensis*, *C. maculicollis* and *C. aaronbaueri* have been described recently (Cyriac et al., 2018; Sayyed et al., 2019). Additionally, we redescribe *C. beddomei*, *C. ornata* and *C. nairi* and provide diagnostic characters, distribution and natural history information.



**Supplementary Figure S14.** Map of the SWG depicting type localities of known species (circles) and ten new species (stars). Colours of symbols correspond to respective clades (refer Figure 2). Labels indicate major physiographic features referred to in the text.

## *Cnemaspis rubraoculus* sp. nov.

(Figure 3C, S11, S14, S15; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:8016C9FD-AE95-4FA7-BFB2-9E242427E75B

**Holotype:** BNHS 2612, adult male (Figure 3C) collected from a tree trunk in an evergreen forest in Upper Manalar, Periyar Tiger Reserve, Megamalai (9.571°N, 77.334°E; 1552 m asl) by S.P. Vijayakumar and team on 8<sup>th</sup> April 2009.

**Paratypes:** CESL 114 & CESL 116, adult females; collected from the same locality as the holotype by Mrugank Prabhu and Aniruddha Dutta Roy on 24<sup>th</sup> August 2010.

**Etymology:** The species epithet is derived by combining the Latin word ‘*rubrum*’, meaning red, and ‘*oculus*’ meaning eye; referring to the prominent red iris.

**Suggested common name:** Ruby eyed forest gecko.

**Lineage diagnosis:** *Cnemaspis rubraoculus* sp. nov. can be readily discerned on a phylogenetic tree and is sister to *C. cf. maculicollis* and *C. smaug* sp. nov. with strong support (BPP 0.95/ UF 96) (Figure 2). It is characterized by moderate genetic divergence at the 16s rRNA gene of 3.6% from *C. cf. maculicollis*, high genetic divergence of 4.0% from *C. beddomei* and 4.5% from *C. smaug* sp. nov., and very high genetic divergence (>7.4%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A medium sized, robust *Cnemaspis* species (SVL up to 45.8 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with larger, irregularly arranged, keeled, rounded tubercles; absence of spine like tubercles on the flank; paired postmentals separated by a single broad median scale; 8–10 rows of middorsal tubercles, 12–14 tubercles in paravertebral rows; ventrals smooth, subimbricate, 122–133 longitudinal scales from mental to cloaca; 33–37 midventral scales; one postcloacal spur on each side; males with 6 precloacal pores, femoral pores absent; a row of enlarged scales from base of first toe to end of foot; subcaudals smooth, median row enlarged with individual large quadrangle scale alternating with slightly smaller subconical one; 6 supralabials to the angle of jaw; 18–19 lamellae on digit IV of pes.

*Cnemaspis rubraoculus* sp. nov. can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL 43.6–45.8 mm, n=3 (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* sp. nov., *C. nigriventris* sp. nov. and *C. galaxia* sp. nov.); a row of enlarged scales from base of first toe till end of foot (*versus* absent in *C. aaronbaueri*, *C. regalis* sp. nov., *C. galaxia* sp. nov., *C. nigriventris* sp. nov. and *C. nairi*); no whorls of enlarged caudal tubercles (*versus* present in *C. aaronbaueri*, *C. regalis* sp. nov., *C. galaxia* sp. nov., *C. ornata*, *C. smaug* sp. nov.); no enlarged metacarpal scale at the junction of forearm and palm below digit I (*versus* distinct enlarged metacarpal scale present below digit I in *C. regalis* sp. nov., *C. galaxia* sp. nov., *C. nigriventris* sp. nov. and *C. nairi*); subdigital lamellae on proximal series entire (*versus* fragmented in *C. ornata*); dorsal tubercles rounded (*versus*

conical in *C. ornata*, *C. smaug* **sp. nov.**, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**); one postcloacal spur on each side (*versus* a pair of postcloacal spur on each side in *C. smaug* **sp. nov.**); males with 6 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*).

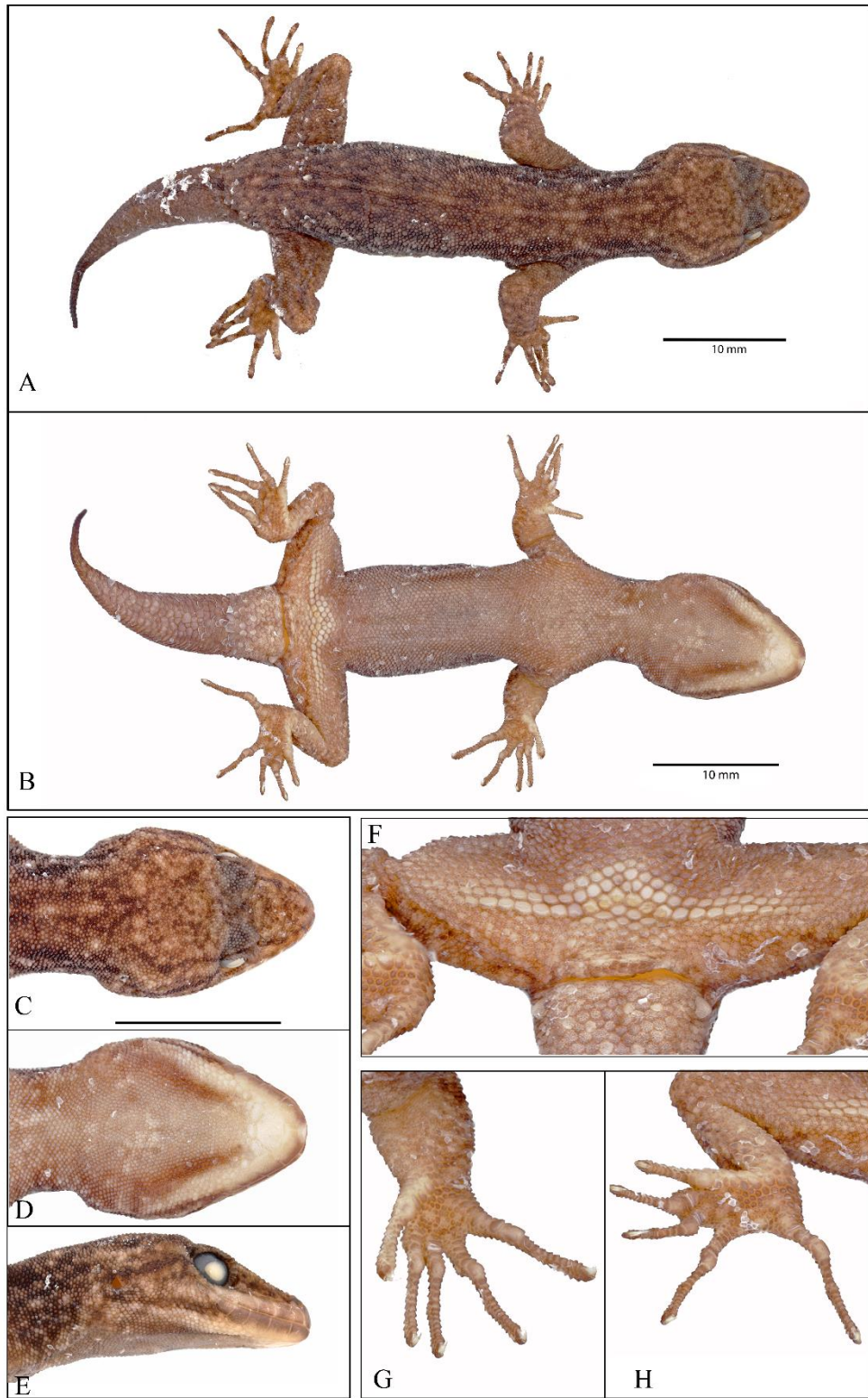
*Cnemaspis rubraoculus* **sp. nov.** is superficially similar to *C. maculicollis*, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.** and *C. beddomei* (Supplementary Table S8). It can be distinguished from them based on the following opposing suites of characters; *C. maculicollis*: 23–24 lamellae on digit IV of pes; males with 10 precloacal pores and presence of distinctive white spots on nape; *C. nimbus* **sp. nov.**: 22–23 lamellae on digit IV of pes; 12–14 rows of middorsal tubercles; 26–27 midventral scale rows, ventrals 134–141; *C. wallaceii* **sp. nov.**: 22–23 lamellae on digit IV of pes; 14–15 rows of middorsal tubercles; 28–29 midventral scale rows; 154–156 ventrals, postmentals separated by 2–3 median scales; *C. beddomei*: 21–23 lamellae on digit IV of pes; 10–12 rows of middorsal tubercles, 18–19 tubercles in paravertebral rows; ventral scales weakly keeled and 154–161 longitudinal scales from mental to cloaca.

**Description of holotype:** BNHS 2612, a medium sized (SVL 45.8 mm) adult male (Supplementary Figure S15). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.73), not strongly depressed (HH/ HL = 0.45) distinct from neck. Snout moderately long (SE/ HW = 0.60) much longer than eye diameter (OD/ SE = 0.46), scales on snout and forehead granular; scales on snout smooth, rounded, larger than those on interorbital region and forehead; occipital and temporal region with smaller granular scales, intermixed with slightly larger, rounded, roughly keeled tubercles (Supplementary Figure S15 C).

Eyes small (OD/ HL = 0.20), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening oval, small and oblique (EL/ HL = 0.09); eye to ear distance greater than diameter of eyes (EE/ OD = 1.95) (Supplementary Figure S15 E). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial and enlarged supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; 2 rows of scales separate orbit from supralabials. Mental subpentagonal, nearly as long as wide, paired postmentals quadrate, smaller than mental and medially in contact with a single wide scale; posteriorly each postmental bounded by 5 smooth scales, including median scale. 6 supralabials to the angle of jaw, 5 at midorbital position, 6 infralabials to the angle of jaw, 5 at midorbital position.

Body relatively robust (BW/ TRL = 0.44), not elongate (TRL/ SVL = 0.42). Dorsal scales on trunk heterogeneous, small, conical, weakly keeled, granular scales intermixed with unevenly scattered, larger rounded tubercles. Tubercles in approximately 8 irregular rows at mid-body; 12 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Keeled scales and tubercles more prominent on the posterior part of trunk. Scales on nape rounded, slightly smaller than granular scales on dorsum. Larger tubercles more prominent near the flanks, dorsal scales becoming rounder and subimbricate on flanks.

Ventral scales smooth, subimbricate, slightly larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 33 midbody scale rows across belly, 133 scales between mental to anterior border of cloaca; 6 rows of enlarged, rounded, smooth, glossy scales around the precloacal region, forming a unique wave like pattern; 6 pre cloacal pores.



**Supplementary Figure S15.** *Cnemaspis rubraoculus* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing preloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Forelimbs short, robust; forearms short (FL/ SVL = 0.14); hind limbs relatively long; tibia short (CL/ SVL = 0.18). Scales on palm and sole smooth, granular; dorsal scales of forelimb and hindlimb conical, keeled. Ventral scales of forelimb and hindlimb smooth, granular. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 11, digit II: 16, digit III: 19, digit IV: 20, digit V: 15; of left pes, digit I: 11, digit II: 17, digit III: 19, digit IV: 23, digit V: 18; row of enlarged scales from the base of first digit till end of feet present on manus and pes.

Tail moderately short, regenerated (TL/ SVL = 0.54); tail base distinctly swollen. Scales on tail base conical to imbricate; enlarged tubercles absent. Dorsal tail scales imbricate; single enlarged subconical post cloacal spur present on each side; subcaudal scales smooth, median row irregular, individual large, divided scales intermixed with smaller ones.

**Colouration in life (based on holotype)** (Figure 3C, S11 E): Dorsal colour of head, body, limbs and tail olive brown, clouded with black blotches along head and trunk; nine to ten yellowish spots longitudinally along mid vertebral from nuchal region to base of the tail alternating with black blotches, spots continue on the tail, more pronounced yellow-orange; a row of 8 smaller yellowish spots parallel to the mid vertebral spots on each side forming lighter broken stripes on the tail. Head dark with a dirty yellow broken stripe from above the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye to above ear in the form of broken spots; supralabials glossy amber yellow with pale yellow spots from second supralabial to ventral margin of eye; a broken yellow band from last labial to the ear; infralabials amber yellow bordered by black band on the top which continues till below the ear. Pupil black surrounded by thick, blood red iris. Limbs mottled, yellowish orange; digits alternating with light and dark bands. Ventrals pale yellow, throat white in the centre speckled with yellow spots and a thick black band parallel to infralabials on both sides; infralabials, mental, postmentals and two to three rows bordering infralabials yellow. Ventral surface of the tail pale white, postcloacal tubercles yellow.

**Variation:** See Supplementary Table S5 for morphometric and meristic data of paratypes. Both the adult paratypes are females and range from 43.6–45.4 mm in SVL. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 8–10 rows of middorsal tubercles; 33–37 midventral scale rows and 122–133 scales from mental to cloaca; tail in both paratypes original, longer than body; postcloacal spur slightly smaller than holotype; median row of subcaudals enlarged in paratypes composed of large quadrate scales alternating with slightly smaller subconical scale; overall colouration in both sexes similar except male holotype with rows of glossy marbled scales in the precloacal region forming a unique band which is absent in female paratypes.

**Distribution:** *Cnemaspis rubraoculus* **sp. nov.** is currently known from a single locality from the high elevation wet evergreen forests (above 1500 m asl) of the Meghamalai Hills in the SWG (Supplementary Figure S14). During this study, it was recorded from Upper Manalar in Periyar Tiger Reserve, Kerala.

**Ecology and natural history:** Individuals were observed at night to be moving actively on tree buttresses and near exposed roots at knee height from the ground in fragmented shola patches along tea estates (Supplementary Figure S11 F). Some individuals were found hiding in crevices

of tree trunks and under rocks during the day. This suggests that *Cnemaspis rubraoculus* **sp. nov.** is probably a crepuscular or nocturnal gecko.

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### *Cnemaspis nimbus* **sp. nov.**

(Figure 3D, S11, S14, S16; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:569F701C-BF0F-43B0-88F8-8BB1E16F5646

**Holotype:** BNHS 2614, adult male (Figure 3D) collected from a boulder in an evergreen forest (Supplementary Figure S11 H), Mathikettan Shola National Park, Cardamom Hills (10.008°N, 77.248°E; 1630 m asl) by Saunak Pal and team on 16<sup>th</sup> July 2011.

**Paratypes:** CESL 252 & CESL 357, adult males; collected from the same locality as the holotype by Saunak Pal and team on 27<sup>th</sup> March 2011 and 16<sup>th</sup> July 2011 respectively.

**Etymology:** The species epithet is derived from the Latin word ‘*nimbus*’ meaning cloud; referring to the prominent clouded pattern on the dorsum and flank.

**Suggested common name:** Clouded forest gecko.

**Lineage diagnosis:** *Cnemaspis nimbus* **sp. nov.** can be readily discerned on a phylogenetic tree and is sister to *C. anamudiensis* with strong support (BPP 1/ UF 99) (Figure 2). It is characterized by moderate genetic divergence at the 16s rRNA gene of 2.4–3.0% from *C. anamudiensis*, high genetic divergence of 4.0% from *C. wallaceii* **sp. nov.**, and very high genetic divergence (>7.6%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 48.2 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with larger keeled, rounded tubercles; absence of spine like tubercles on the flank; paired postmentals separated by a single broad median scale; 12–14 rows of middorsal tubercles, 16–17 tubercles in paravertebral rows; ventrals smooth, 134–141 longitudinal scales from mental to cloaca; 26–27 midventral scales; males with 4–6 precloacal pores, femoral pores absent; row of enlarged scales from base of first toe till end of foot; subcaudals smooth, median row with individual large scale alternating with slightly smaller scale; 7 supralabials to the angle of jaw; 22–23 lamellae on digit IV of pes.

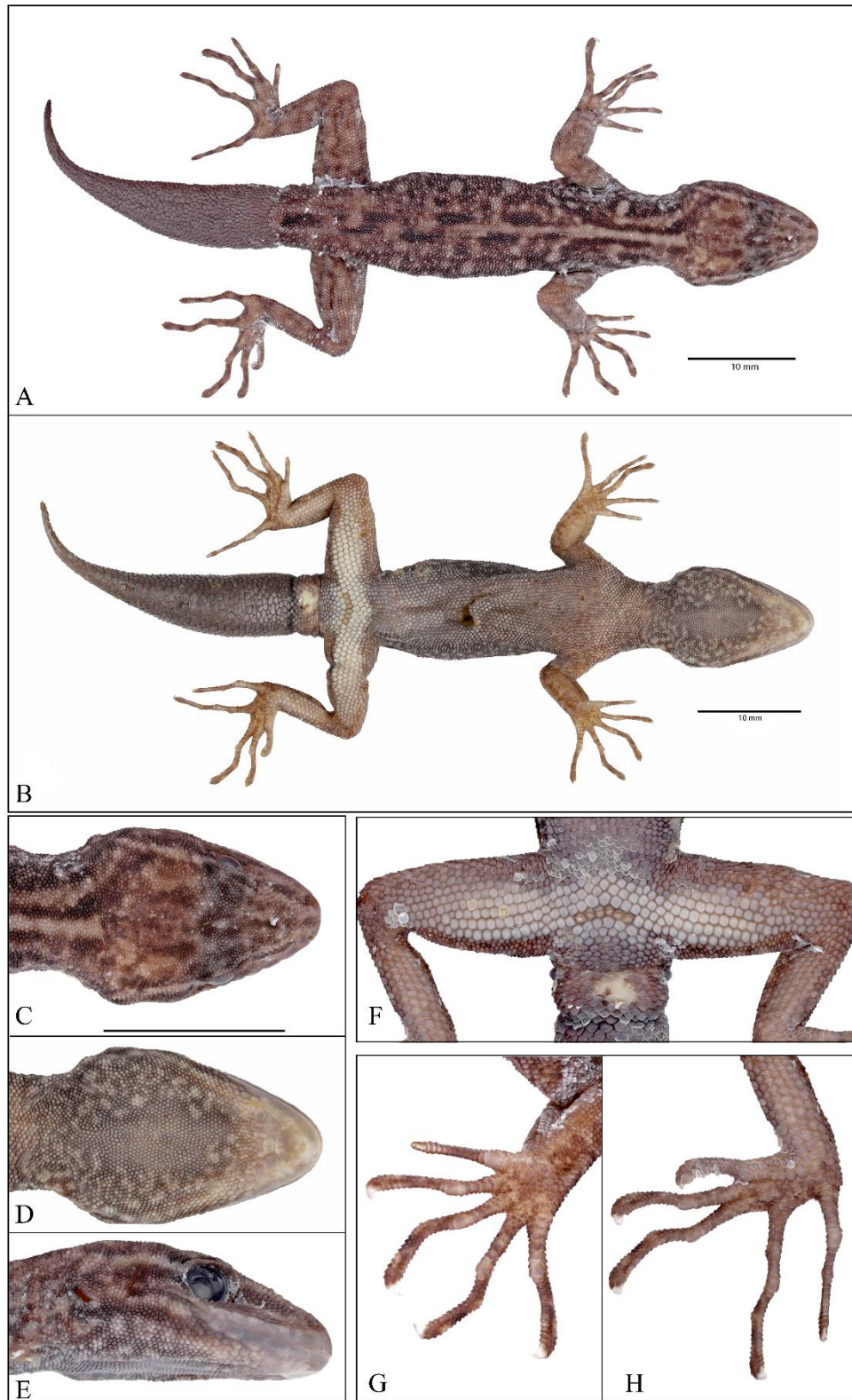
*Cnemaspis nimbus* **sp. nov.** can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL 40.5–48.2 mm, n=3 (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); a row of enlarged scales from base of first toe till end of foot (*versus* absent in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); no whorls of enlarged caudal tubercles (*versus* present in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. ornata*, *C. smaug* **sp. nov.**); no enlarged metacarpal scale at the junction of forearm and palm below digit I (*versus* distinct enlarged metacarpal scale present below digit I in *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); subdigital lamellae

on proximal series entire (*versus* fragmented in *C. ornata*); dorsal tubercles rounded (*versus* conical in *C. ornata*, *C. smaug* **sp. nov.**, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**); one postcloacal spur on each side (*versus* a pair of postcloacal spur on each side in *C. smaug* **sp. nov.**); males with 4–6 precloacal pores (*versus* 10 in *C. maculicollis*).

*Cnemaspis nimbus* **sp. nov.** is superficially similar to its sister species, *C. anamudiensis* and also resembles *C. wallaceii* **sp. nov.**, *C. beddomei* and *C. rubraoculus* **sp. nov.**. It can be distinguished from them by a combination of the following characters (Supplementary Table S8); smaller body size: max SVL 48.2 mm (*versus* larger body size: max SVL 58.2 mm in *C. anamudiensis*); males with 4–6 precloacal pores (*versus* males with 2–3 precloacal pores in *C. anamudiensis*, males with 8 precloacal pores in *C. wallaceii* **sp. nov.**); 12–14 rows of linearly arranged dorsal tubercles (*versus* 10–12 rows of dorsal tubercles in *C. beddomei*, 14–15 in *C. wallaceii* **sp. nov.**, dorsal tubercles few, irregularly arranged in *C. anamudiensis*); ventral scales of hindlimb keeled (*versus* ventral scales of hindlimb smooth in *C. anamudiensis*); 26–27 midventral scales (*versus* 30–34 in *C. beddomei*, 28–29 in *C. wallaceii* **sp. nov.**); 134–141 longitudinal scales from mental to cloaca (*versus* 154–161 in *C. beddomei*, 154–156 in *C. wallaceii* **sp. nov.**); ventrals smooth (*versus* ventrals weakly keeled in *C. beddomei*); postmentals separated by a single broad median scale (*versus* postmentals separated by 2–3 median scales in *C. wallaceii* **sp. nov.**). For a comparison with *C. rubraoculus* **sp. nov.**, see section above.

**Description of holotype:** BNHS 2614, a large sized (SVL 48.2 mm) adult male (Supplementary Figure S16). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.70), not strongly depressed (HH/ HL = 0.44) distinct from neck. Snout moderately long (SE/ HW = 0.59) much longer than eye diameter (OD/ SE = 0.50), scales on snout and forehead granular; scales on snout smooth, rounded, larger than those on interorbital region and forehead; occipital and temporal region with smaller granular scales, intermixed with slightly larger, rounded, tubercles (Supplementary Figure S16 C). Eyes small (OD/ HL = 0.21), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening small, oval and oblique (EL/ HL = 0.06); eye to ear distance greater than diameter of eyes (EE/ OD = 1.98) (Supplementary Figure S16 E). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial and enlarged supranasals; supranasals posteriorly separated by two small scales. Nostrils circular, each surrounded by two postnasals, supranasal and rostral; 2 rows of scales separate orbit from supralabials. Mental subpentagonal, nearly as long as wide, paired postmentals quadrate, smaller than mental and medially in contact with a single wide scale; posteriorly each postmental bounded by 6 to 7 smooth scales, including median scale. 7 supralabials to the angle of jaw, 6 at midorbital position, 7 infralabials to the angle of jaw, 6 at midorbital position.





**Supplementary Figure S16.** *Cnemaspis nimbus* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Body relatively robust (BW/ TRL = 0.45), not elongate (TRL/ SVL = 0.42). Dorsal scales on trunk heterogeneous, small, conical, granular scales intermixed with rows of larger rounded, keeled tubercles. Tubercles in approximately 14 rows at mid-body; 16 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Scales on nape rounded, slightly smaller than granular scales on dorsum. Larger keeled tubercles prominent towards the flanks, dorsal scales weakly keeled, subimbricate on flanks. Ventral scales smooth, imbricate, larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 27 midbody scale rows across belly, 141 scales between mental to anterior border of cloaca; 6–7 rows of enlarged, rounded, smooth, glossy scales around the precloacal region, forming a unique band across the thighs; 6 precloacal pores.

Forelimbs short, robust; forearms short (FL/ SVL = 0.16); hind limbs relatively long; tibia short (CL/ SVL = 0.18). Scales on palm and sole smooth, granular; dorsal scales of forelimb and hindlimb keeled. Ventral scales of forelimb smooth, granular and that of hindlimb, weakly granular, keeled. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 11, digit II: 17, digit III: 19, digit IV: 21, digit V: 15; of left pes, digit I: 9, digit II: 18, digit III: 21, digit IV: 23, digit V: 18; rows of enlarged scales from the base of first digit till end of feet present on manus and pes.

Tail moderately short, regenerated (TL/ SVL = 0.68); tail base distinctly swollen. Scales on tail base conical to imbricate; enlarged tubercles absent. Dorsal tail scales imbricate; single enlarged postcloacal spur present on each side; subcaudal scales smooth, median row irregular, individual large, divided scales intermixed with smaller ones.

**Colouration in life (based on Holotype)** (Figure 3D): Dorsal colour of head, body, limbs and tail olive yellow, clouded with black striations and blotches along head and trunk; a thick yellowish stripe longitudinally along mid vertebral from nuchal region to mid body where it is interrupted by black roughly sickle shaped bar, following which in the form of alternating yellow and black blotched till base of tail; tail regrown, uniform greyish brown; a row of four yellowish spots parallel to the mid vertebral on each side between forelimb and hind limb, loosely joined to the midvertebral stripe by slightly lighter bands bordered with black; a ‘J’ shaped mark on each side of the nape parallel to the midvertebral stripe; flank clouded with yellow and white spots bordered with black reticulations, yellow spots being prominent towards the anterior region which is replaced by white towards the posterior side. Head dirty yellow with a black broken stripe from above second supralabial till end of jaw, another black stripe from the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye to the stripe at the end of jaw; forehead yellow with scattered black markings; supralabials glossy amber yellow, infralabials amber yellow bordered by black band on the top which continues till below the ear. Pupil black surrounded by thick, brick red iris. Limbs olive yellow, mottled with light grey and black markings; digits alternating with light and darker bands. Ventrals grey mixed with a few darker and lighter scales, lighter white scales more prominent towards the sides, pectoral region grey intermixed with scattered yellowish orange scales, throat pale grey in the centre surrounded with yellow and black reticulations; infralabials, mental and postmentals speckled with yellow and white; scales on femur, above and below precloacal pores glossy white. Ventral surface of the tail grey, postcloacal tubercles buff yellow.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary

Table S5. Both the adult male paratypes range from 40.5–45.1 mm in SVL. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 12–14 rows of middorsal tubercles; CESL 357 with 26 midventral scale rows and 134 scales from mental to cloaca; CESL 252 with 139 scales from mental to cloaca; the number of lamellae on digit I of the manus ranges from 10–11 and on digit IV from 20–21, on digit I of the pes 9–11 and on digit IV from 22–23; precloacal pores range from 4–6; CESL 252 and CESL 357 with single enlarged postnasal; original tail in both paratypes cut for tissue, median row of subcaudals enlarged with larger quadrate scale alternating slightly smaller subconical scale. Overall colouration similar to the holotype; CESL 252 overall slightly lighter with more prominent white spots on the flank, middorsal stripe continues as lighter yellow spots on the tail alternating with longitudinal black spots, other parts of tail whitish with slight reticulations of grey (Supplementary Figure S11 G).

**Distribution:** *Cnemaspis nimbus* **sp. nov.** is currently known from a few sites in the high elevation wet evergreen forests (above 1500 m asl) of the Cardamom Hills in the SWG. During this study, it was recorded from Mathikettan Shola National Park, Kerala.

**Ecology and natural history:** Individuals were found hiding in the crevices of boulders along a stream during the day inside an evergreen forest (Supplementary Figure S11 H). A few individuals were also found in the evening moving actively on the mud wall of an abandoned hut inside the forest. This suggests that *Cnemaspis nimbus* **sp. nov.** is probably a nocturnal or crepuscular gecko. In one site, *C. smaug* **sp. nov.** was observed near *C. nimbus* **sp. nov.**, sharing a similar habitat.

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### *Cnemaspis wallaceii* **sp. nov.**

(Figure 3E, S14, S17, S18; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:6BAE4EB8-69C9-4065-81A4-2DC040973CA3

**Holotype:** BNHS 2613, adult male (Figure 3E) collected from a rock in an evergreen forest, Andiparai Shola, Anamalai Hills (10.394°N, 76.992°E; 1307 m asl) by Saunak Pal and team on 8<sup>th</sup> August 2011.

**Paratypes:** CESL 378, adult female; collected along with the holotype.

**Etymology:** The species epithet is a patronym, honouring Alfred Russel Wallace for his tremendous contribution to the field of biogeography. His work has been an inspiration for the authors and towards this study.

**Suggested common name:** Wallace's forest gecko.

**Lineage diagnosis:** *Cnemaspis wallaceii* **sp. nov.** can be readily discerned on a phylogenetic tree and its close relationship with *C. nimbus* **sp. nov.** and *C. anamudiensis* is strongly supported (BPP 1/UP 100) (Figure 2). It is characterized by moderate genetic divergence at the 16s rRNA gene of 3.3–3.9% from *C. anamudiensis* and 4.0% from *C. nimbus* **sp. nov.**, and very high genetic divergence (>8.0%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized *Cnemaspis* species (SVL up to 46.2 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with larger rounded, regularly arranged, weakly keeled tubercles; absence of spine like tubercles on the flank; paired postmentals separated by 2–3 median scales; 14–15 rows of middorsal tubercles, 18–20 tubercles in paravertebral rows; ventrals smooth, 154–156 longitudinal scales from mental to cloaca; 28–29 midventral scales; males with 8 precloacal pores, femoral pores absent; row of enlarged scales from base of first toe till end of foot; subcaudals smooth, median row with individual large scales alternating with slightly smaller scales; 6–7 supralabials to the angle of jaw; 22–23 lamellae on digit IV of pes.

*Cnemaspis wallaceii* **sp. nov.** can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL 45.9–46.2 mm, n=2 (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); a row of enlarged scales from base of first toe till end of foot (*versus* absent in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); no whorls of enlarged caudal tubercles (*versus* present in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. ornata*, *C. smaug* **sp. nov.**); no enlarged metacarpal scale at the junction of forearm and palm below digit I (*versus* distinct enlarged metacarpal scale present below digit I in *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); subdigital lamellae on proximal series entire (*versus* fragmented in *C. ornata*); dorsal tubercles rounded (*versus* conical in *C. ornata*, *C. smaug* **sp. nov.**, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**); one postcloacal spur on each side (*versus* a pair of postcloacal spur on each side in *C. smaug* **sp. nov.**); males with 8 precloacal pores (*versus* 2–3 in *C. anamudiensis*) (Supplementary Table S8).

*Cnemaspis wallaceii* **sp. nov.** is superficially similar to *C. maculicollis*, *C. beddomei*, *C. rubraoculus* **sp. nov.** and *C. nimbus* **sp. nov.**. It can be distinguished from *C. maculicollis* by paired postmentals separated by single median scale, presence of distinctive white spots on nape, males with 10 precloacal pores; from *C. beddomei* based on presence of 10–12 rows of middorsal tubercles; ventral scales keeled and postmentals separated by a single broad median scale. For a comparison with *C. rubraoculus* **sp. nov.** and *C. nimbus* **sp. nov.**, see respective sections.

**Description of holotype:** BNHS 2613, a large sized (SVL 45.9 mm) adult male (Supplementary Figure S17). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.27), moderately wide (HW/ HL = 0.66), not strongly depressed (HH/ HL = 0.42) distinct from neck. Snout long (SE/ HW = 0.66) much longer than eye diameter (OD/ SE = 0.46); scales on snout and forehead granular, scales on snout smooth, rounded, slightly larger than those on interorbital region and forehead; occipital and temporal region with smaller granular scales, intermixed with larger, rounded, weakly keeled tubercles (Supplementary Figure S17 C). Eyes small (OD/ HL = 0.20), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly.

Ear opening small, oval (EL/ HL = 0.07); eye to ear distance greater than diameter of eyes (EE/ OD = 1.68) (Figure S17 E). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial and enlarged supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; 3 rows of scales separate orbit from supralabials. Mental roughly

conical, nearly as long as wide, paired postmentals quadrate, smaller than mental and medially in contact with two rounded scales; each postmental bounded by 6 smooth scales, including median scale. 7 supralabials to the angle of jaw, 6 at midorbital position, 7 infralabials to the angle of jaw, 6 at midorbital position.

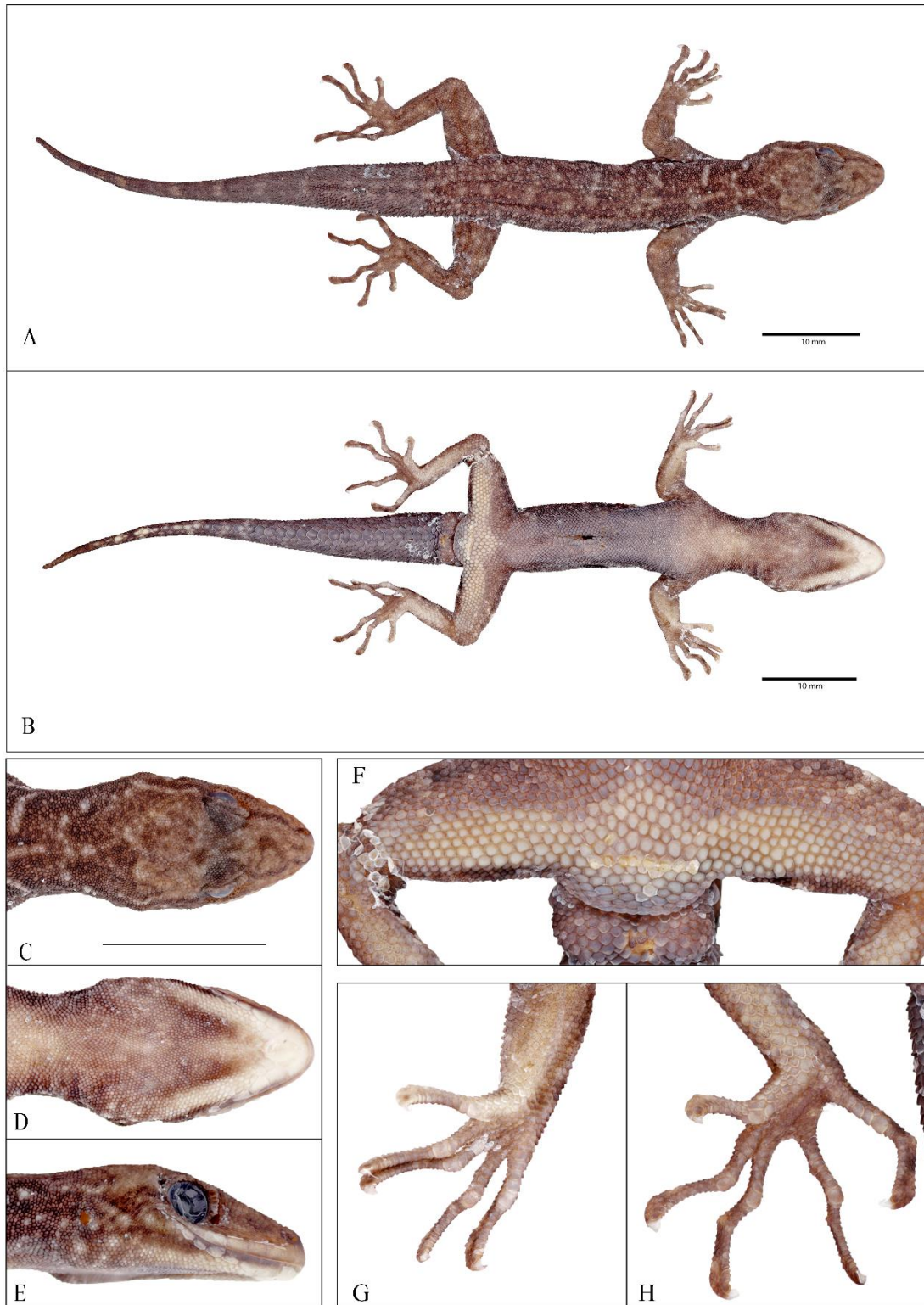
Body relatively slender ( $BW/TRL = 0.36$ ), not elongate ( $TRL/SVL = 0.43$ ). Dorsal scales on trunk heterogeneous, small, conical, granular scales intermixed with rows of larger rounded, keeled tubercles. 14 rows of tubercles at mid-body; 18 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Scales on nape rounded, slightly smaller than scales on dorsum. Keeled tubercles prominent towards the flanks, dorsal scales weakly keeled, subimbricate on flanks. Ventral scales smooth, imbricate, larger than dorsal; gular and ventral surface of neck with smaller, granular scales, pectoral scales weakly keeled; 29 midbody scale rows across belly, 154 scales between mental to anterior border of cloaca; 7–8 rows of enlarged, rounded, smooth, glossy scales around the precloacal region, forming a unique band across the thighs; 8 precloacal pores.

Forelimbs short, robust; forearms short ( $FL/SVL = 0.14$ ); hind limbs relatively long; tibia short ( $CL/SVL = 0.19$ ). Scales on palm and sole smooth, granular; dorsal scales of forelimb and hindlimb weakly keeled. Ventral scales of forelimb smooth, granular and that of hindlimb granular, smooth with a few weakly keeled ones. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 11, digit II: 16, digit III: 19, digit IV: 20, digit V: 15; of left pes, digit I: 10, digit II: 17, digit III: 19, digit IV: 23, digit V: 18; row of enlarged scales from the base of first digit till end of feet present on manus and pes.

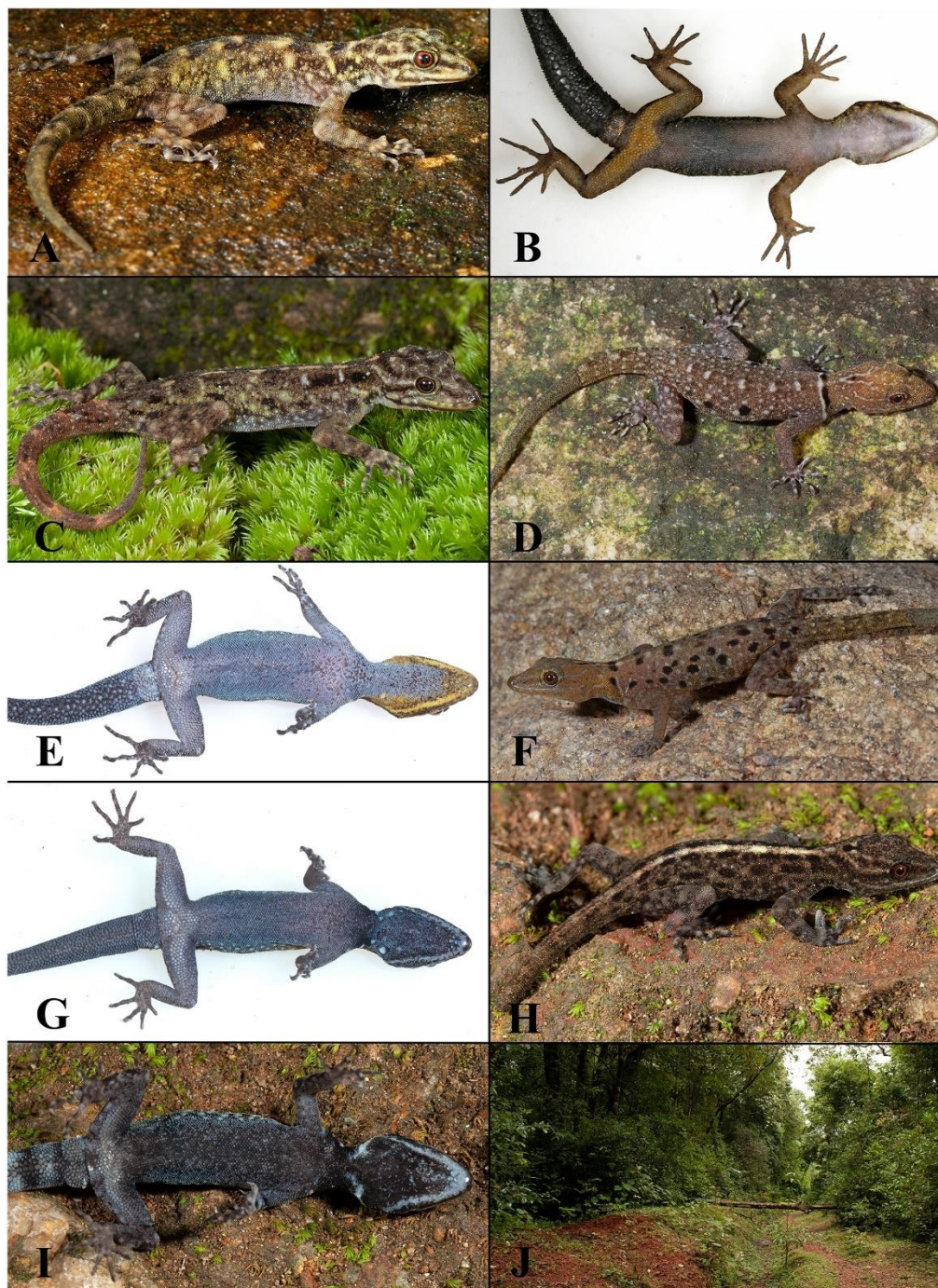
Tail moderately short, almost equal to body length ( $TL/SVL = 1.01$ ); tail base swollen. Scales on tail base conical to imbricate with rows of enlarged tubercles till above the cloacal region. Dorsal tail scales imbricate; single slightly enlarged postcloacal spur present on each side; subcaudal scales smooth, median row composed of large roughly pentagonal scales alternating with slightly smaller ones.

**Colouration in life (based on Holotype)** (Figure 3E): Dorsal colour of head, body, limbs and tail pale yellow, with black markings and blotches along head and trunk; a light-yellow stripe longitudinally along mid vertebral from nuchal region to base of the tail broken on posterior part of trunk with alternating obscure black blotches; pale white spots continue on the tail interrupted by a medial black stripe; two thin yellow collar on the nape, anterior one behind the head forming a ‘W’ pattern while the posterior one across nape in front of the forelimbs, a prominent black band between the collars interrupted medially by the midventral stripe; 2–3 yellow blotches parallel to the midvertebral region on the dorsum; flank with yellow and buff spots bordered with black reticulations.

Head pale with a black broken stripe from above fourth supralabial till slightly above ear, another broken black stripe from the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye to the stripe anterior to the ear opening; forehead buff with scattered black markings; supralabials glossy pale yellow, infralabials pale white bordered by black band on the top which continues till the ear. Pupil black surrounded by thick, red ring followed by black iris.



**Supplementary Figure S17.** *Cnemaspis wallacei* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.



**Supplementary Figure S18.** Life colouration and habitat of new lineages. A. female paratype of *Cnemaspis wallaceii* sp. nov., CESL 378, B. ventral view of holotype of *Cnemaspis wallaceii* sp. nov., BNHS 2613, C. female paratype of *Cnemaspis smaug* sp. nov., BNHS 2616, D. female paratype of *Cnemaspis regalis* sp. nov., CESL 487, E. ventral view of holotype *Cnemaspis regalis* sp. nov. BNHS 2617, F. female paratype of *Cnemaspis galaxia* sp. nov., CESL 511, G. ventral view of male paratype of *Cnemaspis galaxia* sp. nov., CESL 513, H. juvenile paratype of *Cnemaspis nigriventris* sp. nov., CESL 265, I. ventral view of holotype *Cnemaspis nigriventris* sp. nov., BNHS 2619, J. habitat at type locality in Achankovil Reserve Forest, Kerala.

Limbs dirty yellow, mottled with light brown and black markings; digits alternating with light and dark bands. Ventrals grey, darker posteriorly, pectoral region pale white with faint grey blotches towards the sides, throat pale white speckled with few grey spots and a thick black band parallel to infralabials on both sides; infralabials, mental, postmentals and 2–3 rows of scales parallel to infralabials white; scales on femur, above and below precloacal pores glossy yellow. Ventral surface of the tail dark grey, postcloacal tubercles pale yellow (Supplementary Figure S18 B).

**Variation:** Morphometric and meristic data for the paratype are presented in Supplementary Table S5. The female paratype CESL 378 agrees with the holotype in general morphology and scalation except for the following characters: 15 rows of middorsal tubercles; 28 midventral scale rows and 156 scales from mental to cloaca; 10 lamellae on digit I and 19 on digit IV of manus, 22 lamellae on digit IV of pes; overall colouration similar to the holotype except slightly brighter with more prominent yellow blotches, tail alternate with black blotches and pale yellow bands (Supplementary Figure S18 A); no glossy scales on the femur and above cloacal region.

**Distribution:** *Cnemaspis wallaceii* **sp. nov.** is currently known from a single locality in the high elevation wet evergreen forests (above 1200 m asl) of the Anamalai Hills in the SWG. During this study, it was recorded from Andiparai Shola in Valparai, Tamil Nadu.

**Ecology and natural history:** Both the holotype and paratype were found active on a boulder inside a wet evergreen forest patch at night. This suggests that *C. wallaceii* **sp. nov.** might be a nocturnal gecko. No other gecko was observed sharing the microhabitat with *C. wallaceii* **sp. nov.**.

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### *Cnemaspis smaug* **sp. nov.**

(Figure 3F, S14, S18, S19; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:AE84224E-1617-451D-A240-51F54756429F

**Holotype:** BNHS 2615, adult male (Figure 3F) collected from the crevice of a rock in an evergreen forest, Mathikettan Shola National Park, Cardamom Hills (9.975°N, 77.241°E; 1364 m asl) by Saunak Pal and team on 18<sup>th</sup> July 2011.

**Paratypes:** CESL 353 and CESL 355, adult males; CESL 251 and BNHS 2616, adult females; collected from near the same locality as that of the holotype by Saunak Pal and team on 16<sup>th</sup> July 2011 and 27<sup>th</sup> March 2011, respectively.

**Etymology:** The species is named after “Smaug”, the dragon from J. R. R. Tolkien's 1937 novel, ‘The Hobbit’. The name is derived from the old German verb ‘smeuganan’ meaning “to creep” or “to squeeze through a hole”. The type specimens of this species were found within crevices of rocks and boulders inside the forest. Additionally, like dragons, the dorsum is armoured with large conical tubercles.

**Suggested common name:** Smaug forest gecko



**Lineage diagnosis:** *Cnemaspis smaug* **sp. nov.** can be readily discerned on a phylogenetic tree and is sister to *C. cf. maculicollis* with strong support (BPP 0.98/ UF 100) (Figure 2). It is characterized by moderate genetic divergence at the 16s rRNA gene of 3.6% from *C. cf. maculicollis*, high genetic divergence of 4.5% from *C. rubraoculus* **sp. nov.** and 6.1% from *C. beddomei*, and very high genetic divergence (>7.8%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 52 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with large, regularly arranged, keeled conical tubercles more pronounced towards the posterior end; absence of spine like tubercles on the flank; paired postmentals separated by a single median scale; 19–22 rows of middorsal tubercles, 27–30 tubercles in paravertebral rows; ventrals smooth, 142–150 longitudinal scales from mental to cloaca; 30–34 midventral scales; a pair of postcloacal spur on each side; males with 7–8 precloacal pores, femoral pores absent; a row of enlarged scales from base of first toe till end of foot; tail with whorls of enlarged caudal tubercles; subcaudals smooth, median row enlarged, smooth, with pairs of smaller scales alternating with two individual larger ones; 7–9 supralabials to the angle of jaw; 20–22 lamellae on digit IV of pes.

*Cnemaspis smaug* **sp. nov.** can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL 43.6–52 mm,  $n=5$  (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); presence of a pair of postcloacal spurs on each side of tail base (*versus* one postcloacal spur on each side in *C. beddomei*; *C. aaronbaueri*; *C. anamudiensis*; *C. maculicollis*; *C. nairi*; *C. rubraoculus* **sp. nov.**, *C. wallaceii* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. nigriventris* **sp. nov.**, *C. galaxia* **sp. nov.**, and *C. regalis* **sp. nov.**); a row of enlarged scales from base of first toe till end of foot (*versus* absent in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); no enlarged metacarpal scale at the junction of forearm and palm below digit I (*versus* distinct enlarged metacarpal scale present below digit I in *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); subdigital lamellae on proximal series entire (*versus* fragmented in *C. ornata*); males with distinct white spots on the nape (*versus* males with distinct white to yellow band across the shoulder in *C. aaronbaueri*, *C. ornata*, *C. nairi*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); males with 7–8 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*); whorls of enlarged caudal tubercles present (*versus* absent in *C. maculicollis*, *C. anamudiensis*, *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.** and *C. wallaceii* **sp. nov.**); dorsal tubercles conical (*versus* rounded in *C. maculicollis*, *C. anamudiensis*, *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.** and *C. wallaceii* **sp. nov.**). For additional comparisons with *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.** and *C. wallaceii* **sp. nov.**, see respective sections (Supplementary Table S8).

**Description of holotype:** BNHS 2615, a large sized (SVL 50.4 mm) adult male (Supplementary Figure S19). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.72), not strongly depressed (HH/ HL = 0.45) distinct from neck.

Snout long ( $SE/HW = 0.69$ ) much longer than eye diameter ( $OD/SE = 0.45$ ); scales on snout and forehead granular, scales on snout smooth, rounded, slightly larger than those on the forehead; occipital and temporal region with smaller granular scales, intermixed with a few slightly larger, subconical tubercles (Supplementary Figure S19 C).

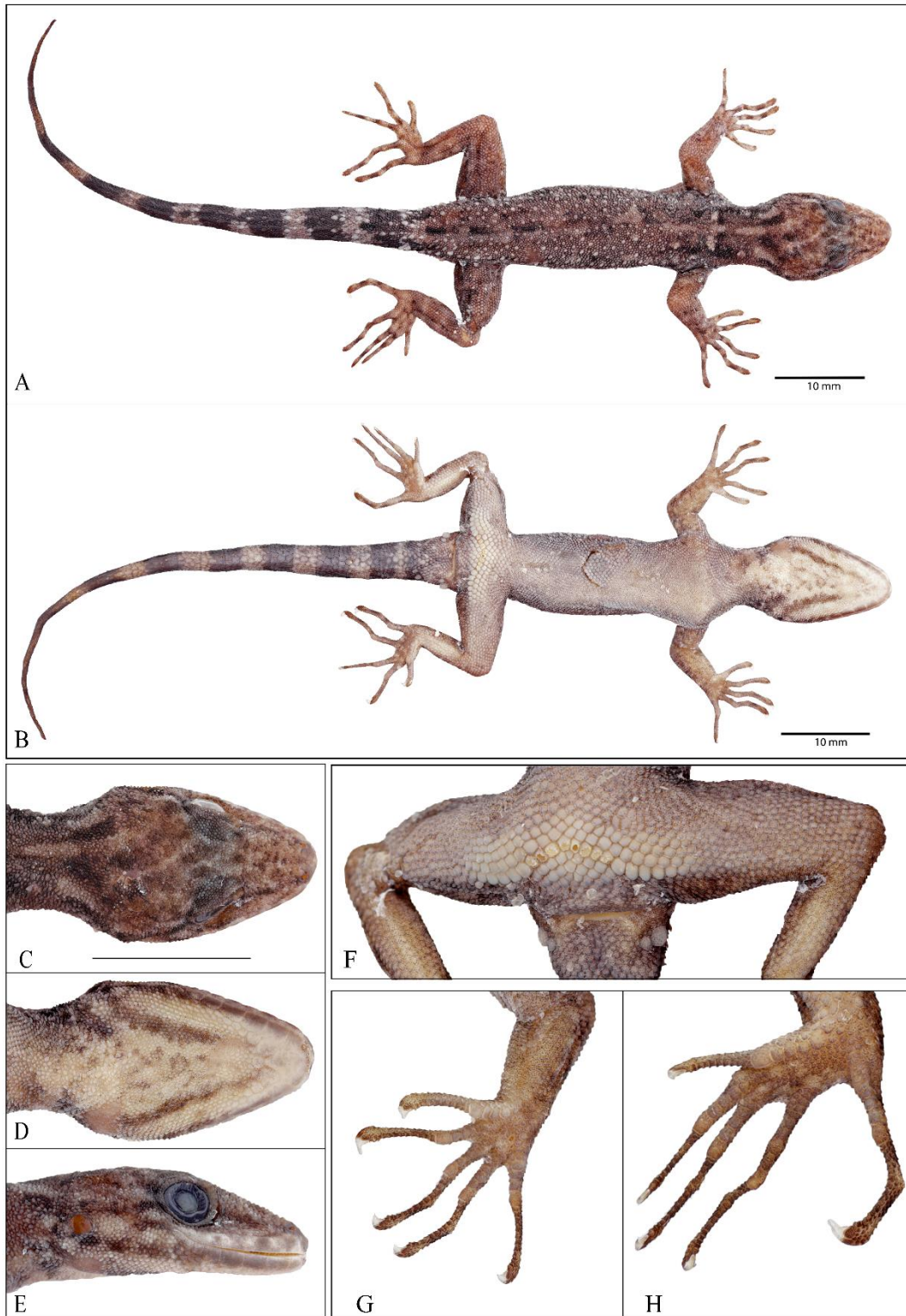
Eyes small ( $OD/HL = 0.22$ ), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening small ( $EL/HL = 0.09$ ); eye to ear distance greater than diameter of eyes ( $EE/OD = 1.50$ ). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial, enlarged supranasals and internasals. Supranasals separated anteriorly by a cluster of three small internasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; two to three rows of scales separate orbit from supralabials. Mental subpentagonal, nearly as long as wide, paired postmentals quadrate, smaller than mental and separated medially by a single rounded scale; each postmental bounded by 5 smooth scales, including median scale. 9 supralabials to the angle of jaw, 7 at midorbital position, 8 infralabials to the angle of jaw, 7 at midorbital position.

Body relatively robust ( $BW/TRL = 0.42$ ), not elongate ( $TRL/SVL = 0.43$ ). Dorsal scales on trunk heterogeneous, small, conical, granular scales intermixed with 19 regularly arranged rows of large, conical, keeled tubercles; 30 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Scales on nape rounded, slightly smaller than scales on dorsum. Conical, keeled tubercles prominent towards the flanks, dorsal scales weakly keeled, subimbricate on flanks. Ventral scales smooth, imbricate, larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 30 midbody scale rows across belly, 143 scales between mental to anterior border of cloaca; 5–6 rows of enlarged, rounded, smooth, glossy scales around the precloacal region; 8 precloacal pores.

Forelimbs short, robust; forearms short ( $FL/SVL = 0.16$ ); hind limbs relatively long; tibia short ( $CL/SVL = 0.19$ ). Scales on palm and sole smooth, granular; dorsal scales of forelimb and hindlimb partially keeled. Ventral scales of forelimb and hindlimb smooth, granular with few rows of weakly keeled scales towards the sides. Digits elongate, slender, all bearing recurved claws; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 11, digit II: 15, digit III: 17, digit IV: 19, digit V: 15; of left pes, digit I: 10, digit II: 15, digit III: 19, digit IV: 21, digit V: 19; row of enlarged scales from the base of first digit till end of feet present on manus and pes.

Tail moderately short, slightly longer than body length ( $TL/SVL = 1.30$ ); tail base swollen. Scales on tail base conical to imbricate with rows of enlarged tubercles above the cloacal region, conical tubercles form whorls of enlarged tubercles on tail. Dorsal tail scales imbricate; a pair of enlarged postcloacal spur present on each side, the outer pair much larger, subtriangular; inner almost half of outer; subcaudal scales smooth, median row composed of enlarged, smooth scales, with a pair of smaller scales alternating two individual larger ones.

**Colouration in life (based on Holotype)** (Figure 3F): Dorsal colour of head, body and limbs pale olive grey, with black blotches and light grey to white markings along head and trunk; dorsum with series of 6–7 lighter spots, along mid vertebral from nuchal region to base of the tail; three pairs of distinct white spots on the nape on each side of the mid vertebral spots, the first pair small,



**Supplementary Figure S19.** *Cnemaspis smaug* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

behind the head while the second pair between the anterior junction of forelimbs and third slightly behind axillar region; a rough black ‘W’ like pattern behind the head; conical tubercles on the dorsum lighter dirty grey to white, lateral side lighter intermixed with black and yellow reticulations. Head dark with 4–5 small black blotches on forehead forming ink blot like pattern; a black broken stripe from above 1<sup>st</sup> supralabial to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye to the above ear opening; a broken pale white stripe from behind the eye roughly bordering the ‘W’ mark; another from junction of jaw till ear opening; supralabials glossy white edged with black, infralabials with thick black band continuing till lower corner of ear. Pupil black surrounded by thin yellowish ring followed by dirty red iris. Limbs dirty olive, clouded with light brown and black markings; digits alternating with light and dark bands; tail with alternating thick white and black bands. Ventrals pale grey, throat white speckled with black markings and a pair of black streaks parallel to infralabials; mental, postmentals and 5–6 rows of scales parallel to infralabials white; scales above and below precloacal pores glossy amber. Ventral surface of the tail banded, paler than the dorsal; postcloacal tubercles white.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 19–22 rows of tubercles around midbody; 30–34 midventral scale rows and 142–150 scales from mental to cloaca; 10–11 lamellae on digit I and 18–19 on digit IV of manus, 10–11 lamellae on digit I and 21–22 lamellae on digit IV of pes; 7–8 precloacal pores in males; CESL 353 and CESL 355 with a single elliptical internasal at the anterior junction of supranasals; supranasals separated anteriorly by two small internasals in CESL 251, joined in BNHS 2616; CESL 251 with regenerated tail, cut for tissue; later half tail regenerated in CESL 353. Colouration in male paratypes overall similar to holotype except white stripe behind the eye not broken, encircling the posterior border of head in CESL 353 and CESL 355; CESL 355 with thicker black blotches on dorsum, middorsal spots joined as a stripe.

*Cnemaspis smaug* **sp. nov.** shows sexual dichromatism. Overall colour of adult female pale reddish brown, middorsal spots light yellow to orange as thin, longitudinal bars; middorsal spots continue on tail as orange spots alternating with pale brown blotches in BNHS 2616, bands not pronounced (Supplementary Figure S18 C); tail in CESL 251 regrown, uniform grey; glossy scales around cloacal region absent in females.

**Distribution:** *Cnemaspis smaug* **sp. nov.** is currently known from a few sites in the high elevation wet evergreen forests (above 1300 m asl) of the Cardamom Hills in the SWG (Supplementary Figure S14). During this study, it was recorded from Mathikettan Shola National Park, Kerala.

**Ecology and natural history:** *Cnemaspis smaug* **sp. nov.** is probably a crepuscular to nocturnal gecko, confined to rocks and boulders in evergreen forests. All the collected specimens were found from crevices of rocks and from gaps between boulders in the wet evergreen forests of Cardamom Hills in the evening. A few individuals were also observed moving actively on huge boulders along the forest path in the evening. In one site, *C. nimbus* **sp. nov.** was observed from a similar habitat. During this study, *C. flavigularis* **sp. nov.** was also recorded from tree trunks in similar habitat.

## *Cnemaspis regalis* sp. nov.

(Figure 3G, S14, S18, S20; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:11681468-AE0A-4CD6-8728-EE58436B8D97

**Holotype:** BNHS 2617, adult male (Figure 3G) collected from a rock along stream in a low elevation forest patch in Mundanthurai, Kalakkad Mundanthurai Tiger Reserve, Tamil Nadu (8.656°N, 77.331°E; 216 m asl) by Saunak Pal and team on 20<sup>th</sup> December 2011.

**Paratypes:** CESL 487, CESL 488 adult females and CESL 489 adult male collected from Kalakkad on 18<sup>th</sup> December 2011; CESL 495, CESL 502 adult males and BNHS 2618 adult female collected from Mundanthurai along with the holotype.

**Etymology:** The species epithet is based on the Latin word ‘*regalis*’ meaning kingly or royal, due to the head ornamented with golden yellow crown like pattern in the males of this species.

**Suggested common name:** Golden crowned day gecko or Royal day gecko.

**Lineage diagnosis:** *Cnemaspis regalis* sp. nov. can be readily discerned on a phylogenetic tree and is sister to *C. galaxia* sp. nov. with strong support (BPP 1/ UF 100) (Figure 2). It is characterized by very high genetic divergence at the 16s rRNA gene of 7.6% from *C. galaxia* sp. nov. and very high genetic divergence (> 11%) from other members of the *beddomei* clade (Supplementary Table S2).

**Diagnosis and comparison:** A medium sized *Cnemaspis* species (SVL up to 36.5 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with conical, regularly arranged, weakly keeled tubercles; absence of spine like tubercles on the flank; paired postmentals partially touching or separated by a single median scale; 7–9 rows of middorsal tubercles; ventrals small, smooth, 148–154 scales from mental to cloaca; 40–44 midventral scales; one postcloacal spur on each side; males with 6–8 precloacal pores, femoral pores absent; subcaudals smooth, median row enlarged, with pairs of slightly smaller scales alternating two individual larger ones; tail with whorls of enlarged conical caudal tubercles; 7–9 supralabials to the angle of jaw; a distinct enlarged metacarpal scale below digit I; 2–3 initial subdigital lamellae on proximal series fragmented followed by entire, distal lamellae entire, 24–27 lamellae on digit IV of pes.

*Cnemaspis regalis* sp. nov. can be distinguished from other members of the *beddomei* clade by a combination of the following characters: smaller body size, max SVL 36.5 mm (*versus* larger body size, max SVL more than 40 mm in *C. beddomei*, *C. anamudiensis*, *C. maculicollis*, *C. rubraoculus* sp. nov., *C. nimbus* sp. nov., *C. wallaceii* sp. nov., *C. smaug* sp. nov. and *C. ornata*); whorls of enlarged conical caudal tubercles (*versus* absent in *beddomei*, *C. anamudiensis*, *C. maculicollis*, *C. rubraoculus* sp. nov., *C. nimbus* sp. nov., *C. wallaceii* sp. nov., *C. smaug* sp. nov., *C. nairi* and *C. nigriventris* sp. nov.); males with 6–8 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*); dorsal tubercles conical (*versus* rounded in *C. nairi* and *C. nigriventris* sp. nov.);

24–28 lamellae on digit IV of pes (*versus* 24–25 in *C. nigriventris* **sp. nov.**); 40–44 midventral scales (*versus* 32–33 in *C. nairi*); tail not banded (*versus* tail banded in *C. nairi* and *C. nigriventris* **sp. nov.**) (Supplementary Table S8). For further comparison with *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.**, *C. smaug* **sp. nov.** and *C. ornata*, see respective sections.

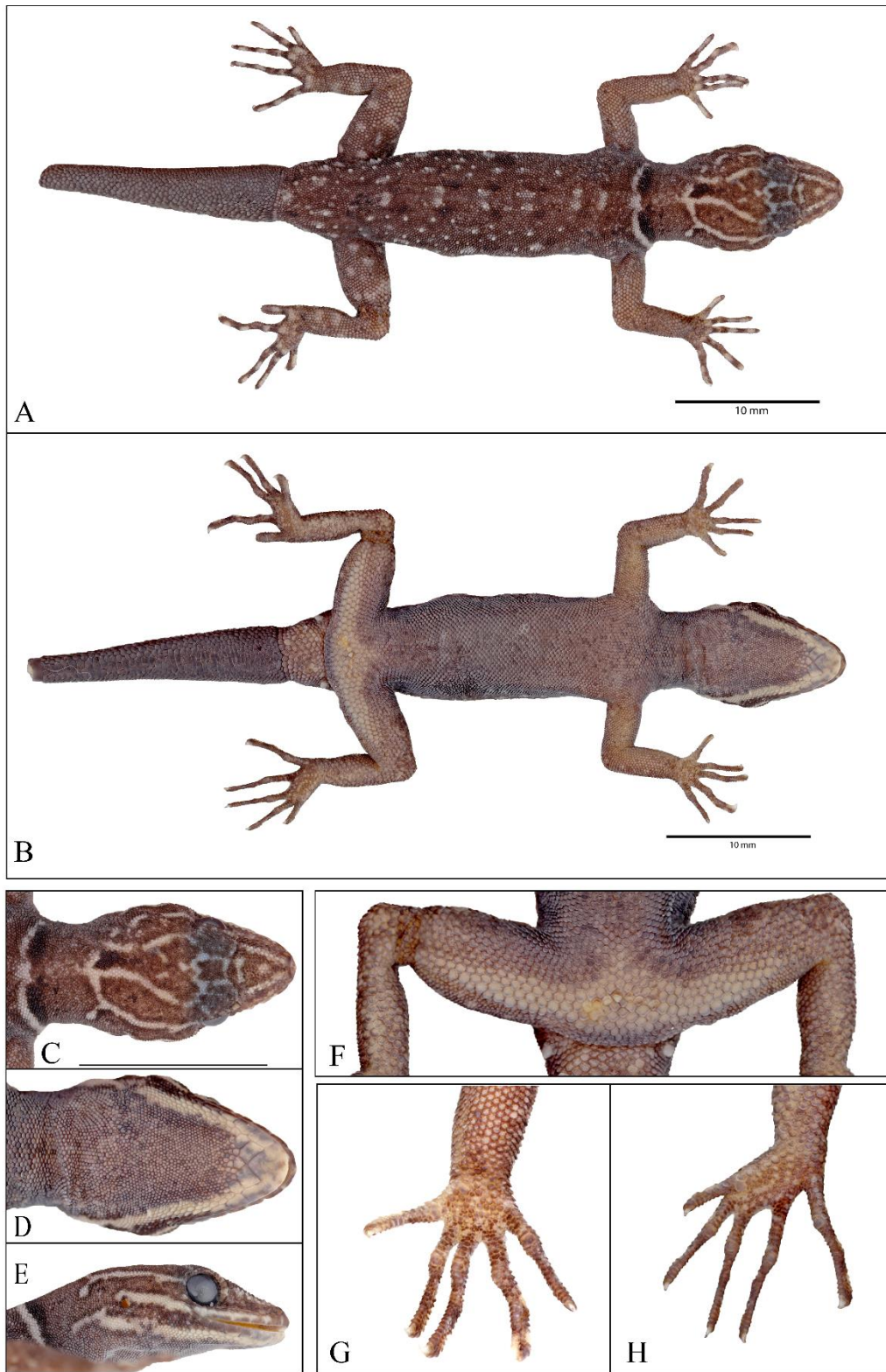
*Cnemaspis regalis* **sp. nov.** closely resembles *C. galaxia* **sp. nov.** and *C. aaronbaueri* from which it can be distinguished by 40–44 midbody scale rows across the belly (*versus* 31–33 in *C. aaronbaueri*, 27–31 in *C. galaxia* **sp. nov.**); 12–14 tubercles in paravertebral rows (*versus* 18–19 in *C. aaronbaueri*, 17–18 in *C. galaxia* **sp. nov.**); 148–154 ventral scales (*versus* 135–140 in *C. aaronbaueri*, 153–159 in *C. galaxia* **sp. nov.**); head of male dirty yellow with bright yellow stripes, dorsum bluish black (*versus* dorsum from shoulder to beyond midbody turmeric yellow, grey to black head in males of *C. galaxia* **sp. nov.**); white spot on shoulder and below end of throat absent (*versus* a distinct white spot present on shoulder and throat end in *C. galaxia* **sp. nov.**).

**Description of holotype:** BNHS 2617, a medium sized (SVL 36.1 mm) adult male (Supplementary Figure S20). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.70), not strongly depressed (HH/ HL = 0.45) distinct from neck. Snout long (SE/ HW = 0.66) longer than eye diameter (OD/ SE = 0.41); scales on snout and forehead granular, scales on snout roughly conical, much larger than those on interorbital region and forehead; scales on the temporal region small, granular; on the occipital region intermixed with few scattered, slightly larger, rounded tubercles (Supplementary Figure S20 C). Eyes small (OD/ HL = 0.19), pupil rounded; orbit with extra-brillar fringe composed of small scales, largest anteriorly.

Ear opening small, oval (EL/ HL = 0.05); eye to ear distance much greater than diameter of eyes (EE/ OD = 1.61) (Supplementary Figure S20 E). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial and enlarged supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; 2–3 rows of scales separate orbit from supralabials. Mental roughly triangular, nearly as long as wide, paired postmentals quadrate, smaller than mental and medially just in contact with each other on anteriorly, posteriorly separated by a single rounded scale; each postmental bounded by 6–7 smooth scales, including median scale. 8 supralabials to the angle of jaw, 6 at midorbital position, 7 infralabials to the angle of jaw, 5 at midorbital position.

Body relatively robust (BW/ TRL = 0.46), not elongate (TRL/ SVL = 0.42). Dorsal scales on trunk heterogeneous, small, granular, rounded scales intermixed with 8 rows of regularly arranged, larger conical, keeled tubercles. 12 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Scales on nape rounded, slightly smaller than scales on dorsum. Keeled tubercles prominent towards the flanks.

Ventral scales smooth, imbricate, larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 44 midbody scale rows across belly, 148 scales between mental to anterior border of cloaca; 7–8 rows of enlarged, rounded, smooth, glossy scales around the precloacal region, forming a unique spindle shaped band across the thighs; 7 precloacal pores.



**Supplementary Figure S20.** *Cnemaspis regalis* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Forelimbs short, robust; forearms short (FL/ SVL = 0.17); hind limbs relatively long; tibia short (CL/ SVL = 0.21). Scales on palm and sole smooth, granular; dorsal scales of forelimb smooth, of hindlimb smooth, weakly keeled on the sides. Ventral scales of forelimb smooth, granular and that of hindlimb smooth, much larger than forelimb. Digits elongate, slender, all bearing claws that are slightly recurved; 2–3 subdigital lamellae of proximal series fragmented, rest entire, unnotched; subdigital lamellae of left manus, on digit I: 12, digit II: 19, digit III: 22, digit IV: 19, digit V: 17; of left pes, digit I: 11, digit II: 21, digit III: 25, digit IV: 27, digit V: 24; a distinct large metacarpal scale below digit I present at the junction of forearm and palm; digit V of right pes broken at the tip.

Tail regrown, short, more than half of body length (TL/ SVL = 0.58); tail base swollen. Dorsal scales on tail base small, imbricate with rows of enlarged, conical tubercles forming whorl posterior to the cloacal region till the junction of regrown region; dorsal scales of regrown part small, smooth, subimbricate. Single enlarged, conical postcloacal spur present on each side; subcaudal scales smooth, median row composed of large roughly rectangular scales on the regrown region of the tail.

**Colouration in life** (Figure 3G, S18 E): Dorsal colour of body, limbs and tail overall dark brown to black; of head and neck yellowish brown with bright yellow stripes on head. A distinct yellow band across the shoulder, starting at the anterior junction of forelimbs; yellow band bordered with a thick black band on the anterior edge and much narrower, obscure at the posterior edge. Seven bluish white spots longitudinally along mid vertebral from the centre of the yellow band to base of the tail. Dorsum spotted with bluish white tubercles surrounded by few more bluish white scales; spots prominent towards the sides; three to four rows of black spots on the dorsum, roughly alternating the white spots. Head dark with a bright yellow stripe from above the nostril to dorsal margin of eye, continuing backwards from posterior of the eye joining at the back of head forming a pointed leaf like border around the head. Snout with a small yellow spot followed by a short yellow band anterior to the eyes; a roughly rectangular hollow mark between the eyes joining a flask-shaped pattern from the forehead till behind the head. The tapering mouth of the ‘flask’ encloses a black spot and joins the leaf like stripe behind the head. Three small yellow marks like an arrow head on the forehead, inside the broader base of the flask. Lateral side of the head with a bright yellow stripe from first supralabial, extending backwards till above the ear opening. Infralabials dark grey to black; a yellow stripe below the infralabials parallel to lower jaw, slightly below the ear opening ending at the start of neck. Pupil black surrounded by thin yellowish orange ring followed by dirty red iris. Limbs blackish brown; forelimbs uniform, intermixed with few bluish white scales; hindlimbs roughly banded with bluish white spots; digits alternating with light and dark spots. Ventrals bluish black with a few scattered black scales, scales around the precloacal pores glossy; throat slightly lighter, with a thick yellow band parallel to infralabials, from postmentals to edge of neck, infralabials black. (Supplementary Figure S18 E). Ventral surface of the tail uniform, dark bluish black.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 7–9 rows of tubercles around midbody; 40–44 midventral scale rows and ventrals 148–154; 11–12 lamellae on digit I and 19–24 on digit IV of manus, 10–11 lamellae on digit I and 24–27 lamellae on digit IV of pes; 7–9 labial scales; 6–8 precloacal pores in males. C.



*regalis* **sp. nov.** shows strong sexual dichromatism; colouration in male paratypes overall similar to holotype except CESL 488 and CESL 495 more bluish black than brown; original tail similar colour to dorsum, bluish black with whorls of bluish white conical tubercles. Colouration in female paratypes as follows: dorsal colour of body, limbs and tail pale brown, head dull orange (Supplementary Figure S18 D). Markings similar to that on males but dull buff to white, not as prominent as in males. Dorsum brown with scattered alternating pale white spots and distinct black spots; 3–4 big black spots towards the sides. Shoulder band pale buff to white bordered on the anterior edge with thick black; tail dull brown with lighter conical tubercles. Black spot behind the head distinct, surrounded with thin light stripes; labial scales glossy amber coloured. Ventrals pale grey to white; throat similar, intermixed with few pale-yellow scales, pale yellow towards the sides forming indistinct bands. CESL 489 and BNHS 2618 overall brighter; dorsal spots buff, continues above the tail; middorsal spots forming a broken stripe alternating with black spots; black spots as blotches.

**Distribution:** *Cnemaspis regalis* **sp. nov.** is currently known from low to mid elevation forests (up to 650 m asl) on the eastern slopes of the Agasthyamalai Hills in the SWG. During this study, it was recorded from Kalakkad, Mundanthurai and near Manimuthar in Kalakkad Mundanthurai Tiger Reserve, Tamil Nadu.

**Ecology and natural history:** *Cnemaspis regalis* **sp. nov.** is a diurnally active rock dwelling gecko, restricted to the dry forests in the eastern slopes of the SWG. During this study, individuals were found to be active on boulders and rocks along streams during the day. A few individuals were also observed on mud cliffs along roads inside forests. Two gravid females were also found hiding under a culvert on a forest path. This hints that the breeding period for this gecko might be around the month of December. All the observed individuals were found along riparian forest patches and near streams in dry forests. *Hemidactylus triedrus* (Daudin, 1802) and *Hemidactylus acanthopholis* Mirza & Sanap, 2014, were the other gekkonids observed sharing similar habitat at night in some sites.

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### *Cnemaspis galaxia* **sp. nov.**

(Figure 3H, S14, S18, S21; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:F9BF48EB-B199-4A14-8BCC-22FE43BD6033

**Holotype:** BNHS 2626, adult male (Figure 3H) collected from a rock in a low elevation riparian forest, Srivilliputhur, Tamil Nadu (9.566°N, 77.559°E; 290 m asl) by Saunak Pal and Varun Torsekar on 30<sup>th</sup> December 2011.

**Paratypes:** CESL 511, adult female and CESL 513, adult male; collected along with the holotype.

**Etymology:** The species epithet is derived from the word ‘*galaxy*’ due to the dorsum colouration with the sun’s haze like yellow on the anterior and bluish white star like spots on a black background towards the posterior end, in the male of this species.

**Suggested common name:** Galaxy day gecko.

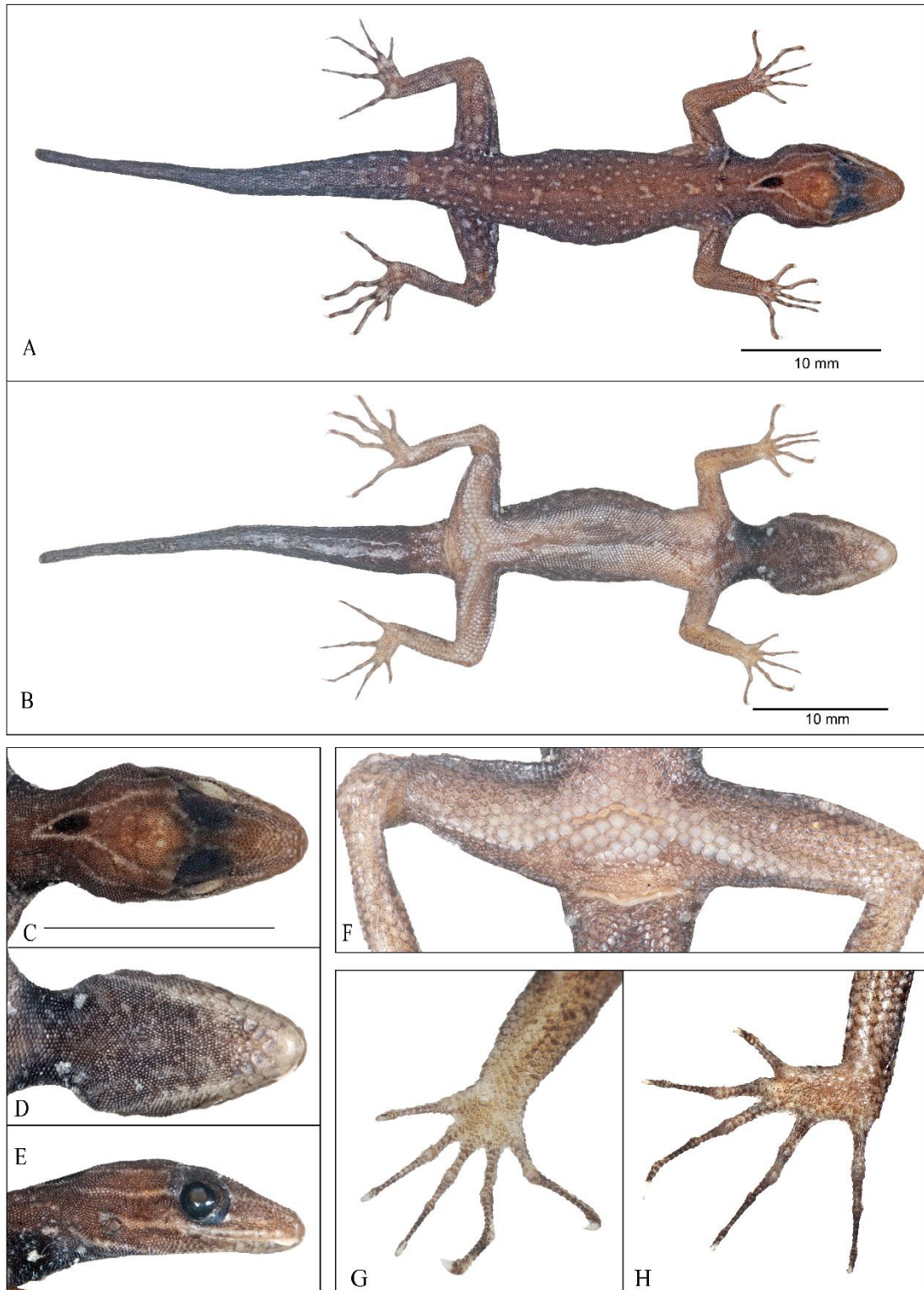
**Lineage diagnosis:** *Cnemaspis galaxia* **sp. nov.** can be readily discerned on a phylogenetic tree and its sister relationship with *C. regalis* **sp. nov.** is strongly supported (Figure 2). It is characterized by very high genetic divergence at the 16s rRNA gene of 7.6% from *C. regalis* **sp. nov.** and very high genetic divergence (>9.5%) from other members of the *beddomei* clade (Supplementary Table S2).

**Diagnosis and comparison:** A small sized *Cnemaspis* species (SVL up to 33.5 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with conical, regularly arranged, weakly keeled tubercles; absence of spine like tubercles on the flank; paired postmentals separated by a single median scale; 8 rows of middorsal tubercles; ventrals small, smooth, 153–159 scales from mental to cloaca; 27–31 midventral scales; one postcloacal spur on each side; males with 7 precloacal pores, femoral pores absent; subcaudals smooth, median row enlarged, with pairs of slightly smaller scales alternating two individual larger ones; tail with whorls of enlarged conical caudal tubercles; 7–8 supralabials to the angle of jaw; a distinct enlarged metacarpal scale below digit I; 2–3 subdigital lamellae on proximal series fragmented followed by entire, distal lamellae entire, 23–25 lamellae on digit IV of pes.

*Cnemaspis galaxia* **sp. nov.** can be distinguished from other members of the *beddomei* clade by a combination of the following characters: smaller body size, max SVL 33.5 mm (*versus* larger body size, max SVL more than 40 mm in *C. beddomei*, *C. anamudiensis*, *C. maculicollis*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.**, *C. smaug* **sp. nov.** and *C. ornata*); whorls of enlarged conical caudal tubercles (*versus* absent in *C. beddomei*, *C. anamudiensis*, *C. maculicollis*, *C. nairi* and *C. nigriventris* **sp. nov.**); males with 7 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*); dorsal tubercles conical (*versus* rounded in *C. beddomei*, *C. anamudiensis*, *C. maculicollis*, *C. nairi* and *C. nigriventris* **sp. nov.**); 23–25 lamellae on digit IV of pes (*versus* 27–28 in *C. nairi*); 27–31 midventral scales (*versus* 31–33 in *C. aaronbaueri*, 32–33 in *C. nairi*, 38–40 in *C. nigriventris* **sp. nov.**); 153–159 ventral scales (*versus* 135–140 in *C. aaronbaueri*); tail not banded (*versus* tail banded in *C. nairi* and *C. nigriventris* **sp. nov.**); males with turmeric yellow dorsum from shoulder to beyond midbody (*versus* males with brownish-yellow head and neck, dorsum grey in *C. aaronbaueri*); a distinct white spot present on shoulder and throat end (*versus* absent in *C. aaronbaueri*). For additional comparisons with *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.**, *C. smaug* **sp. nov.** and *C. ornata*, see respective sections (Supplementary Table S8). *Cnemaspis galaxia* **sp. nov.** closely resembles its sister species, *C. regalis* **sp. nov.** See section of *C. regalis* **sp. nov.** for comparison.

**Description of holotype:** BNHS 2626, a small sized (SVL 32.6 mm) adult male (Supplementary Figure S21). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.24), moderately wide (HW/ HL = 0.72), not strongly depressed (HH/ HL = 0.45) distinct from neck. Snout long (SE/ HW = 0.69) much longer than eye diameter (OD/ SE = 0.52), scales on snout and forehead, smooth, larger than those on the interocular region; occipital

and temporal region with smaller granular scales lacking tubercles (Supplementary Figure S21 C). Eyes small ( $OD/HL = 0.26$ ), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening oval, small and oblique ( $EL/HL = 0.07$ ); eye to ear distance greater than diameter of eyes ( $EE/OD = 1.25$ ). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial and enlarged supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; a single row of scales separates orbit from supralabials.



**Supplementary Figure S21.** *Cnemaspis galaxia* **sp. nov.** holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Mental subpentagonal, nearly as long as wide, paired postmentals sub-quadrated, smaller than mental and medially just in contact with each other, separated posteriorly by single rounded median scale; posteriorly each postmental bounded by 4 smooth scales, including median scale. 7 supralabials to the angle of jaw, 6 at midorbital position, 7 infralabials to the angle of jaw, 5 at midorbital position.

Body relatively robust ( $BW/TRL = 0.47$ ), not elongate ( $TRL/SVL = 0.42$ ). Dorsal scales on trunk heterogeneous, small, conical, weakly keeled, granular scales intermixed with unevenly scattered, larger rounded un-keeled tubercles. Tubercles in approximately 8 irregular rows at mid-body; 16–18 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Keeled scales and tubercles more prominent on the posterior part of trunk. Scales on nape rounded, slightly smaller than granular scales on dorsum. Larger tubercles more prominent near the flanks, dorsal scales becoming rounder on flanks. Ventral scales smooth, imbricate, slightly larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 28 midbody scale rows across belly, 153 scales between mental to anterior border of cloaca; 6 rows of enlarged, rounded, smooth, glossy scales around the precloacal region, forming a unique wave like pattern; 7 precloacal pores (Supplementary Figure S21 F).

Forelimbs short, robust; forearms short ( $FL/SVL = 0.14$ ); hind limbs relatively long; tibia short ( $CL/SVL = 0.19$ ). Scales on palm and sole smooth, granular; scales on inner surface of fore and hind limb smooth, granular; on the dorsal surface granular, conical, larger than the ventral ones. Palm of forelimb with a large, smooth scale at the base of digit I. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; subdigital lamellae of left manus, on digit I: 11, digit II: 16, digit III: 19, digit IV: 20, digit V: 15; of left pes, digit I: 11, digit II: 17, digit III: 19, digit IV: 23, digit V: 18; a row of enlarged scales from the base of 1<sup>st</sup> digit of pes till end of feet present.

Tail moderately long, ( $TL/SVL = 0.90$ ), regrown; tail base distinctly swollen. Scales on tail base conical to imbricate; enlarged tubercles absent. Dorsal tail scales imbricate; single enlarged, subconical, blunt, postcloacal spur present on each side; subcaudal scales smooth, median row scales large, irregular, with a single keel.

**Colouration in life** (Figure 3H): Dorsal colour of head, body, limbs and tail overall grey to black; dorsum from neck till beyond mid body turmeric yellow; distinct bluish white stripes on the head. A distinct yellow band across the shoulder, starting at the anterior junction of forelimbs; yellow band bordered with obscure black towards the edges. Six to seven bluish white spots longitudinally along mid vertebral from the centre of the yellow band to base of the tail; spots continue on the anterior part of tail as blotches; tail with whorls of bluish white conical tubercles. Dorsum spotted with bluish white tubercles, spots prominent towards the sides; few indistinct black spots on the dorsum, intermixed with the blue white spots. Head grey with a bluish white stripe from above the nostril to dorsal margin of eye, continuing backwards across the extra-brillar fringe, joining at the back of head forming a roughly rhombus shape encircling the head. The tapering end of the rhombus encloses a dark elliptical black spot. Snout with a small obscure light grey marking followed by a roughly rectangular hollow mark between the eyes; the corners of the rectangle with short angular markings. Forehead with a few pale bluish markings forming a broken circular mark. Lateral side of the head with a pale bluish stripe from first supralabial to the eye, extending

backwards from posterior corner of the eye ending abruptly behind the head. Another small stripe from lower end of eye meeting labial stripe at the end of mouth opening. Supralabials bluish, continuing backwards as a stripe ending just above the ear opening. Infralabials speckled with dark grey to black; a thick stripe below the infralabials along the lower jaw, slightly below the ear opening ending at the start of neck. A distinct white spot on the shoulder surrounded by thick black ring, between the ear opening and forelimb. Pupil black surrounded by thin yellowish orange ring followed by dirty red iris. Limbs pale bluish grey; forelimbs uniform, intermixed with few black scales; hindlimbs roughly banded with bluish white spots; digits alternating with light and dark spots. Ventrals uniform bluish black, scales around the precloacal pores glossy; throat darker, with a rough bluish band parallel to infralabials, from postmentals to edge of neck; a distinct bluish white spot inner to the jaw end on each side. Ventral surface of the tail uniform, dark bluish black.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 27–31 midventral scale rows and 153–159 ventrals; 9–11 lamellae on digit I and 20–22 on digit IV of manus, 9–11 lamellae on digit I and 23–25 lamellae on digit IV of pes; 6–8 labial scales; first pair of postmentals strongly separated by an enlarged median scale in CESL 511 and CESL 513; CESL 513 with entire regenerated tail, subcaudal scales irregular. *C. galaxia* **sp. nov.** shows strong sexual dichromatism; colouration in male paratypes CESL 513 overall similar to holotype except head markings brighter; short bands on the forehead; middorsal spots forming a light stripe; tail regrown, uniform bluish black; ventral similar with two spots at the end of throat on each side (Supplementary Figure S18 G). Colouration in female paratype CESL 511 is as follows (Supplementary Figure S18 F): dorsal colour of body, limbs and tail pale brown, neck pale orangish brown. Markings indistinct, much narrower than in males, pale grey. Dorsum with scattered distinct large black spots, 2–3 rows towards the sides; middorsal black spots roughly paired. Shoulder band incomplete, visible only on side as narrow pale buff stripe. Tail dull brown with lighter yellow conical tubercles. Black spot behind the head distinct, bordered by with narrow buff stripes forming ‘V’ mark; labial scales glossy amber coloured. Ventral uniform pale grey to white.

**Distribution:** *Cnemaspis galaxia* **sp. nov.** is currently known from a single site in low elevation forests (250 m asl) on the eastern slopes of Megamalai Hills in the SWG. During this study, it was recorded from near Shenbagathoppu in Srivilliputhur Grizzled Squirrel Wildlife Sanctuary, Tamil Nadu.

**Ecology and natural history:** *Cnemaspis galaxia* **sp. nov.** is a diurnally active rock dwelling gecko, restricted to the forests of the SWG. During this study, individuals were found to be active on boulders and rocks near a dry stream bed in riparian forests during the day. One individual was also found hiding in the crevice of a rock along a forest trail. One gravid female was also found on a rock near waterfall. This hints that the breeding period for this gecko might be around the month of December. All the observed individuals were found in shaded places inside forests and were quick to escape within the gaps of boulders on approach.

## *Cnemaspis nigriventris* sp. nov.

(Figure 3I, S14, S18, S22; Supplementary Table S4, S5, S8)

urn:lsid:zoobank.org:act:6EB87455-5E48-4ACA-8CDD-9BCDE5E2EA73

**Holotype:** BNHS 2619, adult male, (Figure 3I) collected from gaps between rocks along a forest trail (Supplementary Figure S18 J), Achankovil Reserve Forest (9.127 °N, 77.177°E; 207 m asl) by Saunak Pal and Mrugank Prabhu on 25<sup>th</sup> May 2011.

**Paratypes:** CESL 264, adult male and CESL 265, juvenile; collected along with the holotype.

**Etymology:** The species epithet is derived from the combination of Latin word ‘*niger*’ meaning black and ‘*venter*’ meaning belly, due to the distinct black ventral colouration in the male of this species.

**Suggested common name:** Black bellied day gecko.

**Lineage diagnosis:** *Cnemaspis nigriventris* sp. nov. can be readily discerned on a phylogenetic tree and is sister to *C. nairi* with strong support (BPP 1/UF 100) (Figure 2). It is characterized by shallow genetic divergence at the 16s rRNA gene of 1.9–2.1% from *C. nairi* and high to very high genetic divergence (>8.0%) from other members of the *beddomei* clade (Supplementary Table S2).

**Diagnosis and comparison:** A medium sized *Cnemaspis* species (SVL up to 38.2 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with rounded, regularly arranged tubercles; absence of spine like tubercles on the flank; paired postmentals separated by 1 median scale; 13–14 rows of middorsal tubercles; ventrals small, smooth, 154–159 scales from mental to cloaca; 38–40 midventral scales; one postcloacal spur on each side; males with 6–7 precloacal pores, femoral pores absent; subcaudals smooth, median row enlarged, with two slightly smaller scales alternating single larger one; 7–8 supralabials to the angle of jaw; an enlarged metacarpal scale below digit I; few subdigital lamellae on proximal series fragmented followed by entire, distal lamellae entire; 24–25 lamellae on digit IV of pes.

*Cnemaspis nigriventris* sp. nov. can be distinguished from other members of the *beddomei* clade by a combination of the following characters: smaller body size, max SVL 38.2 mm (*versus* larger body size, max SVL more than 40 mm in *C. beddomei*, *C. anamudiensis*, *C. maculicollis*, *C. rubraoculus* sp. nov., *C. nimbus* sp. nov., *C. wallaceii* sp. nov., *C. smaug* sp. nov. and *C. ornata*); an enlarged metacarpal scale present below digit I (*versus* absent in *C. beddomei*, *C. maculicollis*, *C. anamudiensis*, *C. rubraoculus* sp. nov., *C. nimbus* sp. nov., *C. wallaceii* sp. nov., *C. smaug* sp. nov. and *C. ornata*); males with 6–7 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 9–10 in *C. maculicollis*); whorls of enlarged conical caudal tubercles absent (*versus* present in *C. aaronbaueri*, *C. ornata*, *C. regalis* sp. nov. and *C. galaxia* sp. nov.); dorsal tubercles small, rounded (*versus* conical in *C. aaronbaueri*, *C. ornata*, *C. regalis* sp. nov. and *C. galaxia* sp. nov.); 24–25 lamellae on digit IV of pes (*versus* 28–31 in *C. ornata*); tail banded (*versus* tail not banded in *C. aaronbaueri*, *C. regalis* sp. nov. and *C. galaxia* sp. nov.). For further comparison with *C. beddomei*, *C. rubraoculus* sp. nov., *C. nimbus* sp. nov., *C. wallaceii* sp. nov., *C. smaug* sp. nov.,

*C. ornata*, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**, see respective sections (Supplementary Table S8).

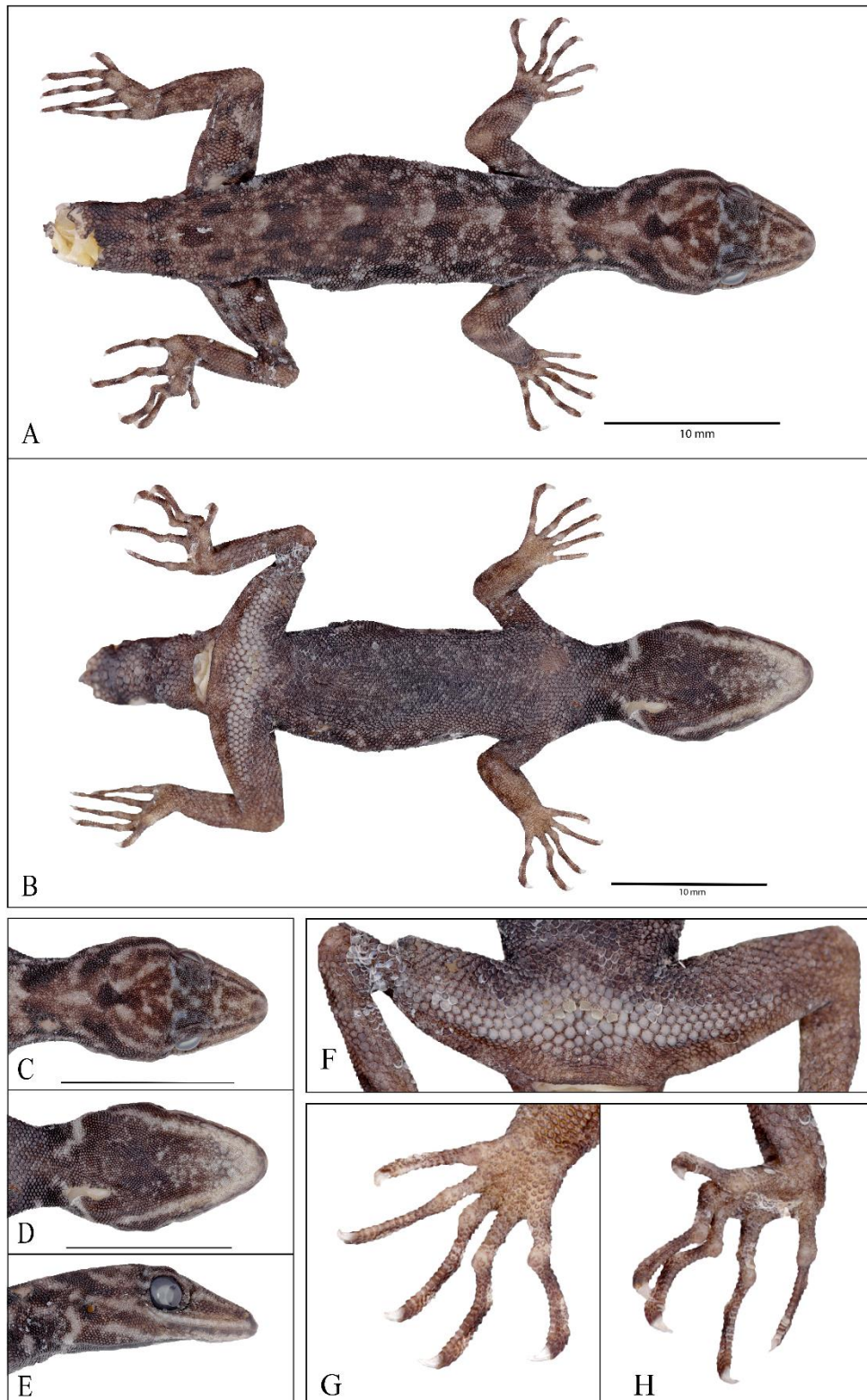
*Cnemaspis nigriventris* **sp. nov.** closely resembles its sister species, *C. nairi*, from which it can be distinguished by 23–25 lamellae on digit IV of pes (*versus* 27–28 in *C. nairi*); 38–40 midbody scale rows across the belly (*versus* 32–33 midbody scale rows); 15–16 tubercles in paravertebral rows (*versus* 20–22); 154–159 ventral scales from mental to cloaca (*versus* 143–147 ventral scales); 13–14 rows of smaller dorsal tubercles (*versus* 16–18 rows of slightly enlarged dorsal tubercles); males with a short broken white bar from below the jaw towards the throat on both sides (*versus* males with a distinct white throat band in *C. nairi*).

**Description of holotype:** BNHS 2619, a medium sized (SVL 36.1 mm) adult male (Supplementary Figure S22). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.66), not strongly depressed (HH/ HL = 0.44) distinct from neck. Snout long (SE/ HW = 0.69) longer than eye diameter (OD/ SE = 0.48); scales on snout and forehead granular, scales on snout smooth, larger than those on interorbital region and forehead; scales on the temporal region small, on the occipital region small, granular intermixed with few scattered, slightly larger, rounded tubercles (Supplementary Figure S22 C). Eyes small (OD/ HL = 0.22), pupil rounded; orbit with extra-brillar fringe composed of small scales, largest anteriorly. Ear opening small, oval (EL/ HL = 0.07); eye to ear distance greater than diameter of eyes (EE/ OD = 1.52). Rostral half as long as wide, partially divided by a median groove and in contact with first supralabial, enlarged supranasals and a single internasal. Supranasals separated by quadrate internasal scale.

Nostrils circular, each surrounded by a postnasal, supranasal and rostral; 2 rows of scales separate orbit from supralabials. Mental roughly triangular, nearly as long as wide, paired postmentals quadrate, smaller than mental and medially separated from each other by a single roughly pentagonal scale; each postmental bounded by 5–6 smooth scales, including median scale. 8 supralabials to the angle of jaw, 6 at midorbital position, 8 infralabials to the angle of jaw, 5 at midorbital position.

Body relatively robust (BW/ TRL = 0.44), not elongate (TRL/ SVL = 0.42). Dorsal scales on trunk heterogeneous, small, granular, rounded scales intermixed with 14 rows of regularly arranged, slightly larger rounded tubercles. 16 tubercles in paravertebral row from occiput to dorsal side of anterior margin of cloaca. Scales on nape rounded, slightly smaller than scales on dorsum. Ventral scales smooth, subimbricate, larger than dorsal; gular and ventral surface of neck with smaller, granular scales; 40 midbody scale rows across belly, 159 scales between mental to anterior border of cloaca; 6–7 rows of enlarged, rounded, smooth, glossy scales around the precloacal region, forming a unique spindle shaped band across the thighs; 6 precloacal pores.





**Supplementary Figure S22.** *Cnemaspis nigriventris* **sp. nov.** holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Forelimbs short, robust; forearms short (FL/ SVL = 0.16); hind limbs relatively long; tibia short (CL/ SVL = 0.20). Scales on palm and sole smooth, granular; dorsal scales of forelimb and hindlimb weakly keeled. Ventral scales of forelimb smooth, granular and that of hindlimb smooth, much larger than forelimb. Digits elongate, slender, all bearing claws that are slightly recurved; 2–3 subdigital lamellae of proximal series fragmented, rest entire, unnotched; subdigital lamellae of left manus, on digit I: 12, digit II: 19, digit III: 21, digit IV: 23, digit V: 19; of left pes, digit I: 11, digit II: 19, digit III: 22, digit IV: 25, digit V: 23; a distinct large metacarpal scale below digit I present at the junction of forearm and palm.

Tail broken, remaining region short, less than half of body length (TL/ SVL = 0.20); tail base swollen. Dorsal scales on tail base small, imbricate, intermixed with few slightly enlarged rounded to subconical scales; on the posterior region small, smooth, subimbricate. Single enlarged, conical postcloacal spur present on each side; subcaudal scales smooth, median row enlarged, composed of large roughly rectangular scale alternating with two slightly smaller subconical scales.

**Colouration in life** (Figure 3I, S18 I): Dorsal colour of head, body, limbs and tail overall dull white to pale grey, with distinct white markings and stripes on head; anterior part of dorsum from behind head to mid body powdered yellow; six black blotches longitudinally along mid vertebral from nuchal region to base of the tail alternating with smaller yellowish white spots; the first and second black markings forming distinct bands on nape and shoulder. The blotches continue on the tail in the form of alternating thick black and white bands. Trunk spotted with scattered big and small black markings; spots more prominent towards the sides. Head dark with a white stripe from above the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye curving upwards to back of head; another white stripe from first supralabial to ventral margin of eye continuing backwards to end of jaw where it meets a white labial stripe which continues till above ear, forming a yellow band behind the head. Another yellow band across the shoulder anterior to the forelimbs. A distinct white spot at the junction of neck and shoulder between the ear opening and forelimb, surrounded by dark black patch. Head with an inverted conical flask shaped black mark, the narrow end being darker, rounded giving a spot like appearance at the junction of head and nape. Pupil black surrounded by thin brick red ring followed by dark dirty red iris. Limbs pale grey, roughly banded with black; digits alternating with light and dark bands. Ventral black, throat black bordered with pale bluish-white scales parallel to the infralabials; a short broken white bar from below the jaw towards the throat on both sides; mental and postmentals pale bluish white. Scales around the cloacal region lighter, glossy. Ventral surface of the tail banded.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 13–14 rows of tubercles around midbody; 38–40 midventral scale rows and ventral 154–159; 12–13 lamellae on digit I and 22–23 on digit IV of manus, 10–12 lamellae on digit I and 24–25 lamellae on digit IV of pes; 7–8 labial scales; 6–7 precloacal pores in males. Colouration in male paratypes CESL 264 overall similar to the holotype. Colouration in juvenile paratype CESL 265 (Supplementary Figure S18 H) as follows: dorsal colour of head, body, limbs and tail dull brown, head stripes buff, indistinct; a distinct black spot at the back of the head. A thick pale-yellow stripe from nape to base of tail, continuing on the tail but lighter. Trunk with 2–3 rows of black spots on both sides of middorsal stripe. Bands on tail indistinct. Ventral pale grey; throat lighter, border with glossy white labials, metal and postmentals.

*Cnemaspis nigriventris* **sp. nov.** shows strong sexual dichromatism. Female specimens observed in field (not collected) had an overall dull brown dorsum with scattered alternating pale white spots and darker grey to black spots; alternating white and black spots continue on tail in the form of thick bands. Trunk with 2–3 rows of black spots on both side of mid dorsum. Shoulder and neck band pale white, indistinct. Head orangish brown with thin, broken buff stripes; a distinct black longitudinal spot behind the head, joining the thin light stripes. Limbs lighter, roughly banded with black and white.

**Distribution:** *Cnemaspis nigriventris* **sp. nov.** is currently known from a single site in low elevation deciduous forests (up to 210 m asl) on the western slopes of the SWG. During this study, it was recorded from Achankovil Reserve Forest, Kerala.

**Ecology and natural history:** *Cnemaspis nigriventris* **sp. nov.** is a diurnal to crepuscular ground dwelling gecko, restricted to the forests of the SWG. During this study, individuals were found to be active on mud cliff along forest paths (Supplementary Figure S18 J) and on exposed tree trunks at less than knee height in deciduous forests in the early evening (between 1700–1900 hrs). A female specimen (not collected) was also observed feeding on termites near an exposed broken region of a termite hill. On disturbance, the gecko escaped into the hill. *Hemidactylus frenatus* Dumeril & Bibron, 1836 and *Cnemaspis* cf. *australis* were the other gekkonids observed in the habitat.

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## *Cnemaspis beddomei* (Theobald, 1876)

(Supplementary Figure S13 E-G, S14; Supplementary Table S6, S8)

*Gymnodactylus marmoratus* Beddome, 1870

*Gymnodactylus beddomei* Theobald, 1876

**Original description:** *Gymnodactylus marmoratus* Beddome, 1870. Description of some new reptiles from the Madras Presidency. Madras Monthly Journal of Medical Science, i: 31.

**Lectotype:** (Designated by Manamendra-Arachchi et al., 2007) BMNH 1946.9.4.83 (male) SVL 46.6 mm; collected by coll. R.H. Beddome from “under stones on the South Tinnevely and Travancore Hills, 3000–5000 feet”.

**Paralectotype:** (Designated by Manamendra-Arachchi et al., 2007) BMNH 1946.9.4.82 (female) SVL 48.2 mm; BMNH 1946.9.4.84 (male) SVL 42.2 mm and BMNH 1946.9.4.85 (male) SVL 43.9 mm; collection details same as that of lectotype.

**Taxonomic comments:** *Cnemaspis beddomei* was initially described as *Gymnodactylus marmoratus* based on specimens collected from under stones in the South Tinnevely Hills at an elevation of 3000–5000 feet (914–1524 m asl) by coll. R.H. Beddome (Beddome, 1870). Theobald in 1876 replaced the name as *G. beddomei*, since *G. marmoratus* was pre-occupied (Theobald, 1876). The syntype in ZSI, Kolkata (ZSI 5859) was also collected by Col. R.H. Beddome from Tirunelveli, at an elevation of 4000 ft. (1219 msl). Given this information, the type locality is most

likely to be somewhere in high elevations of the Agasthyamalai Hills. Based on our analysis, *C. beddomei* is nested within the *beddomei* clade. Manamendra-Arachchi et al. (2007) provided a thorough description of the lectotype and paralectotype which is similar to our studies on additional collections from Agasthyamalai Hills and ZSI 5859. We provide additional information on diagnosis within members of *beddomei* clade, colouration, distribution and natural history information based on fresh collection from Agasthyamalai Hills.

**Suggested common name:** Beddome's forest gecko.

**Additional materials examined:** CESL 379 and CESL 381 adult males; CESL 380, adult female; collected from rocks along stream in evergreen forest, Kakachi, Agasthyamalai Hills by Saunak Pal and team; ZSI 5859 (Syntype) collected by R.H. Beddome from "Tinnevely, S. India, alt. 4000 ft." (Badly damaged specimen of adult male, lacks limbs and tail).

**Lineage diagnosis:** *Cnemaspis beddomei* can be readily discerned on a phylogenetic tree (Figure 2) and is characterized by high genetic divergence at the 16s rRNA gene of 4.0% from *C. rubraoculus* **sp. nov.** and 5.2% from *C. cf. maculicollis*, and very high genetic divergence (>6.1%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 52.5 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with large, keeled, rounded tubercles more pronounced towards the posterior end; absence of spine like tubercles on the flank; 10–12 rows of middorsal tubercles, 18–19 tubercles in paravertebral rows; ventrals weakly keeled, 154–161 longitudinal scales from mental to cloaca, 30–34 midventral scales; paired postmentals separated by a single broad median scale, each postmental surrounded by 4–5 scales including median scale; males with 6–8 precloacal pores, femoral pores absent; a row of enlarged scales from base of first toe to end of foot; subcaudals smooth, median row with two individual enlarged scales alternating with a pair of slightly smaller ones; 6–7 supralabials to the angle of jaw; 21–23 lamellae on digit IV of pes.

*Cnemaspis beddomei* can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL up to 52.5 mm (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); row of enlarged scales from base of first toe till end of foot (*versus* absent in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); no whorls of enlarged caudal tubercles (*versus* present in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. ornata* and *C. smaug* **sp. nov.**); no enlarged metacarpal scale at the junction of forearm and palm below digit I (*versus* distinct enlarged metacarpal scale below digit I present in *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. nairi*); subdigital lamellae on proximal series entire (*versus* fragmented in *C. ornata*); dorsal tubercles rounded (*versus* conical in *C. ornata*, *C. smaug* **sp. nov.**, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**); one postcloacal spur present on each side (*versus* pair of postcloacal spur present on each side in *C. smaug* **sp. nov.**); males with 6 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*).

*C. beddomei* is superficially similar to *C. maculicollis*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.** and *C. wallaceii* **sp. nov.** It can be distinguished from *C. maculicollis* based on presence of smooth

ventral scales; males with 10 precloacal pores and presence of distinctive white spots on nape. For comparisons with *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.** and *C. wallaceii* **sp. nov.**, see respective sections.

**Colouration in life** (Supplementary Figure S13 E-G): Dorsal colour of head, body, limbs and tail overall yellow to brown, clouded with dark mottling on head, lighter mottling on dorsum; six to seven lighter yellowish blotches longitudinally along mid vertebral from nuchal region to base of the tail alternating with black blotches the anterior and posterior margins of which are undulating. The yellow blotches trail down to the sides in the form of irregular spots. The blotches form alternating light and dark band on the tail. Head dark with a light whitish stripe from above the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye to above ear meeting the first nuchal blotch in the form of broken spots; another pale stripe from second supralabial to ventral margin of eye continuing to margin of ear as spots; a third broken band from last labial joins the above series of spots to the ear. Pupil black surrounded by thick, bright red iris edged with black. Limbs mottled, roughly banded; digits alternating with light and dark bands, white at the joints. Ventrals pale buff, throat white with dark brown to black band parallel to infralabials. Ventral surface of the tail banded, not as prominently as the dorsal. Overall colouration in both sexes similar except, males with rows of glossy marbled scales in the precloacal region forming a unique band and thicker black band on throat.

**Distribution:** *Cnemaspis beddomei* is distributed across high elevation forests (above 1200 m asl) in the Agasthyamalai Hills of the SWG. During this study, it was recorded from Kakachi, Muthukulivayal and near Agasthyamalai peak.

**Ecology and natural history:** *Cnemaspis beddomei* is a nocturnal rock dwelling gecko, restricted to high elevation evergreen forests. During this study, multiple individuals of *C. beddomei* were found to be active on huge boulders along streams at night. They were also observed frequenting rocky caves and crevices in boulders. In a few instances, they were found hiding in the crevices of tree trunks and under rocks in daytime. Gravid females were observed in the monsoon, which hints that the monsoon might be a breeding season for this species like most of its congeners. No other gecko was observed sharing the microhabitat with *C. beddomei*, but in some sites *C. australis* and *C. cf. maculicollis* were observed from similar habitat. Both these geckos were found to be more common below 1300 msl. elevation.

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## *Cnemaspis ornata* (Beddome, 1870)

(Supplementary Figure S14, S23 A-B; Supplementary Table S6, S8)

*Gymnodactylus ornatus* Beddome, 1870

*Cnemaspis ornata* Smith, Fauna of British India, 1935

**Original description:** *Gymnodactylus ornatus* Beddome, 1870. Description of some new reptiles from the Madras Presidency. Madras Monthly Journal of Medical Science, i: 32.

**Lectotype:** (Designated by Manamendra-Arachchi et al., 2007) BMNH 74.4.29.400 (male) SVL 42.0 mm; “South Tinnevelly Hills”.

**Paralectotype:** (Designated by Manamendra-Arachchi et al., 2007) BMNH 74.4.29.401 (male) SVL 41.7 mm; BMNH 74.4.29.404 (juvenile), SVL 26.6 mm; BMNH 74.4.29.405 (female), SVL 37.2 mm; BMNH 74.4.29.406 (juvenile), SVL 25.6 mm; BMNH 74.4.29.407 (juvenile), SVL 26.7 mm; BMNH 74.4.29.408 (juvenile), SVL 27.4 mm and BMNH 74.4.29.409 (juvenile), SVL 22.6 mm; “South Tinnevelly Hills”.

**Taxonomic comments:** *Cnemaspis ornata* was described based on specimens collected from under rocks in the South Tinnevelly Hills by coll. R.H. Beddome (Beddome, 1870). Based on our analysis, *C. ornata* is nested within the *beddomei* clade. Manamendra-Arachchi et al. (2007) provided a thorough description of the lectotype and paralectotype. A recent study showed that BMNH 74.4.29.402 and BMNH 74.4.29.403 (considered as paralectotypes of *C. ornata* by Manamendra-Arachchi et al., 2007) actually belong to the newly described species *C. aaronbaueri* (Sayyed et al., 2019). Based on our observations of the museum specimens as well as fresh collections, we provide additional information on diagnosis from members of the *beddomei* clade, colouration, distribution and natural history information.

**Additional materials examined:** CESL 280 adult female, CESL 276, CESL 281 and CESL 283 adult males; collected from boulders along streams at the edge of evergreen forests, towards Devarmalai Hills on the eastern slopes of the SWG, Tamil Nadu by Saunak Pal and Mrugank Prabhu.

**Suggested common name:** Ornate day gecko.

**Lineage diagnosis:** *Cnemaspis ornata* can be readily discerned on a phylogenetic tree (Figure 2) and is characterized by very high genetic divergence at the 16s rRNA gene of 7.8–8.0% from *C. nairi* and 8.3% from *C. nigriventris* **sp. nov.**, and very high genetic divergence (>9.9%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A large sized, robust *Cnemaspis* species (SVL up to 46.1 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with large, keeled, conical tubercles more pronounced towards the posterior end; absence of spine like tubercles on the flank; 12–14 rows of middorsal tubercles; 21–23 tubercles in paravertebral rows; ventrals smooth, subimbricate; 157–165 longitudinal scales from mental to

cloaca; 33–37 midventral scales; paired postmentals separated by a single broad median scale, each postmental surrounded by 5–6 scales including median scale; pair of postcloacal spur on each side; outer males with 6–7 precloacal pores, femoral pores absent; a row of enlarged scales from base of first toe to end of foot; subcaudals smooth, median row with individual large divided scales alternate pair of slightly smaller ones; 7–9 supralabials to the angle of jaw; subdigital lamellae fragmented on proximal region, distal lamellae entire, 28–31 lamellae on digit IV of pes.

*Cnemaspis ornata* can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL up to 46.1 mm (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); whorls of enlarged conical caudal tubercles (*versus* absent in *C. nairi*, *C. nigriventris* **sp. nov.**, *C. beddomei*, *C. maculicollis*, *C. anamudiensis*, *C. rubraoculus* **sp. nov.**, *C. wallaceii* and *C. nimbus* **sp. nov.**); males with 6–7 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*); dorsal tubercles conical (*versus* rounded in *C. nairi*, *C. nigriventris* **sp. nov.**, *C. beddomei*, *C. maculicollis*, *C. anamudiensis* **sp. nov.**, *C. rubraoculus* **sp. nov.**, *C. wallaceii* and *C. nimbus* **sp. nov.**); no enlarged metacarpal scale below digit I (*versus* a distinct enlarged metacarpal scale present below digit I in *C. aaronbaueri*, *C. nairi*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); 28–31 lamellae on digit IV of pes (*versus* 24–25 in *C. aaronbaueri*, 27–28 in *C. nairi*, 24–25 in *C. nigriventris* **sp. nov.**, 24–28 in *C. regalis* **sp. nov.**, 23–25 in *C. galaxia* **sp. nov.**); 33–37 midventral scales (*versus* 38–40 in *C. nigriventris* **sp. nov.**, 40–44 in *C. regalis* **sp. nov.**, 27–31 in *C. galaxia* **sp. nov.**); tail banded (*versus* tail not banded in *C. aaronbaueri*, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**). For further comparisons with *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.** and *C. smaug* **sp. nov.**, see respective sections.

**Colouration in life** (Supplementary Figure S23 A-B): *Cnemaspis ornata* shows strong sexual dichromatism. Males (Supplementary Figure S23 A): Dorsal colour of head, body, limbs and tail overall grey, with concentric white stripes on head; anterior part of dorsum from behind head to mid body powdered yellow; six to seven lighter white spots longitudinally along mid vertebral from nuchal region to base of the tail. The blotches continue on the tail in the form of alternating thick black and white bands. Posterior part of dorsum spotted with white tubercles surrounded by few more white scales; spots prominent towards the sides. Head dark with a white stripe from above the nostril to dorsal margin of eye, continuing backwards from posterior dorsal corner of eye curving upwards to back of head; another white stripe from first supralabial to ventral margin of eye continuing backwards to end of jaw where it meets a white labial stripe which continues till above ear, forming a yellow band around behind the head. Another yellow band across the shoulder anterior to the forelimbs. A distinct white spot at the junction of neck and shoulder between the ear opening and forelimb, surrounded by dark black scales.

Head with a longitudinal hollow rhombus between the eyes followed by a heart shaped pattern with the broader end on forehead and elongated narrow end extending to the back of the head. The tapering end borders a dark black elliptical spot and the broader part encircles a U-shaped mark on the forehead. Pupil black surrounded by thin yellowish ring followed by dirty red iris. Limbs grey, roughly banded with white; digits alternating with light and dark bands. Ventrals pale white, throat white with dark brown to black band parallel to infralabials; infralabials black bordered by a white stripe. Ventral surface of the tail banded.



**Supplementary Figure S23.** Life colouration of known lineages. A. *Cnemaspis ornata*, adult male, B. *C. ornata* adult female, C. *Cnemaspis nairi* adult male, D. *C. nairi* adult female, E. *C. nairi* juvenile, F. *Cnemaspis indica* juvenile, G. egg clutch of *C. indica* observed in habitat, H. *C. indica* adult male.



Females (Supplementary Figure S23 B): Dorsal colour of head, body, limbs and tail pale brown, with pale broken buff around head. Markings similar to that on males but much paler and not as prominent. Dorsum brown with scattered black and pale white spots. Shoulder band and dorsal spots pale white to buff, tail with alternating dirty black and buff bands. Black spot behind the head distinct, surrounded with indistinct light stripes; labial scales glossy amber coloured. Ventrals pale yellow; throat pale white, dark throat bands absent.

**Distribution:** *Cnemaspis ornata* is currently known from forests on the eastern slopes of the SWG around the Agasthyamalai Hills. During this study, it was recorded from a single site near Devarmalai Hills on the eastern slopes of the SWG, Tamil Nadu.

**Ecology and natural history:** *Cnemaspis ornata* is probably a diurnally active rock dwelling gecko, restricted to the forests of the SWG. During this study, individuals were found to be active on boulders along streams during the day. One individual was also observed on the buttress of a huge tree inside an evergreen forest.

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## *Cnemaspis nairi* Inger, Marx and Koshy 1984

(Supplementary Figure S14, S23 C-E; Supplementary Table S6, S8)

*Cnemaspis nairi* Inger, Marx and Koshy 1984

**Original description:** *Cnemaspis nairi* Inger, Marx and Koshy 1984. An Undescribed Species of Gekkonid Lizard (*Cnemaspis*) from India with Comments on the Status of *C. tropidogaster*. Herpetologica, 40 (2): 149–154.

**Holotype:** NMNHI 30422, adult female collected from Ponmudi, Trivandrum District, Kerala; collected by Robert F. Inger and H. Bradley Shaffer on 16<sup>th</sup> May 1982.

**Paratypes:** NMNHI 30156, 30661, 30765, 30926, 30961, 31044 and 31459; FMNH 216571–79; collection locality same as the holotype by Robert F. Inger, H. Bradley Shaffer, Mammen Koshy and Ramesh Bakde.

**Taxonomic comments:** *Cnemaspis nairi* was described based on a series of specimens collected from mid elevation forestd (600 m asl) at Ponmudi, Kerala by Robert F. Inger, H. Bradley Shaffer, Mammen Koshy and Ramesh Bakde (Inger et al., 1984). The holotype (NMNHI 30422) and a series of paratypes (NMNHI 30156, 30661, 30765, 30926, 30961, 31044 and 31459) deposited in the National Museum of Natural History (New Delhi) are currently considered lost due to a fire at the museum. A series of the paratypes are currently housed in the Field Museum of Natural History (FMNH) Chicago. Inger et al. provided a thorough description of the type specimens which is similar to our field observations and collections (Inger et al., 1984). We provide additional information on diagnosis within members of the *beddomei* clade, colouration, distribution and natural history information based on fresh collections and museum specimens.

**Materials examined:** CESL 712 adult female, collected from Pandimotta, Shendurney Wls, Kerala; CESL 715, adult female from Ambanad Estate, Kerala by S.R. Chandramouli and K.P. Dinesh; FMNH 216572 and FMNH 216573, adult male paratypes, from Ponmudi, Kerala, collected by Robert F. Inger, H. Bradley Shaffer, Mammen Koshy and Ramesh Bakde.

**Suggested common name:** Nair's day gecko.

**Lineage diagnosis:** *Cnemaspis nairi* can be readily discerned on a phylogenetic tree (Figure 2) and shows 0.2% intraspecific genetic divergence at the 16s rRNA gene. It is characterized by shallow genetic divergence of 1.9–2.1% from its closest sister lineage *C. nigriventris* **sp. nov.** and very high genetic divergence (>7.8%) from other members of the *beddomei* clade (Supplementary Table S2).

**Morphological diagnosis and comparison:** A medium sized, robust *Cnemaspis* species (SVL up to 43 mm) characterised by the presence of heterogenous dorsal scales, small granular scales intermixed with large, partially keeled, rounded tubercles more pronounced towards the posterior end; absence of spine like tubercles on the flank; 16–18 rows of middorsal tubercles; ventrals smooth, subimbricate; 143–147 longitudinal scales from mental to cloaca; 32–33 midventral scales; paired postmentals separated by a single broad median scale, each postmental surrounded by 5–6 scales including median scale; one postcloacal spur on each side; males with 7–8 precloacal pores, femoral pores absent; row of enlarged scales from base of first toe to end of foot absent; subcaudals smooth; median row enlarged, subconical, almost twice the adjoining ones; two enlarged scales alternating with pair of slightly smaller ones; 8–9 supralabials to the angle of jaw; few subdigital lamellae on proximal series fragmented followed by entire, distal lamellae entire; 27–28 lamellae on digit IV of pes.

*Cnemaspis nairi* can be distinguished from other members of the *beddomei* clade by a combination of the following characters: larger body size, SVL up to 43 mm (*versus* max SVL less than 40 mm in *C. aaronbaueri*, *C. regalis* **sp. nov.**, *C. nigriventris* **sp. nov.** and *C. galaxia* **sp. nov.**); whorls of enlarged conical caudal tubercles absent (*versus* present in *C. aaronbaueri*, *C. ornata*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.** and *C. smaug* **sp. nov.**); males with 7–8 precloacal pores (*versus* 2–3 in *C. anamudiensis*, 10 in *C. maculicollis*); dorsal tubercles rounded (*versus* conical in *C. aaronbaueri*, *C. ornata*, *C. regalis* **sp. nov.**, *C. galaxia* **sp. nov.** and *C. smaug* **sp. nov.**); an enlarged metacarpal scale present below digit I (*versus* absent in *C. beddomei*, *C. maculicollis*, *C. anamudiensis*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.**, *C. smaug* **sp. nov.** and *C. ornata*); 27–28 lamellae on digit IV of pes (*versus* 24–25 in *C. aaronbaueri*, 28–31 in *C. ornata*, and 23–25 in *C. galaxia* **sp. nov.**); 32–33 midventral scales (*versus* 40–44 in *C. regalis* **sp. nov.**, 27–31 in *C. galaxia* **sp. nov.**); tail banded (*versus* tail not banded in *C. aaronbaueri*, *C. regalis* **sp. nov.** and *C. galaxia* **sp. nov.**). For further comparisons with *C. beddomei*, *C. rubraoculus* **sp. nov.**, *C. nimbus* **sp. nov.**, *C. wallaceii* **sp. nov.** and *C. smaug* **sp. nov.**, see respective sections.

*Cnemaspis nairi* closely resembles its sister species, *C. nigriventris* **sp. nov.** from which it can be distinguished by 27–28 lamellae on digit IV of pes (*versus* 23–25 in *C. nigriventris* **sp. nov.**); 32–33 midbody scale rows across the belly (*versus* 38–40 in *C. nigriventris* **sp. nov.**); 20–22 tubercles in paravertebral rows (*versus* 15–16 in *C. nigriventris* **sp. nov.**); 143–147 ventral scales from

mental to cloaca (*versus* 154–159 in *C. nigriventris* **sp. nov.**); 16–18 rows of slightly enlarged dorsal tubercles (*versus* 13–14 rows of smaller dorsal tubercles in *C. nigriventris* **sp. nov.**); males with a distinct white throat band (*versus* males with a short broken white bar from below the jaw towards the throat on both sides in *C. nigriventris* **sp. nov.**).

**Colouration in life** (Supplementary Figure S23 C-E): *Cnemaspis nairi* shows strong sexual dichromatism. Males (Supplementary Figure S23 C): Dorsal colour of head, body, limbs and tail overall grey to brown with pale stripes on head; anterior part of dorsum from behind head to mid body yellow, fading towards the posterior end; seven to eight dark brown to black spots longitudinally along mid vertebral from nuchal region to base of the tail. The spots continue on the tail in the form of alternating thick black and white bands. Head dark with two pale stripes from behind the eye to back of head, another stripe from first supralabial to ventral margin of eye. A distinct yellow band on the nape, behind the head. Another yellow band across the shoulder anterior to the forelimbs. A distinct white spot at the junction of neck and shoulder between the ear opening and forelimb, surrounded by dark black scales. Head speckled with white and indistinct black markings, a dark black elliptical spot at the back of the head. Pupil black surrounded by thin reddish ring followed by dark iris. Limbs lighter, roughly banded with white; digits alternating with light and dark bands. Ventral uniform bluish grey, throat bordered with bluish white scales along the infralabials; infralabials mental and postmentals bluish white; a distinct white band across the neck from corner of the ear, partially broken at the centre in some followed by thick black gular band. Ventral surface of the tail banded.

Females (Supplementary Figure S23 D): Dorsal colour of head, body, limbs and tail olive to brown, with pale broken buff around head. Markings similar to that in males but much paler and not as prominent. Dorsum brown with scattered black and buff spots. Shoulder band and dorsal spots pale, indistinct; tail with alternating dirty black and olive to buff bands. Black spot behind the head distinct, surrounded with indistinct light stripes; labial scales glossy amber coloured. Ventral pale white to light grey; throat pale white, dark throat band absent. Juveniles (Supplementary Figure S23 E) with a thick creamy buff stripe from nape till base of tail on a dark greyish brown body. Band continues on the head forming darker buff patch covering the head dorsally, single black elliptical spot at the back of the head distinct.

**Distribution:** *Cnemaspis nairi* is currently known from mid elevation forests (600–700 m asl) of the SWG around the Agasthyamalai Hills. During this study, it was recorded from Pandimotta in Shendurney Wildlife Sanctuary and near Ambanad tea estate in Thenmala Reserve Forest in the SWG of Kerala.

**Ecology and natural history:** *Cnemaspis nairi* is mostly a diurnally active ground dwelling gecko, restricted to the forests of the SWG. During this study, individuals were found to be active on rocks in tea estates during the day. One individual was also observed on a rock along a forest path at knee height from the ground. *Cnemaspis australis* was another congener inhabiting the same habitat.

## *littoralis* clade

Members of this clade are characterised by a small to medium, slender body; fairly homogenous dorsal scales; few spine-like tubercles on flank often present, scattered; dorsal scales of tail fairly smooth with a few slightly enlarged subconical scales, more prominent on the sides towards the base of the tail; median row of subcaudal enlarged; proximal lamellae enlarged, plate like; males with more than 10 femoral pores on each side; sexual dichromatism; distributed across the CWG and SWG (Table 1). The *littoralis* clade shows 1.9%–10.3% genetic divergence within its members and 9.1%–18.7% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. Members of this clade include diurnal geckos with scansorial habits, frequenting tree trunks, vertical rocks and mud cliffs. *C. littoralis* was redescribed recently along with the designation of a neotype based on specimens collected from the coasts of Kozhikode district of Kerala (Cyriac & Umesh, 2013). *C. palakkadensis* was recently described from the lowland forests of Palakkad Hills in the CWG (Sayyed et al., 2020). We describe two new lineages from this clade distributed in the high elevations of the SWG. This clade also includes a sub-clade comprising members of the *podihuna* clade from Sri Lanka.

### *Cnemaspis flavigularis* sp. nov.

(Figure 3J, S14, S24, S25; Supplementary Table S4, S5, S9)

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**Holotype:** BNHS 2621, adult male (Figure 3J), collected from the trunk of a tree, Mathikettan Shola National Park, Cardemom Hills, Kerala (9.973°N, 77.245°E; ca. 1340 m asl) by Saunak Pal and team on 27<sup>th</sup> March 2011.

**Paratypes:** BNHS 2622, adult female; CESL 247 and CESL 249, adult males; collected along with the holotype.

**Etymology:** The species epithet is derived from the combination of the Latin word ‘*flavus*’ meaning yellow and ‘*gularis*’ meaning throat, referring to the distinct yellow colouration of the throat in males of the new species.

**Suggested common name:** Yellow throated day gecko.

**Lineage diagnosis:** *Cnemaspis flavigularis* sp. nov. can be readily discerned on a phylogenetic tree and its sister relationship with *C. palanica* sp. nov. and *C. cf. palanica* is strongly supported (BPP 1/ UF 100) (Figure 2). It is characterized by moderate genetic distance at the 16s rRNA gene of 2.8% from *C. palanica* sp. nov. and very high genetic divergence of 8.6–8.8% from *C. littoralis* and 8.8% from *C. palakkadensis* (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small sized, *Cnemaspis* species (SVL up to 33.1 mm) characterised by the presence of homogenous dorsal scales, small, granular; few scattered tubercles on the flank, reduced, subconical; ventrals smooth, subimbricate, 104–108 longitudinal

scales from mental to cloaca, 21–23 midventral scales; three pairs of postmentals, first pair separated by a single median scale, each postmental surrounded by three to four scales including median scale; males with 10 to 12 femoral pores, precloacal pores absent; a pair of small postcloacal spur present; subcaudals smooth, median row enlarged; seven to nine supralabials to the angle of jaw; proximal lamellae enlarged, plate like, followed by much smaller distal lamellae; 16–18 lamellae on digit IV of pes.

*Cnemaspis flavigularis* **sp. nov.** can be distinguished from *C. littoralis* and *C. palakkadensis* of the *littoralis* clade by a combination of the following characters: head moderately wide, HW/ HL: 0.65–0.68 (*versus* head narrow, HW/ HL: 0.58 in *C. littoralis*; 0.57–0.58 in *C. palakkadensis*); males with 10 to 12 femoral pores (*versus* 15–18 in *C. littoralis*; 15–16 in *C. palakkadensis*); 21–23 midventral scales (*versus* 26 midventral scales in *C. littoralis*, 32–38 midventral scales in *C. palakkadensis*); 104–108 longitudinal scales from mental to cloaca (*versus* 122 in *C. littoralis*, 130–134 in *C. palakkadensis*); and black spot on the nape small, indistinct (*versus* presence of a distinct black, subrectangular spot on the nape).

*C. flavigularis* **sp. nov.** closely resembles *C. palanica* **sp. nov.** in overall morphology but can be separated based on a combination of the following characters: tubercles on flank reduced, subconical (*versus* tubercles on flank spinose); 21–23 midventral scales (*versus* 16–18 midventral scales); 10–12 femoral pores separated by 10 to 12 poreless scales (*versus* 12–15 femoral pores separated by 7–8 poreless scales) (Supplementary Table S9).

**Description of holotype:** BNHS 2621, a small sized (SVL 29.8 mm) adult male (Supplementary Figure S24). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.28), moderately wide (HW/ HL = 0.65), strongly depressed (HH/ HL = 0.37) distinct from neck. Snout long (SE/ HW = 0.72) much longer than eye diameter (OD/ SE = 0.39), scales on snout and forehead, smooth, larger than those on the interocular region, those in contact with internasal largest gradually decreasing in size till they reach the interocular area; occipital and temporal region with smaller granular scales, a single slightly enlarged scale above ear opening.

Two slightly enlarged subconical scales, one laterally behind the head and the other posterior to the ear opening (Supplementary Figure S24 E). Eyes small (OD/ HL = 0.18), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening oval, small and oblique (EL/ HL = 0.08); eye to ear distance much greater than diameter of eyes (EE/ OD = 2.35). Rostral as long as wide, partially divided by a median groove and in contact with first supralabial, enlarged supranasals and internasal; a single, small elongated internasal scale separates the supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; two rows of scales separate orbit from supralabials. Mental subpentagonal, nearly as long as wide, paired postmentals sub-quadrate, smaller than mental and medially separated by a small, rounded scale; posteriorly each postmental bounded by three smooth scales, including median scale; nine supralabials to the angle of jaw, seven at midorbital position; eight infralabials to the angle of jaw, seven at midorbital position.

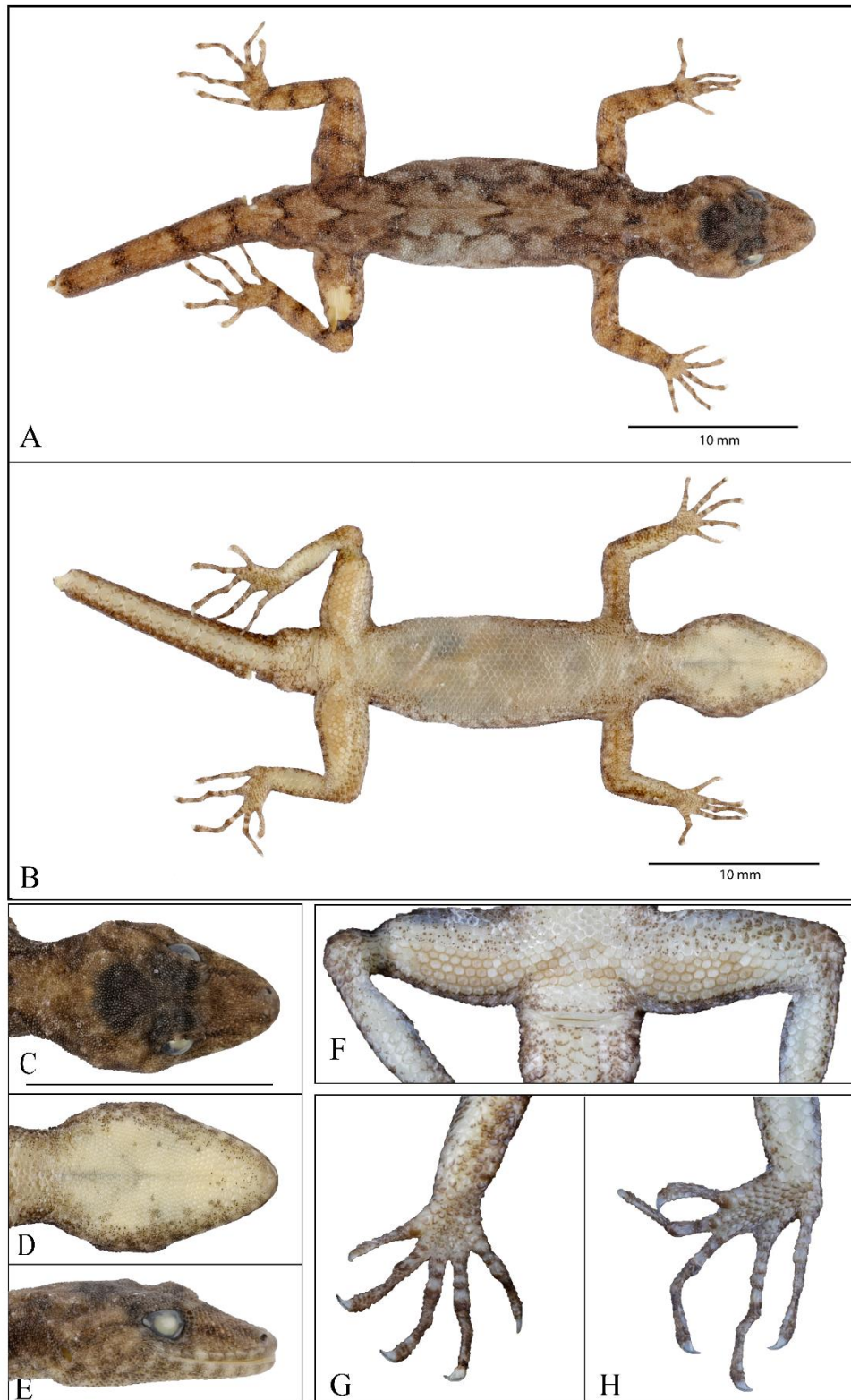
Body relatively robust (BW/ TRL = 0.37), elongate (TRL/ SVL = 0.48). Dorsal scales on trunk homogeneous, small, granular. Scales on nape rounded, slightly smaller than granular scales on

dorsum. Dorsal scales becoming rounder on flanks; six to seven slightly enlarged scales, roughly forming a series from behind the forearm junction to base of the tail; lower flank with another series of subconical, reduced tubercles. Ventral scales smooth, sub-imbricate, slightly larger than dorsal; gular and ventral surface of neck with small, granular scales; slightly larger towards the mental; 22 midbody scale rows across belly, 108 scales between mental to anterior border of cloaca; 10 elongated femoral pores on the left and 11 on the right separated by 12 poreless scales. Forelimbs short, robust; forearms short (FL/ SVL = 0.16); hind limbs relatively long; tibia short (CL/ SVL = 0.20). Scales on palm and sole smooth, granular; scales on inner surface of fore and hind limb smooth, granular; on the dorsal surface granular, conical, larger than the ventral ones. Digits elongate, slender, all bearing claws that are slightly recurved; three to four rows of scales on the femur and above the precloacal region enlarged; subdigital lamellae entire, unnotched; proximal lamellae enlarged, plate like followed by much smaller distal lamellae; subdigital lamellae of left manus, on digit I: 8, digit II: 12, digit III: 13, digit IV: 13, digit V: 11; of left pes, digit I: 8, digit II: 12, digit III: 14, digit IV: 17, digit V: 14.

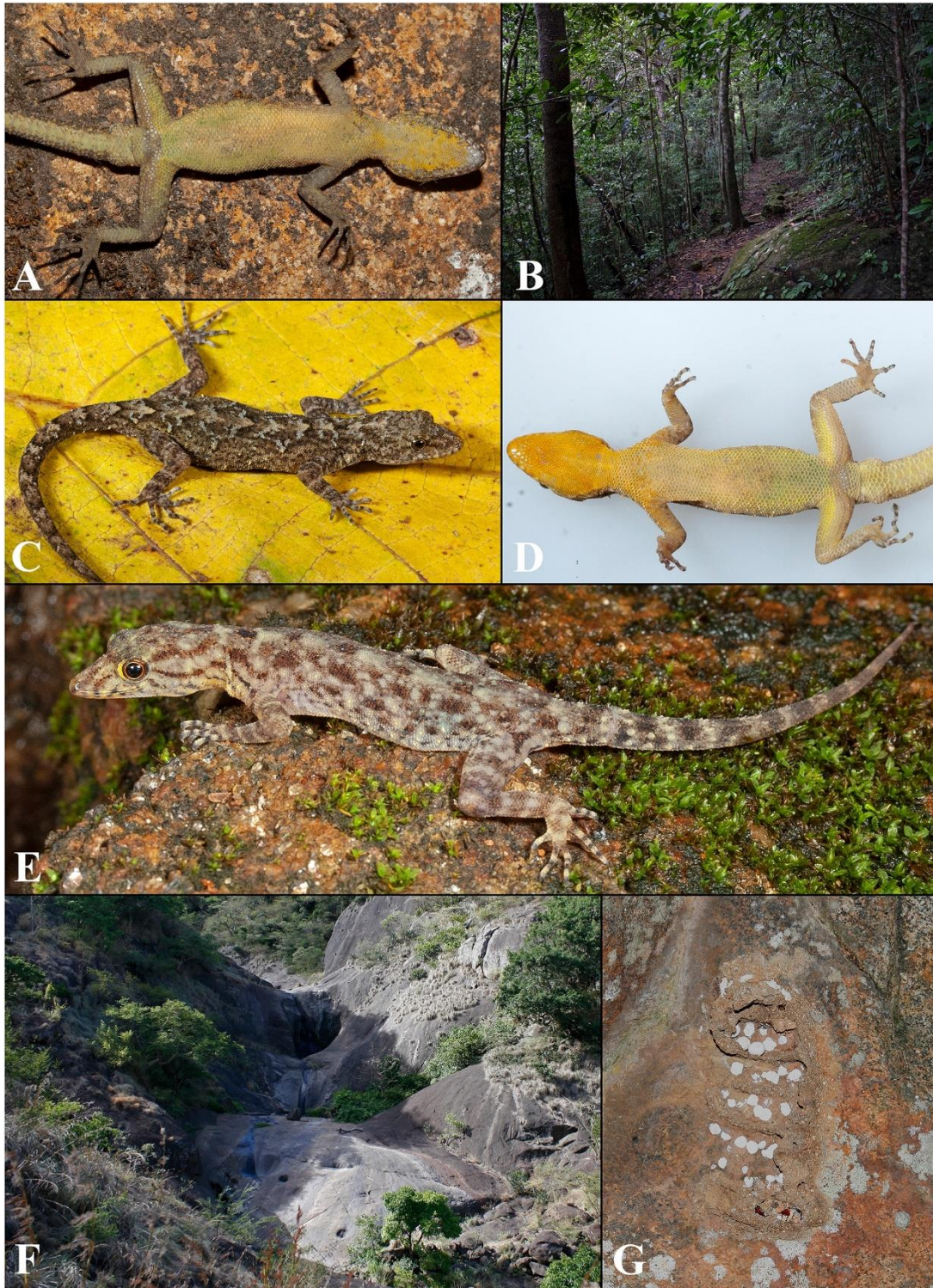
Tail moderately long, incomplete (TL/ SVL = 0.55); tail base distinctly swollen. Scales on tail base conical to imbricate; enlarged tubercles absent. Dorsal tail scales small, imbricate with few slightly enlarged subconical scales, more prominent on the sides towards the base of the tail; single enlarged, conical, postcloacal spur present on each side; subcaudal scales smooth, median row of subcaudals enlarged composed alternating subconical and subpentagonal scales.

**Colouration in life** (Figure 3J, S25 A): Dorsal colour of head, body, limbs and tail overall buff to pale brown, patterned with dark brown and black wavy markings on the dorsum, with dark yellowish brown and black reticulations towards the lateral side; head uniform buff with few darker markings. Mid dorsum with seven pale yellow spots alternating with pale white patch, longitudinally from nape to base of tail. Each yellow spot bordered with black and brown marks on the anterior sides, roughly forming 'W' like the bands across the trunk; the first yellow spot behind the head without black markings on the sides, followed by a small arrow shaped central black spot on nape. The light and dark pattern continue on the dorsal part of tail as alternating broad and narrow indistinct stripes. Lateral part of trunk reticulated with darker brown markings forming undulating pattern across the trunk, larger rounded scales on the flank yellow.

Head with a short dark stripe from the nostril to anterior margin of eye, continues behind the eye as broad broken stripe along the head meeting first yellow spot anterior to nape. Top of the head speckled with darker scales and pale buff striations. Labial scales glossy, dirty yellow edged with dark brown to black; a pale-yellow stripe continues from labials to lower margin of ear. Pupil dark black surrounded by a thin yellowish orange iris edged with broad brick red. Limbs buff, reticulated with darker markings; digits alternating with light and dark bands. Ventrals uniform pale yellow, throat bright yellow, edged with dirty grey and white spots on the sides. Three to four rows of scales in the femoral and precloacal region glossy pale brown forming a roughly band like pattern (Supplementary Figure S25 A). Ventral surface of the tail uniform pale yellow with darker scales towards the edge.



**Supplementary Figure S24.** *Cnemaspis flavigularis* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.



**Supplementary Figure S25.** Life colouration and habitat of new lineages. A. ventral view of holotype of *Cnemaspis flavigularis* **sp. nov.**, BNHS 2621, B. habitat at type locality in Mathikettan Shola National Park, Cardemom Hills, Kerala, C. female paratype of *Cnemaspis palanica* **sp. nov.**, CESL 339, D. ventral view of holotype of *C. palanica* **sp. nov.**, BNHS 2628, E. female paratype of *Cnemaspis jackieii* **sp. nov.**, CESL 193, F. Habitat at type locality in Vairavankulam Reserve Forest, Tamil Nadu, G. communal egg deposition in used potter wasp nests.



**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 21–23 midventral scale rows and 104–108 ventrals; seven to eight lamellae on digit I and 13–14 on digit IV of manus, seven to nine lamellae on digit I and 16–18 lamellae on digit IV of pes; seven to nine labial scales; BNHS 2622 with slightly enlarged median internasal scale separating supranasals, sub equal to supranasals. Dorsal colouration in adult female, BNHS 2622, overall similar as the males, ventral scales including throat region white instead of yellow, femoral pores and glossy scales in the precloacal region absent, missing tail.

**Distribution:** *C. flavigularis* **sp. nov.** is currently known from a few sites in the high elevation wet evergreen forests (above 1300 m asl) of the Cardamom Hills in the SWG. During this study, it was recorded from Mathikettan Shola National Park, Kerala.

**Ecology and natural history:** *C. flavigularis* **sp. nov.** is a diurnally active arboreal gecko restricted to the high elevations of Cardamom Hills. During this study, individuals were found moving actively on tree trunks during the day (10:00–13:00 hrs) inside evergreen forests (Supplementary Figure S25 B). One individual was also found hiding under the bark of a tree in the early evening (17:30 hrs). In one site, *C. nimbus* **sp. nov.** was observed from similar habitat. *C. smaug* **sp. nov.** was also recorded in similar habitat from nearby boulders during this study.

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### *Cnemaspis palanica* **sp. nov.**

(Figure 3K, S14, S25, S26; Supplementary Table S4, S5, S9)

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**Holotype:** BNHS 2628, adult male (Figure 3K), collected from the trunk of a tree, near Kookal, Palani Hills, Tamil Nadu (10.298°N, 77.364°E; ca. 1550 m asl) by Saunak Pal and Mrugank Prabhu on 10<sup>th</sup> July 2011.

**Paratypes:** CESL 340, adult male; CESL 339 and BNHS 2629, adult females; collected along with the holotype.

**Additional referred material:** MNHN-RA-1948.205, adult male collected from Kodaikanal, Tamil Nadu by K. Lindberg.

**Etymology:** The species epithet refers to the ‘Palani Hills’ in the SWG of Tamil Nadu, from where this species is described.

**Suggested common name:** Palani Hills day gecko.

**Lineage diagnosis:** *Cnemaspis palanica* **sp. nov.** can be readily discerned on a phylogenetic tree and is sister to another unidentified lineage, *C. cf. palanica* with moderate support (BPP 0.59/ UF 97) (Figure 2). It is characterized by moderate genetic distance at the 16s rRNA gene of 2.8% from

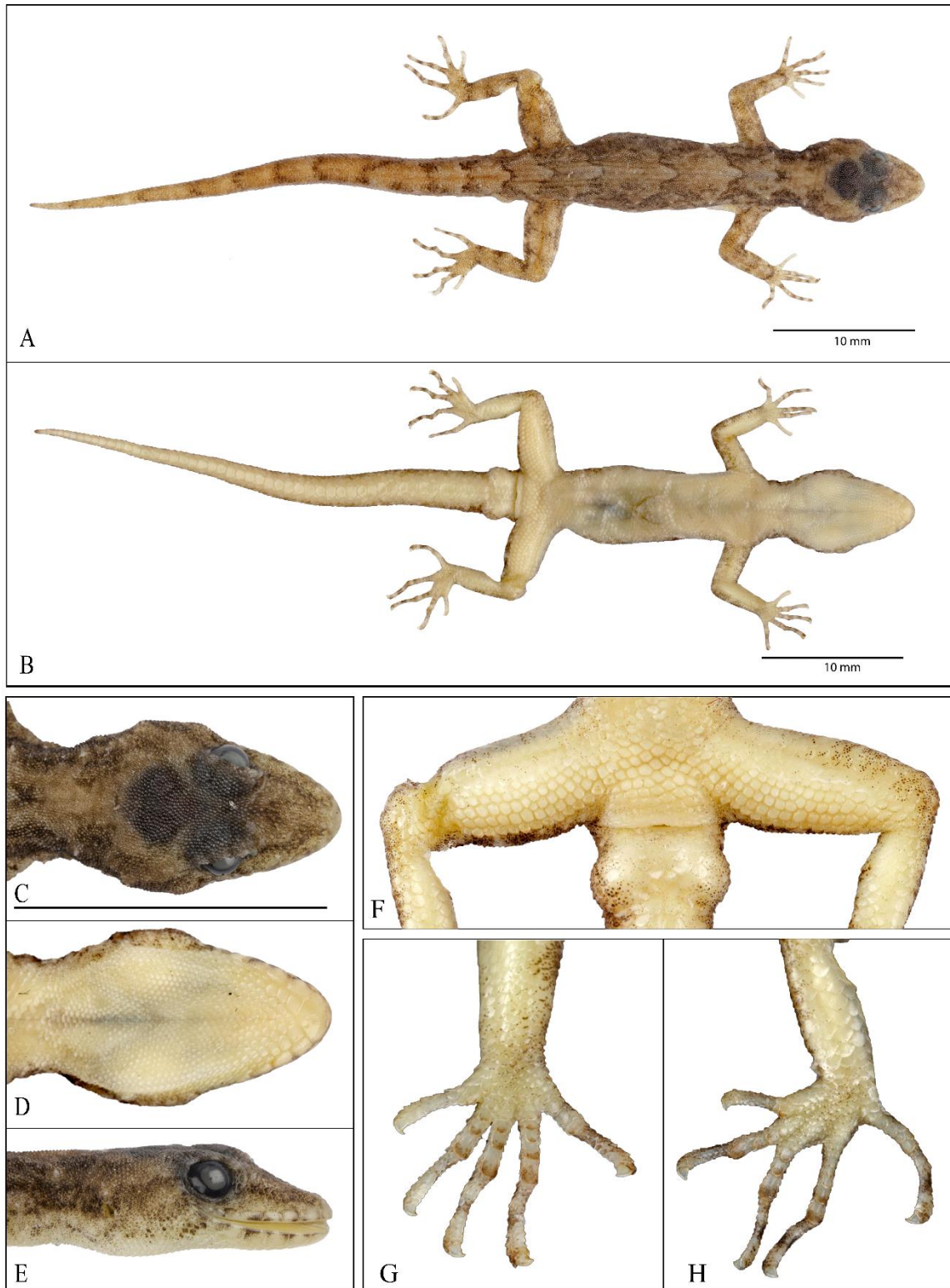
*Cnemaspis flavigularis* **sp. nov.** and very high genetic divergence of 10.0–10.2% from *C. littoralis* and 10.3% from *C. palakkadensis*. (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small sized *Cnemaspis* species (SVL up to 30.6 mm) characterised by the presence of homogenous dorsal scales, small, granular; few scattered tubercles on the flank, spinose; ventrals smooth, subimbricate, 103–106 longitudinal scales from mental to cloaca, 16–18 midventral scales; two to three pairs of postmentals, first pair separated by a single median scale, each postmental surrounded by three to four scales including median scale; males with 12 to 15 elongated femoral pores, precloacal pores absent; a pair of small postcloacal spur present; subcaudals smooth, median row enlarged; seven to eight supralabials to the angle of jaw; proximal lamellae enlarged plate like, followed by much smaller distal lamellae; 17–18 lamellae on digit IV of pes.

*Cnemaspis palanica* **sp. nov.** can be distinguished from *C. littoralis* and *C. palakkadensis* of the *littoralis* clade by a combination of the following characters: head moderately wide, HW/ HL: 0.65–0.70 (*versus* head narrow, HW/ HL: 0.58 in *C. littoralis*; 0.57–0.58 in *C. palakkadensis*); males with 12 to 15 femoral pores (*versus* 15–18 in *C. littoralis*, 15–16 in *C. palakkadensis*); 17–18 lamellae on digit IV of pes (*versus* 14–15 lamellae on digit IV of pes in *C. littoralis*, 14–17 in *C. palakkadensis*); 16–18 midventral scales (*versus* 26–29 in *C. littoralis*, 32–38 in *C. palakkadensis*); and 103–106 longitudinal scales from mental to cloaca (*versus* 122 in *C. littoralis*, 130–134 in *C. palakkadensis*). *C. palanica* **sp. nov.** closely resembles its sister species, *C. flavigularis* **sp. nov.** in overall morphology; for a comparison, see section of *C. flavigularis* **sp. nov.** above (Supplementary Table S9).

**Description of holotype:** BNHS 2628, a small sized (SVL 28.3 mm) adult male (Supplementary Figure S26). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.27), wide (HW/ HL = 0.70), strongly depressed (HH/ HL = 0.37) distinct from neck. Snout long (SE/ HW = 0.75) much longer than eye diameter (OD/ SE = 0.39), scales on snout and forehead, smooth, larger than those on the interocular region, those in contact with internasal largest gradually decreasing in size till they reach the interocular area; occipital and temporal region with smaller granular scales, a single slightly enlarged scale above ear opening. Two enlarged scales, one laterally behind the head prominent, spinose, the other posterior to the ear opening subconical, reduced (Supplementary Figure S26 C). Eyes small (OD/ HL = 0.20), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening oval, small and oblique (EL/ HL = 0.06); eye to ear distance much greater than diameter of eyes (EE/ OD = 2.18) (Supplementary Figure S26 E).

Rostral as long as wide, partially divided by a median groove and in contact with first supralabial, enlarged supranasals and internasal a single, elongated internasal scale separates the supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral; two rows of scales separate orbit from supralabials. Mental subtriangular, nearly as long as wide, paired postmentals sub-quadrangle, smaller than mental and medially separated by a small scale; posteriorly each postmental bounded by three to four smooth scales, including median scale; eight supralabials to the angle of jaw, seven at midorbital position; seven infralabials to the angle of jaw, six at midorbital position.



**Supplementary Figure S26.** *Cnemaspis palanica* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.

Body relatively robust ( $BW/TRL = 0.38$ ), elongate ( $TRL/SVL = 0.45$ ). Dorsal scales on trunk homogeneous, small, granular. Scales on nape rounded, slightly smaller than granular scales on dorsum. Dorsal scales becoming rounder on flanks; six to seven slightly enlarged conical scales, roughly forming a series from behind the forearm junction to base of the tail; lower flank with another series of conical, reduced tubercles. Ventral scales smooth, sub-imbricate, slightly larger than dorsal; gular and ventral surface of neck with small, granular scales; slightly larger towards the mental; 17 midbody scale rows across belly, 105 scales between mental to anterior border of cloaca; 14 elongated femoral pores on the left and 15 on the right separated by eight poreless scales (Supplementary Figure S26 F).

Forelimbs short, robust; forearms short ( $FL/SVL = 0.16$ ); hind limbs relatively long; tibia short ( $CL/SVL = 0.19$ ). Scales on palm and sole smooth, granular; scales on inner surface of fore and hind limb smooth, granular; on the dorsal surface granular, conical, larger than the ventral ones. Digits elongate, slender, all bearing claws that are slightly recurved; three to four rows of scales on the femur and above the precloacal region enlarged; subdigital lamellae entire, unnotched; proximal lamellae enlarged, plate like followed by much smaller distal lamellae; subdigital lamellae of left manus, on digit I: 9, digit II: 12, digit III: 14, digit IV: 15, digit V: 12; of left pes, digit I: 9, digit II: 12, digit III: 16, digit IV: 18, digit V: 15.

Tail moderately long, longer than body ( $TL/SVL = 1.26$ ); tail base distinctly swollen. Scales on tail base conical to imbricate; enlarged tubercles absent. Dorsal tail scales small, imbricate with few slightly enlarged subconical scales, more prominent on the sides towards the base of the tail; single slightly enlarged, conical, postcloacal spur present on each side; subcaudal scales smooth, median row of subcaudals enlarged composed alternating subconical and subpentagonal scales.

**Colouration in life** (Figure 3K, S25 D): Dorsal colour of head, body, limbs and tail overall pale buff, patterned with dark brown and grey wavy markings on the dorsum and reticulations towards the lateral side; head uniform buff with few darker markings. Mid dorsum with five pale yellow indistinct spots alternating with paler patches, longitudinally from nape to base of tail. Each spot bordered with narrow brown marks on the anterior sides, roughly forming 'W' like the bands across the trunk; the first pale yellow spot behind the head preceded by a small central black spot on nape. The light and dark pattern continues on the dorsal part of tail as alternating indistinct stripes. Lateral part of trunk reticulated with darker brown markings forming undulating pattern across the trunk. Head with a short dark stripe from the nostril to anterior margin of eye, continues behind the eye as broad stripe along the head meeting anterior border of ear opening. Top of the head speckled with darker striations. Labial scales glossy, pale yellow. Pupil dark black surrounded by a thin yellowish orange iris edged with broad brick red. Limbs darker buff, reticulated with few dark brown markings; digits alternating with light and dark bands. Ventrals uniform yellow, throat scales bright turmeric yellow. Three to four scale rows in the femoral and precloacal region glossy pale buff forming a roughly band like pattern. Ventral surface of the tail uniform pale yellow.

**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 16–18 midventral scale rows and 103–106 ventrals eight to nine lamellae on digit I and 14–15 on digit IV of manus, eight to nine lamellae on digit I and 17–18 lamellae on

digit IV of pes; seven to eight labial scales; supranasals almost touching each other anteriorly, separated at the posterior aspect by small triangular internasal scale in CESL 339; CESL 340 with 12 femoral pores on each side separated by seven poreless scales. BNHS 2629 and CESL 339 (Supplementary Figure S25 C), adult females, with overall similar colouration as the males except dorsum slightly darker, ventral scales including throat region pale white to grey intermixed with few darker scales, femoral pores and glossy scales in the precloacal region absent.

**Distribution:** *C. palanica* **sp. nov.** is currently known from the high elevations (above 1500 m asl) of the Palani Hills in the SWG (Supplementary Figure S14). During this study, it was recorded from a high elevation mountain slope near Kookal village in the Palani Hills of Tamil Nadu. We found a single male specimen of *C. palanica* **sp. nov.** collected from Kodaikanal, Tamil Nadu in the collection of MNHN deposited as *C. jerdonii*.

**Ecology and natural history:** *C. palanica* **sp. nov.** is a diurnally active gecko restricted to the high elevation region of the Palani Hills. During this study, individuals were found on mud cliffs along trails on mountain slopes during the day (ca. 15:00 hrs). One gravid female was also found on the trunk of a nearby tree. The presence of a gravid female in July signifies that the monsoon might be a potential breeding season for this species. The habitat comprised of open terrace farms, fragmented evergreen forest patches and open land. *Dravidogecko* cf. *tholpalli* was found sharing the habitat during this study.

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## *indica* clade

Members of this clade are restricted to the high elevations of the Nilgiri Hills in the CWG (Supplementary Figure S8). They are characterised by a small to medium sized, stout body; roughly homogenous, small mid-dorsal scales; small, subconical spine like tubercles present on the flanks, absent in *C. indica*; a pair of conical postcloacal tubercle present; adult males with 4–6 femoral pores and without preanal pores (Table 1). The *indica* clade shows 1.7%–3.8% genetic divergence within its members and 6.4%–17.0% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. Members of this clade are either diurnal, crepuscular or nocturnal in habit and are mostly ground dwelling, inhabiting small rocks, tree buttresses and crevices. We redescribe *C. indica* and provide diagnostic characters, distribution and natural history information based on existing as well as fresh collections from the Nilgiri Hills. *C. nilagirica* and *C. anandani* were described recently based on fresh collections from the WG (Cyriac et al., 2019; Murthy et al., 2019).

### *Cnemaspis indica* (Gray, 1846)

(Supplementary Figure S8, S23 F-H; Supplementary Table S6)

*Goniodactylus indicus* Gray, 1846

**Original description:** *Goniodactylus indicus* Gray, 1846. Description of some new species of Indian lizards. The Annals and magazine of natural history, including zoology, botany and geology; xviii: 429–430.

**Lectotype:** (Designated by Manamendra-Arachchi et al., 2007) BMNH 46.11.22.22b (male), SVL 29.3 mm, “Madras”.

**Paralectotype:** (Designated by Manamendra-Arachchi et al., 2007) BMNH 46.11.22.22a (male), SVL 30.4 mm and BMNH 46.11.22.22c (female), SVL 30.0 mm; “Madras”.

**Taxonomic comments:** *Cnemaspis indica* was initially described as *Goniodactylus indicus* by J. E. Gray based on specimens sent to the British Museum by T.C. Jerdon (Gray, 1846). Jerdon collected these specimens from under stones at Dodabetta peak in the Nilgiri Hills and also mentioned that he had seen this species in Coorg (Jerdon, 1853). Given this information, the type locality of *C. indica* lies in the high elevations the Nilgiri Hills of Tamil Nadu. Based on our analysis of specimens collected from Nilgiri Hills, we find *C. indica* to be nested within the *indica* clade. Manamendra-Arachchi et al. (2007) designated a lectotype and two paralectotypes from the above specimens in NHM, London and provided a thorough description of the lectotype. The lectotype description is similar to our observations of fresh collections from the Nilgiri Hills. We provide additional information on diagnosis within members of the *indica* clade, colouration, distribution and natural history information based on fresh collections.

**Suggested common name:** Nilgiri ground gecko

**Additional materials examined:** CESL 139, adult male collected from near Sispara peak; CESL 291, adult male, and CESL 292, adult female, collected from near Upper Bhavani, Mukurthi National Park; and CESL 307, juvenile, collected from Doddabetta Peak, Tamil Nadu by Saunak Pal, Mrugank Prabhu and S.P. Vijayakumar.

**Lineage diagnosis:** *Cnemaspis indica* can be readily discerned on a phylogenetic tree (Figure 2) and is characterized by shallow genetic distance at the 16s rRNA gene of 1.7% from *C. nilagirica* and moderate genetic divergence of 3.8% from *C. anandani*. (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small to medium sized, robust *Cnemaspis* species (SVL up to 35.6 mm) characterised by the presence of small imbricate, homogeneous dorsal scales, carinate; dorsal scales on limbs tricarinate; absence of spine like tubercles on the flank; ventrals smooth bordered by 2–3 rows of keeled scales towards the sides, imbricate; gular and throat scales keeled; 94–103 longitudinal scales from mental to cloaca, 17–20 midventral scales; two pairs of postmentals, first pair separated by a single median scale, each postmental surrounded by 3–4 scales including median scale; males with 4–5 femoral pores, precloacal pores absent; a pair of conical postcloacal spur present; subcaudals smooth, median row enlarged, subpentagonal; seven supralabials to the angle of jaw; 13–14 lamellae on digit IV of pes.

*Cnemaspis indica* can be distinguished from other members of the *indica* clade by a combination of the following characters: smaller body size, SVL up to 35.6 mm (*versus* max SVL 47.0 mm in *C. nilagirica*, and max SVL 41.2 mm in *C. anandani*); spine like tubercles on flank absent (*versus* present in *C. nilagirica*, and *C. anandani*); dorsal scales imbricate (*versus* granular in *C. nilagirica*, and *C. anandani*); ventrals smooth, gular keeled (*versus* ventral and gular scales keeled in *C. nilagirica*, ventral and gular scales smooth in *C. anandani*); 13–14 lamellae on digit IV of pes (*versus* 16–17 in *C. anandani* and 17–19 in *C. nilagirica*).

**Colouration in life** (Supplementary Figure S23 F-H): Dorsal colour of head, body, limbs and tail overall dark brown to black, reticulated with yellow to red striations; a thin middorsal stripe often present; head uniform with few lighter scattered markings. Lateral part of trunk with yellow to red reticulations forming irregular longitudinal markings and spots along the lateral side of trunk from behind head to hindlimb. Tail paler than the dorsum with obscure alternating light and dark markings, forming indistinct bands. Head with two yellow to red spots between jaw end and ear opening; three more spots from behind the ear opening till anterior to the forearm, the last being the largest; another series of spots from behind the posterior margin of eye till behind the head; labial scales glossy grey to brown, few edged with yellow. Pupil dark black surrounded by thin golden yellow to orange iris edged with dirty golden to bronze. Limbs striated with lighter markings; digits alternating with light and dark bands. Ventrals uniform pale grey to white, throat paler grey with few scattered darker spots. Ventral surface of the tail darker, few scattered light and dark spots. Overall colouration similar in both the sexes. Juveniles (Supplementary Figure S23 F) overall reddish brown with pale grey markings along the dorsum, middorsal stripe lighter buff continuing on the tail as a thin black line, posterior part of tail lighter, reddish orange.

**Distribution:** *Cnemaspis indica* is currently known from the high elevation (> 2000 m asl) montane grasslands of the Nilgiri Hills in the CWG. During this study, it was recorded from multiple sites across montane habitats in the Nilgiri Hills of Kerala and Tamil Nadu.

**Ecology and natural history:** *Cnemaspis indica* is probably a crepuscular or nocturnal ground dwelling gecko, restricted to high elevation montane shola grassland habitats in the Nilgiri Hills. They were found concealed under stones during the day. During this study, multiple individuals of *C. indica* were found hiding inside crevices of rocks and under stones in high elevation grasslands during the day (ca 09:00 to 16:00 hrs.). Communal egg clutches composed of more than 15 eggs were found stuck between two rocks in a grassland near Sispara peak in the month of November (Supplementary Figure S23 G). All the individuals recorded during this study were found in grasslands and never from inside shola forests. This was the only species of gecko observed above 2000 m in the Nilgiri Hills.

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### *bangara* clade

Members of this clade are characterised by a medium, slender body; heterogenous dorsal scales; spine like tubercles on flank absent; males with both precloacal and femoral pores; anterior part of tail with enlarged tubercles forming whorls, median row of subcaudals smooth, enlarged; distributed in the Mysore Plateau of Peninsular India (Supplementary Figure S8) (Table 1). All the three members belonging to this clade were described recently from the high elevation rocky habitats at the southern edge of the Mysore Plateau (Agarwal et al., 2020).

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### *girii* clade

Members of this clade are characterised by a small to medium, slender body; heterogenous dorsal scales; spine like tubercles on flank mostly absent, tubercles if present then few, not spinose; males with 2–5 femoral pores on each side, precloacal pores absent; median row of subcaudal not strongly enlarged, subcaudals smooth; distributed in the NWG (Supplementary Figure S9) (Table 1). The *girii* clade shows 2.7%–9.8% genetic divergence within its members and 7.4%–18.4% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. All the members of this clade have been described in the past few years with *C. girii* being the oldest, in 2014 (Khandekar et al., 2019b; Mirza et al., 2014a; Sayyed et al., 2016, 2018).

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## *goaensis* clade

Members of this clade are characterised by a small, slender body; heterogenous dorsal scales, small granular scales intermixed with enlarged, keeled tubercles; presence of distinct spine like tubercles on the flanks; tail with whorls of enlarged, conical caudal tubercles, median row of subcaudal slightly enlarged; males with both precloacal and femoral pores; males with a pair of prominent triangular post cloacal spurs, reduced in females; members of this clade are known from low to mid elevation forests from parts of southern Maharashtra, Goa and northern Karnataka (Supplementary Figure S9) (Table 1). The *goaensis* clade shows 4.3%–17.3% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. Members of this clade are predominantly diurnal, inhabiting vertical surfaces of trees, rocks and boulders. *C. goaensis* was described based on specimens collected from Cancona, Goa (Sharma, 1976). *C. amboliensis* was described recently based on specimens collected from Amboli in the NWG of Maharashtra (Sayyed et al., 2018). We redescribe *C. goaensis* and provide diagnostic characters, distribution and natural history information based on existing as well as fresh collections.

### *Cnemaspis goaensis* Sharma, 1976

(Supplementary Figure S9, S27 A-C; Supplementary Table S6)

**Original description:** *Cnemaspis goaensis* Sharma, R. C., 1976b. Records of the reptiles of Goa. *Records of the Zoological Survey of India*, 71: 152–153.

**Holotype:** ZSI 22100, male, from 'ca. 3 km S. of Forest Rest House, Canacona (Poinguinim)', Goa on 7<sup>th</sup> October 1969.

**Paratypes:** ZSI 22213, ZSI 22214 and ZSI 22215, adult males; ZSI 22216, female; collected along with the holotype.

**Taxonomic comments:** *Cnemaspis goaensis* was described from Cancona in south Goa (Sharma, 1976). Manamendra-Arachchi *et al.*, provided a thorough description of the holotype from the collection of Zoological Survey of India, Kolkata (Manamendra-Arachchi *et al.*, 2007).

Bauer described *Cnemaspis indraneildasii* based on a single subadult female specimen collected from Gund, Karnataka (Bauer, 2002). Recent studies showed the toptotypical *C. indraneildasii* to be genetically identical to *C. goaensis* and Khandekar *et al.*, 2019b considered *C. indraneildasii* as a junior synonym of *C. goaensis* (Khandekar *et al.*, 2019a, 2019b; Sayyed *et al.*, 2018). Results of our molecular study also showed similar results with very low genetic difference, 0.7% (Supplementary Table S2), between *C. goaensis* and the toptotypical *C. indraneildasii*. Morphologically, we were unable to identify any significant difference between specimens from both the localities and hence we agree with the synonymy *C. indraneildasii*. Based on our observations of the type specimens, as well as fresh collection from near the type locality and adjoining habitats, we provide diagnostic characters, distribution and natural history information for *C. goaensis*.

**Suggested common name:** Goan day gecko

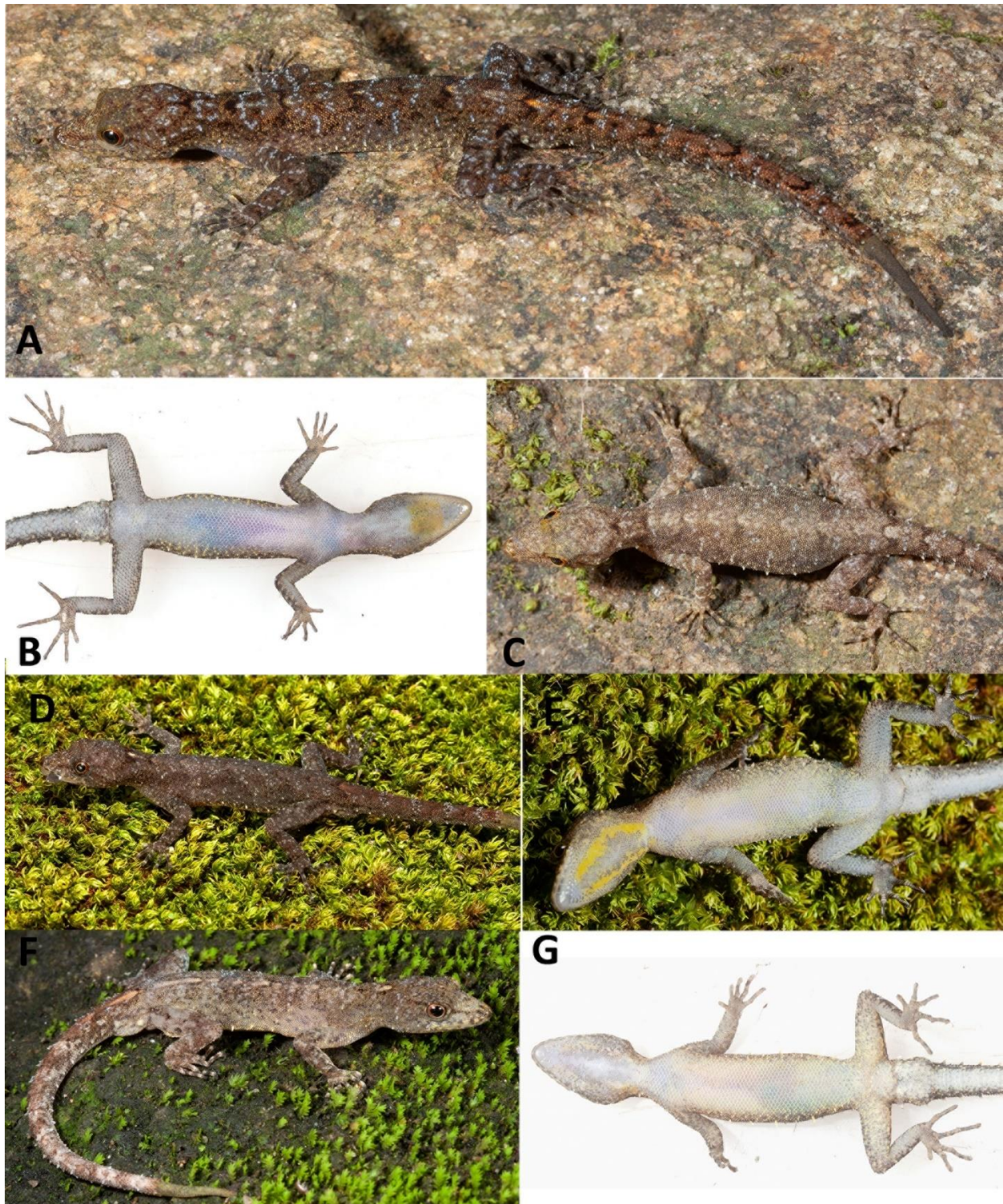
**Additional materials examined:** CESL 686, adult male, and CESL 687, adult female, collected from Cotigaon Wildlife Sanctuary, Goa; CESL 806, adult male, and CESL 807, adult female, collected from Gund, Karnataka by Saunak Pal and Varun Torsekar.

**Lineage diagnosis:** *Cnemaspis goaensis* can be readily discerned on a phylogenetic tree (Figure 2) and shows 0.2–0.9% intraspecific genetic divergence at the 16s rRNA gene. It is characterized by high genetic divergence of 5.7–6.4% from its sister species *C. amboliensis* (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small sized, slender *Cnemaspis* species (SVL up to 31.9 mm) characterised by the presence of heterogenous dorsal scales; small, granular scales intermixed with weakly keeled conical tubercles; 6–8 rows of irregularly arranged keeled dorsal tubercles, paravertebral tubercles irregularly arranged; five to six spine-like tubercles present on the flank. Ventral scales on belly smooth, subimbricate; pectoral scales weakly keeled; 20–25 scales across the belly, 117–119 longitudinal scales between mental to anterior border of cloaca; two to three pairs of postmentals, first pair separated by a single median scale; eight to nine supralabials to the angle of jaw; 16–20 lamellae under digit IV of pes; males with 2–4 femoral pores on each thigh separated on either side by 9–11 poreless scales from 2–3 preloacal pores; tail with 6–8 enlarged, keeled, conical tubercles forming whorls; subcaudals weakly keeled; median row slightly enlarged, subconical, keels prominent towards the tail end.

*Cnemaspis goaensis* is superficially similar to *C. amboliensis* but can be separated based on a combination of morphological characters (Sayyed et al., 2018). See Sayyed et al. (2018) for a detailed comparison.

**Colouration in life** (Supplementary Figure S27 A-C): Dorsal colour of head, body, limbs and tail buff to yellowish-brown; marked with white and dark streaks and pale blotches, head uniform brown reticulated with few darker markings. Mid dorsum with six to seven pale yellow spots bordered with transverse broad dark markings, forming obscure bands towards the sides. Darker markings alternating with white striations and pale-yellow markings. A small dark ocellus on occiput flanked by cluster of white scales towards the sides, followed by another single small central black ocellus anterior to the forelimb insertion. The dorsal pattern continues on the dorsal part of tail as alternating indistinct light and dark bands. Lateral part of trunk reticulated with irregular white and brown streaks, spine like tubercles pale yellow. Head with a short dark stripe from the nostril to anterior margin of eye, continues behind the eye as three short radiating stripes, labial scales glossy amber to yellow. Pupil dark black surrounded by a thin golden yellowish iris edged with broad yellow orange. Limbs darker, reticulated with few lighter markings; digits alternating with light and dark bands. Ventrals uniform white to pale grey, throat often with a cluster of pale-yellow scales forming blotch at the centre, prominent in males.



**Supplementary Figure S27.** Life colouration known lineages. A. *Cnemaspis goaensis* adult male, dorsal view, B. *C. goaensis* adult male, ventral view, C. *C. goaensis* adult female, D. *Cnemaspis australis* adult male, dorsal view, E. *C. australis* adult male, ventral view, F. *Cnemaspis monticola* adult male, dorsal view, G. *C. monticola* adult male, ventral view.

**Distribution:** *Cnemaspis goaensis* is currently known from low to mid elevation (up to 700 m asl) moist forests in the NWG. During this study, it was recorded from multiple sites in the forests of Madai WLS, Cotigaon WLS and Netravali WLS in Goa; and Gund, Ganeshgudi near Dandeli-Anshi Tiger Reserve in northern Karnataka.

**Ecology and natural history:** *Cnemaspis goaensis* is predominantly a diurnal gecko with scansorial habits, restricted to low to mid elevation moist forests. During this study, individuals of *C. goaensis* were often found to be active on tree trunks during the day. Some individuals were also observed on walls of culverts as well as taking shelter within abandoned structures near forests. Gravid females were observed in the monsoon. *C. cf. flaviventralis*, *C. heteropholis*, *Hemidactylus prashadi* and *H. cf. frenatus* were the other gekkonid lizards observed occupying similar habitats in some of the sites during the study.

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### *mysoriensis* clade

Members of this clade are characterised by a small to medium, slender body; heterogenous dorsal scales; spine like tubercles on flanks mostly absent, tubercles if present then not spinose; males with both preloacal and femoral pores; tail with enlarged tubercles forming whorls, median row of subcaudals not prominently enlarged; distributed in the Eastern Ghats and Mysore Plateau in Peninsular India (Supplementary Figure S8, S9) (Table 1). The studied members of *mysoriensis* clade show 5.0%–10.2% within clade genetic divergence and 5.9%–19.2% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. *C. mysoriensis* has been redescribed with the designation of a neotype based on specimens collected from the type locality (Giri et al., 2009a). Other than *C. mysoriensis*, all other members of this clade have been described from 2000 onwards (Das & Bauer, 2000; Giri et al., 2009a; Khandekar et al., 2020a; Srinivasulu et al., 2015).

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## *gracilis* clade

Members of this clade are characterised by a small to medium sized, relatively slender body; dorsal scales heterogenous, partially keeled granular scales intermixed with strongly keeled conical tubercles; spine-like tubercles on the flank absent; tail with enlarged, strongly keeled, conical tubercles forming whorls; a pair of conical postcloacal tubercle present; males with both precloacal and femoral pores; strong sexual dichromatism (Table 1). Comprises four known lineages viz. *C. gracilis*, *C. agarwali*, *C. shevaroyensis* and *C. thackerayi* of which the latter three were described recently from the Eastern Ghats (Khandekar, 2019; Khandekar et al., 2019a) (Supplementary Table S9). The studied members of the *gracilis* clade show 5.2%–18.2% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. This is the only clade of *Cnemaspis* with members occurring both in the WG and the Eastern Ghats (Supplementary Figure S8, S14). *Cnemaspis gracilis* was described by Beddome in 1870 based on specimens collected from under stones in the Palghat Hills (Beddome, 1870; Manamendra-Arachchi et al., 2007). Here, we describe a new lineage belonging to this clade based on its phylogenetic position, genetic divergence and morphological characters. A thorough redescription of *C. gracilis* based on fresh collections from the type locality will be provided elsewhere.

### *Cnemaspis jackieii* sp. nov.

(Figure 3L, S14, S25, S28; Supplementary Table S4, S5, S10)

urn:lsid:zoobank.org:act:A7DB6E6A-4F98-4044-B0B4-3CA6A119C71C

**Holotype:** BNHS 2620, adult male, (Figure 3L) collected from a boulder next to a stream, near Karuppanadhi dam, Vairavankulam Reserve Forest, Tamil Nadu (9.170°N, 77.277°E; ca. 750 m asl) by Saunak Pal and Mrugank Prabhu on 29<sup>th</sup> May 2011.

**Paratypes:** CESL 192, adult male, and CESL 193, adult female, collected along with the holotype.

**Etymology:** The species epithet is a patronym as a tribute to the famous actor and martial artist Jackie Chan. The new species was found to be very fast and moved rapidly on rock boulders, sneaking into the smallest crevices to escape when approached, reminiscent of the stunts of Jackie Chan. His many screen characters as an explorer and adventurer have been an inspiration for the authors.

**Suggested common name:** Jackie's day gecko.

**Lineage diagnosis:** *Cnemaspis jackieii* sp. nov. can be readily discerned on a phylogenetic tree and its sister relationship with *C. gracilis* is strongly supported (BPP 0.98/ UF 98) (Figure 2). It is characterized by moderate genetic distance at the 16s rRNA gene of 2.6% from *C. gracilis* and high genetic divergence (>5.0%) from other lineages (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small sized *Cnemaspis* species (SVL up to 31.3 mm) characterised by the presence of heterogenous dorsal scales, small, weakly keeled, granular

scales intermixed with strongly keeled conical tubercles; spine-like tubercles on the flank absent; 8–9 rows of dorsal tubercles, 11–12 tubercles in paravertebral rows. Ventral scales on belly smooth, subimbricate, 28–31 scales across the belly, 119–125 longitudinal scales between mental to anterior border of cloaca; two pairs of postmentals, first strongly in contact with each other; seven to eight supralabials to the angle of jaw; 21–22 lamellae under digit IV of pes; males with 5–6 femoral pores on each thigh separated on either side by 9–11 poreless scales from 3–4 precloacal pores; precloacal pores separated medially by 1–2 poreless scale; tail with enlarged, strongly keeled, conical tubercles forming whorls; median row of subcaudals smooth, enlarged; presence of two single dorsal ocelli on occiput and between forelimb insertions, a smaller pair on either side just anterior to forelimb insertion.

*Cnemaspis jackieii* **sp. nov.** can be distinguished from other members of the *gracilis* clade by a combination of the following characters: smaller body size, SVL up to 31.3 mm (*versus* max SVL 41 mm in *C. thackerayi*); 11–12 tubercles in paravertebral rows (*versus* 12–17 in *C. agarwali*, 13–17 in *C. shevaroyensis* and 12–14 in *C. thackerayi*); 8–9 rows of dorsal tubercles (*versus* 9–11 in *C. agarwali*, 11–14 in *C. thackerayi*, 10–14 in *C. shevaroyensis* and 11–14 in *C. gracilis*); 21–22 lamellae under digit IV of pes (*versus* 17–20 in *C. agarwali* and 16–20 in *C. shevaroyensis*); 28–31 scales across the belly (*versus* 23–25 in *C. gracilis*, 22–25 in *C. thackerayi*, 21–24 in *C. shevaroyensis* and 24–26 in *C. agarwali*); presence of five to six femoral pores on each thigh and 3–4 precloacal pores separated medially by one or two poreless scales (*versus* 2–4 precloacal pores separated medially by 2–3 poreless scales in *C. shevaroyensis*, 5–9 femoral pores on each thigh and 5–6 precloacal pores separated medially by one or two poreless scales in *C. thackerayi*, 3–5 femoral pores on each thigh and two precloacal pores separated medially by 2–3 poreless scales in *C. gracilis*); 119–125 longitudinal scales between mental to cloaca (*versus* 102–117 in *C. agarwali*, 111–118 in *C. shevaroyensis* and 111–116 in *C. gracilis*) (Supplementary Table S10).

**Description of holotype:** BNHS 2620, a small sized (SVL 31.1 mm) adult male (Supplementary Figure S28). Morphometric & meristic data are summarised in Supplementary Table S4. Head elongate (HL/ SVL = 0.25), wide (HW/ HL = 0.68), strongly depressed (HH/ HL = 0.39) distinct from neck. Snout long (SE/ HW = 0.66) much longer than eye diameter (OD/ SE = 0.46), scales on snout and forehead, smooth, larger than those on the interocular region occipital and temporal region with smaller granular scales, intermixed with slightly larger, roughly rounded, tubercles (Supplementary Figure S28 C). Eyes small (OD/ HL = 0.21), pupil rounded; orbit with extra-brillar fringe composed of small scales that are largest anteriorly. Ear opening oval, small and oblique (EL/ HL = 0.10); eye to ear distance much greater than diameter of eyes (EE/ OD = 1.66). Rostral wider than long, partially divided by a median groove and in contact with first supralabial, supranasals and median elliptical internasal scale that separates the supranasals. Nostrils circular, each surrounded by a postnasal, supranasal and rostral. Two rows of scales separate orbit from supralabials. Mental subtriangular, nearly as long as wide, two pairs of postmentals, inner pair large, roughly rectangular; posteriorly each postmental bounded by three to four smooth scales; seven supralabials to the angle of jaw, six at midorbital position; seven infralabials to the angle of jaw, six at midorbital position.

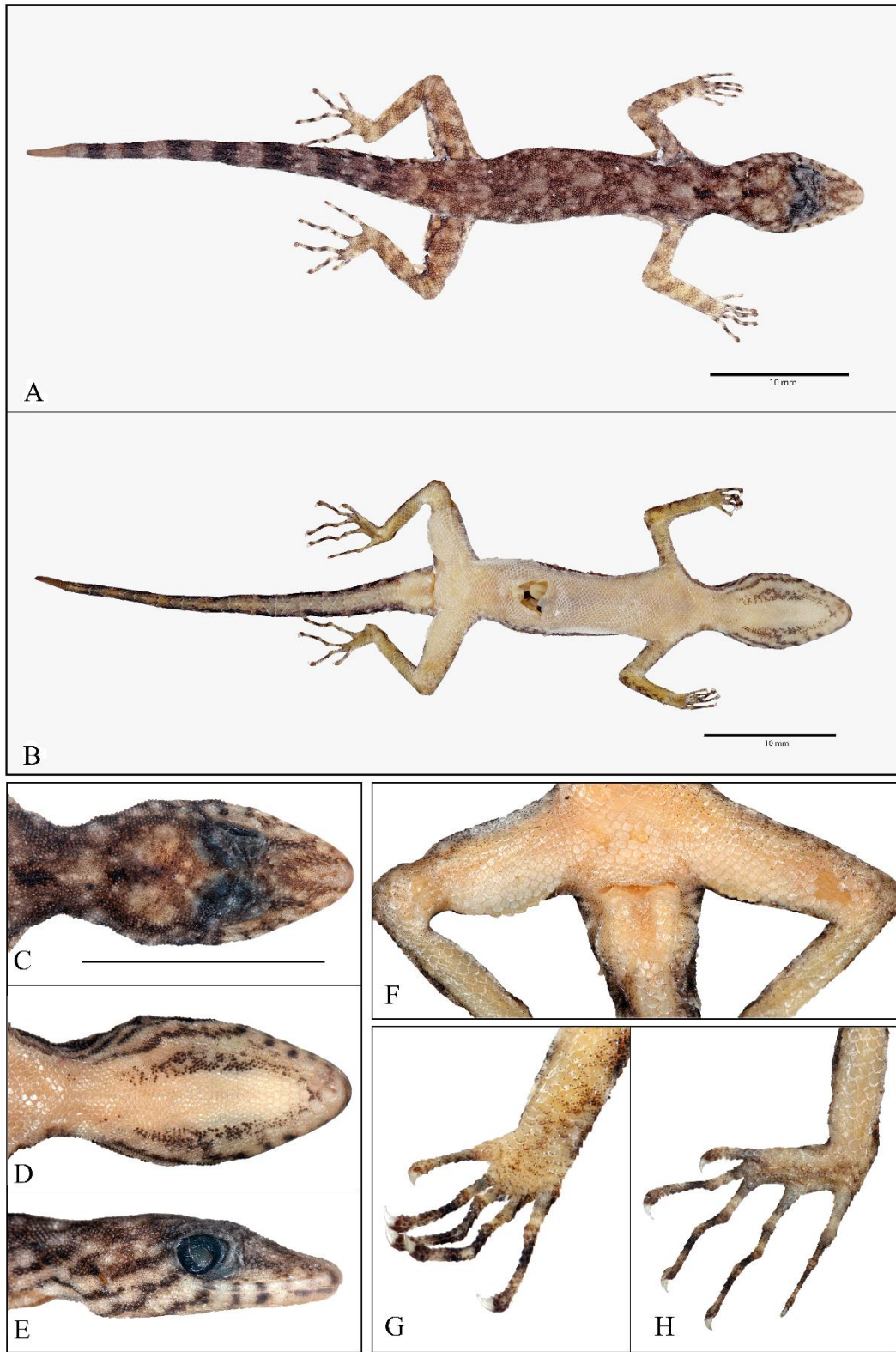
Body relatively slender (BW/ TRL = 0.38), elongate (TRL/ SVL = 0.44). Dorsal scales on trunk heterogeneous, weakly keeled granular scales intermixed with much larger strongly keeled, conical tubercles. Tubercles in approximately 9 longitudinal rows at mid-body; 11 tubercles in

paravertebral row from occiput to dorsal side of anterior margin of cloaca. Scales on nape slightly smaller than granular scales on dorsum. Ventral scales smooth, sub-imbricate, slightly larger than dorsal; gular and ventral surface of neck with slightly elongated scales, imbricate; slightly larger along the mental, juxtaposed; 31 midbody scale rows across belly, 125 scales between mental to anterior border of cloaca; five femoral pores on both sides, separated on both sides by 9 poreless scales from four precloacal pores; precloacal pores separated medially by a single poreless scale.

Forelimbs short, robust; forearms short (FL/ SVL = 0.18); hind limbs relatively long; tibia short (CL/ SVL = 0.21). Scales on palm and sole smooth, rounded; scales on inner surface of fore and hind limb mostly smooth, granular, few rows of lower arm and shank weakly keeled; on the dorsal surface partially keeled, granular, conical, slightly larger than the ventral ones. Digits elongate, slender, all bearing claws that are slightly recurved; subdigital lamellae entire, unnotched; proximal lamellae enlarged, plate like followed by smaller distal lamellae; subdigital lamellae of left manus, on digit I: 9, digit II: 14, digit III: 16, digit IV: 17, digit V: 15; of left pes, digit I: 9, digit II: 15, digit III: 17, digit IV: 21, digit V: damaged, 17 on digit V of right pes.

Tail moderately long, entire, longer than body (TL/ SVL = 1.02); tail base distinctly swollen. Dorsal scales at the base of tail granular, similar in size and shape to granular scales on midbody dorsum, gradually becoming larger, flatter, subimbricate posteriorly, intermixed with slightly enlarged, strongly keeled, conical tubercles forming whorls; single enlarged, conical, postcloacal spur present on each side; subcaudal scales smooth, median row of subcaudals enlarged composed alternating subconical and partially hexagonal scales.

**Colouration in life** (Figure 3L): Dorsal colour of head and body dirty red, limbs suffused with yellow; tail base similar to body dorsum, rest of tail with seven alternating black and pale white bands, regrown tip of tail dirty brown; head patterned with greyish blotches, snout yellow. Dorsum with six pale grey vertebral blotches between limb insertions and one on tail base; smaller light grey spots on rest of dorsum and flanks alternating with dirty red to brown blotches. A small dark ocellus on occiput flanked by larger pale grey blotches followed by another single large central black ocellus anterior to the forelimb insertion; a pair of slightly smaller spots on each side just anterior to forelimb insertions that are larger than occipital spot; all ocelli bordered by reddish-brown scales. Snout with a V shaped dirty red mark originating from nostrils to anterior of intraorbital region; head with pair of short stripes, first from second supralabial to anterior margin of eye and the other from fourth supralabial to lower corner of eye; three postorbital stripes, lower smallest, black from posterior ventral corner of the eye radiating across the jaw end continuing below the ear opening towards the throat forming narrow reticulations; the central broad dark brown, continues laterally behind the eye to anterior to forelimb insertion as a small black streak; the third dorsal stripe continues to the back of head forming broad red circle encompassing a large pale grey spot one each side just anterior to the small ocellus. Labial scales dark yellow banded with black. Pupil dark black surrounded by a thin yellowish orange iris edged with broad brick red; extra-brillar fringe bright yellow. Limbs pale yellow, reticulated with dark brown markings; digits alternating with light and dark bands. Ventrals uniform pale yellow, darker towards the sides and lateral margin of gular region, gular scales pale white in the centre edged with a black broken longitudinal streak outlines yellow of throat, followed by two more prominent streaks within yellow going up to labial scales. Ventral surface of the tail uniform pale grey intermixed with few yellow scales.



**Supplementary Figure S28.** *Cnemaspis jackieii* sp. nov. holotype. A. dorsal view of body, B. ventral view of body, C-E. dorsal, ventral and lateral view of head, F. view of cloacal region showing precloacal pores, G. ventral view of left manus, H. ventral view of left pes. Scale bars 10 mm.



**Variation:** Morphometric and meristic data for the paratypes are presented in Supplementary Table S5. The paratypes agree with the holotype in general morphology and scalation except for the following characters: 11–12 tubercles in paravertebral rows, 8–9 rows of dorsal tubercles, 28–31 midventral scale rows and 119–125 ventral scales from mental to cloaca, 8–10 lamellae on digit I and 16–18 on digit IV of manus, 8–10 lamellae on digit I and 21–22 lamellae on digit IV of pes; seven to eight labial scales; CESL 192, adult male with five femoral pores on left and six on right separated by 11 poreless scales on left and 10 on right from three precloacal pores, precloacal pores with two on the left and one on right separated by two scales; colouration mostly similar to holotype except belly scales pale white, pectoral region and ventral aspect of forelimbs and hindlimbs yellow in CESL 192. *C. jackieii* **sp. nov.** shows strong sexual dichromatism: CESL 193 (Supplementary Figure S25 E), adult female, overall dull grey to brown, dorsal spots dark brown intermixed with smaller pale buff spots; tail bands dark grey to black alternating with pale buff; extra-brilliant fringe pale yellow; ventral scales pale buff, gular region bordered with light yellow intermixed with narrow black streaks.

**Distribution:** *C. jackieii* **sp. nov.** is currently known from a single locality in the mid elevation mix deciduous forests (up to 800 m asl) of the eastern slopes of Devermalai Hills in the SWG. During this study, it was recorded from Vairavankulam Reserve Forest, Tamil Nadu.

**Ecology and natural history:** *C. jackieii* **sp. nov.** is a diurnally active gecko known from mid elevation deciduous forests in the SWG. During this study, individuals were found on rocks along a stream in a riparian forest patch during the day (ca. 15:00 hrs). A few individuals were observed moving actively on the shaded parts of rocks and soon escaped within crevices of boulders on being approached. Multiple egg clutches were also observed laid in series, within chambers of used potter wasp nests (Supplementary Figure S25 G). This shows that, like many of its congeners, *C. jackieii* **sp. nov.** also exhibits communal oviposition (Ngo et al., 2018; Somaweera, 2009). The habitat was a small riparian forest patch along a small stream surrounded by mixed scrub and deciduous forest (Supplementary Figure S25 F).

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## *monticola* clade

Members of this clade are characterised by a small to medium, slender body; heterogenous dorsal scales, small granular scales intermixed with enlarged, keeled tubercles; presence of distinct spine like tubercles on the flanks; tail with whorls of enlarged, conical caudal tubercles, median row of subcaudal enlarged; males with both precloacal and femoral pores; males with a pair of prominent triangular post cloacal spurs, reduced in females; sexual dichromatism present; members of this clade are known from the CWG and SWG in Peninsular India (Table 1). The *monticola* clade shows 4.3%–18.6% genetic divergence from all other SA *Cnemaspis* at the 16s rRNA gene. This clade also includes a sub-clade comprising members of the larger *kandiana* clade (Agarwal et al., 2017, 2020). Morphologically, members of the *monticola* clade belong to the group of *Cnemaspis* historically referred to as *Cnemaspis kandiana* from the WG (Manamendra-Arachchi et al., 2007). Manamendra-Arachchi *et al.* described *C. australis* and *C. monticola* from the syntypes of *Gonatodes kandianus* var. *tropidogaster* described by Boulenger in 1885. We redescribe *C. australis* and *C. monticola* and provide diagnostic characters, distribution and natural history information based on existing as well as fresh collections.

### *Cnemaspis australis* Manamendra-Arachchi, Batuwita and Pethiyagoda, 2007

(Supplementary Figure S14, S27 D-E; Supplementary Table S6)

**Original description:** *Cnemaspis australis* Manamendra-Arachchi, Batuwita and Pethiyagoda, 2007. A taxonomic revision of the Sri Lankan day-geckos (Reptilia: Gekkonidae: *Cnemaspis*), with description of new species from Sri Lanka and southern India. *Zeylanica*, 7 (1): 9–122.

**Holotype:** BMNH 82.5.22.67, male, from “Tinnevely” (Tirunelveli district, Tamil Nadu, India), purchased from Col. Beddome (formerly a syntype of *Cnemaspis tropidogaster*).

**Taxonomic comments:** *Cnemaspis australis* was described from Tirunelveli, Tamil Nadu, based on a single male specimen which was earlier among the syntypes of *C. tropidogaster* described by Boulenger in 1885 (Manamendra-Arachchi et al., 2007). The species is currently known only from the type specimens collected over 130 years ago. A living population of this species has not been reported since its original description. Tirunelveli is situated in the southern part of Peninsular India and is close to the Agasthyamalai Hills. Based on close observations of the type specimen and comparison with fresh collections from forests around the Agasthyamalai Hills, we identified an extant population of *C. australis*. Here, we provide additional information on diagnosis within members of the *monticola* clade, colouration, distribution and natural history information.

**Suggested common name:** Southern day gecko

**Additional materials examined:** CESL 020, CESL 027 and CESL 107, adult males, and CESL 702, adult female, collected from Peppara Wildlife Sanctuary, Kerala; CESL 708, adult male, collected by Saunak Pal and team from Ponmudi, Kerala and CESL 711, adult male, collected by Saunak Pal and team from near Shendurney Wildlife Sanctuary, Kerala. All the specimens were collected from the forests of the Agasthyamalai Hills in the SWG.

**Lineage diagnosis:** *Cnemaspis australis* can be readily discerned on a phylogenetic tree (Figure 2) and shows 0.3% intraspecific genetic divergence at the 16s rRNA gene, and very high genetic divergence of 5.4–6.2% from *C. monticola* (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small sized, slender *Cnemaspis* species (SVL up to 30.9 mm) characterised by the presence of heterogenous dorsal scales; small, granular scales intermixed with keeled conical tubercles; 12–15 rows of irregularly arranged keeled dorsal tubercles, 14–16 tubercles in paravertebral rows; five to six spine-like tubercles present on the flank. Ventral scales keeled, subimbricate; 30–35 scales across the belly, 130–136 longitudinal scales between mental to anterior border of cloaca; two pairs of postmentals, first pair separated by 1–2 median scales; seven to nine supralabials to the angle of jaw; 15–17 lamellae under digit IV of pes; males with 4–5 femoral pores on each thigh separated on either side by 11–13 poreless scales from 2–3 precloacal pores; tail with 6–8 enlarged, keeled, conical tubercles forming whorls; subcaudals keeled, median enlarged, a single large conical scale alternating with a slightly smaller one.

*Cnemaspis australis* can be distinguished from *C. monticola* of the *monticola* clade by a combination of the following characters: 15–16 rows of keeled dorsal tubercles (*versus* 10–13 rows of keeled dorsal tubercles in *C. monticola*); 30–35 midventral scales (*versus* 25–28 in *C. monticola*); 130–136 longitudinal scales from mental to cloaca (*versus* 118–125 in *C. monticola*); scales on belly and subcaudals keeled (*versus* scales on belly and subcaudals smooth).

**Colouration in life** (Supplementary Figure S27 D-E): Dorsal colour of head, body, limbs and tail yellowish-brown; patterned with dark streaks and pale blotches, head uniform pale brown with few darker markings. Mid dorsum with six to seven pale yellow elongated spots alternating with paler patches, longitudinally from nape to base of tail. Each spot bordered with narrow brown to black marks on the anterior sides, roughly forming inverted ‘V’ like the bands across the trunk; the first yellow spot behind the head distinct, followed by a small central black spot on nape (Supplementary Figure S27 D). The light and dark pattern continue on the dorsal part of tail as alternating indistinct light and dark bands. Some individuals often with a pale yellow middorsal stripe. Lateral part of trunk reticulated with irregular darker brown to black streaks, spine like tubercles bright yellow. Head with a short dark stripe from the nostril to anterior margin of eye, continues behind the eye as three radiating stripes, the middle one broad continuing above anterior border of ear opening. Labial scales glossy, pale yellow alternating with dark grey borders. Pupil dark black surrounded by a thin yellow iris edged with broad dirty red. Limbs darker brown, reticulated with few lighter markings; digits alternating with light and dark bands. Ventrals uniform grey to pale yellow, few throat scales edged with black speckles, underside of tail uniform pale grey. Adult males with a thick yellow band from behind postmental to start of throat parallel to the infralabials on both sides (Supplementary Figure S27 E).

**Distribution:** *Cnemaspis australis* is currently known from mid to high elevation (up to 1100 m asl) moist forests of the Agasthyamalai Hills in the SWG. During this study, it was recorded from multiple sites in and around Peppara WLS, Shendurney WLS and Ponnudi in Kerala.

**Ecology and natural history:** *Cnemaspis australis* is a predominantly diurnal gecko, restricted to mid to high elevation moist forests. During this study, individuals of *C. australis* were observed to be moving actively on tree trunks during the day. Some individuals were also found on rocks and boulders along streams and forest paths. Gravid females and egg clutches were often observed in the monsoon during this study. *C. cf. maculicollis* and *H. cf. frenatus* were the other gekkonid lizards observed occupying similar habitats in some of the sites during the study.

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## *Cnemaspis monticola* Manamendra-Arachchi, Batuwita and Pethiyagoda, 2007

(Supplementary Figure S8, S27 F-G; Supplementary Table S6)

**Original description:** *Cnemaspis monticola* Manamendra-Arachchi, Batuwita and Pethiyagoda, 2007. A taxonomic revision of the Sri Lankan day-geckos (Reptilia: Gekkonidae: *Cnemaspis*), with description of new species from Sri Lanka and southern India. *Zeylanica*, 7 (1): 9–122.

**Holotype:** BMNH 74.4.29.372, female, from “Wynaad” (Wayanad district, Kerala, India), purchased from Col. Beddome (formerly a syntype of *Cnemaspis tropidogaster*).

**Taxonomic comments:** *Cnemaspis monticola* was described from Wayanad, Kerala, based on three female specimens which were earlier among the syntypes of *C. tropidogaster* described by Boulenger in 1885 (Manamendra-Arachchi et al., 2007). Closer observation of the type specimens revealed some stark differences within the holotype and the paratypes. The ventral scales of the holotype BMNH 74.4.29.372, is composed of smooth scales, which matches the diagnosis provided by Manamendra-Arachchi et al., but both the paratypes BMNH 74.4.29.373 and BMNH 74.4.29.374 show the presence of strongly keeled ventral scales. Since the presence or absence of keeled ventral scales has often been used as a strong character to distinguish species like in the case of the recently described *Cnemaspis anandani*, it is possible that the paratypes belong to a different undescribed species (Murthy et al., 2019). As the diagnosis provided by Manamendra-Arachchi et al. matches the holotype, we restrict our observations for this study to the holotype alone. A detailed study of the paratypes along with fresh collections from the Wayanad region might be needed to correctly classify the paratypes. The Wayanad Plateau is composed of mid to high elevation hills situated in southern part of Peninsular India adjoining the Nilgiri Hills. Based on close observations of the holotype and comparisons with fresh collections, we identified an extant population of *C. monticola*. Here, we report the collection of this species after over 130 years, provide diagnostic characters using both male and female specimens, provide information on diagnosis within members of the *monticola* clade, as well as information on colouration, distribution and natural history.

**Suggested common name:** Montane day gecko

**Additional materials examined:** CESL 043 and CESL 044, adult males, collected from Manikunjmalai; CESL 053, adult male, collected by Saunak Pal and team from near Puthurvayal, Kerala; CESL 054, adult male, collected from Chembra, Kerala and CESL 637 and CESL 639,

adult males, collected by Saunak Pal and team from Wayanad Wildlife Sanctuary Kerala. All the specimens were collected from the forests of hills in the Wayanad Plateau, Kerala.

**Lineage diagnosis:** *Cnemaspis monticola* can be readily discerned on a phylogenetic tree (Figure 2) and is characterized by very high genetic divergence at the 16s rRNA gene of 5.4–6.2% from *C. australis* (Supplementary Table S2).

**Morphological diagnosis and comparison:** A small sized, slender *Cnemaspis* species (SVL up to 32.7 mm) characterised by the presence of heterogenous dorsal scales; small, granular scales intermixed with keeled conical tubercles; 8–11 rows of irregularly arranged keeled dorsal tubercles, 9–12 tubercles in paravertebral rows; five to six spine-like tubercles present on the flank. Ventral scales smooth with few weakly keeled scales towards the lateral sides, subimbricate; 25–28 scales across the belly, 118–125 longitudinal scales between mental to anterior border of cloaca; two to three pairs of postmentals, first pair separated by a single median scale; seven to eight supralabials to the angle of jaw; 15–18 lamellae under digit IV of pes; males with 3–5 femoral pores on each thigh separated on either side by 9–12 poreless scales from 3–4 precloacal pores; tail with 4–6 enlarged, keeled, subconical tubercles loosely forming whorls; subcaudals smooth, median row enlarged, subconical. *Cnemaspis monticola* can be distinguished from *C. australis* by a combination of characters. For a comparison with *C. australis*, see section above.

**Colouration in life** (Supplementary Figure S27 F-G): Dorsal colour of head, body, limbs and tail buff to brown; marked with dark and light streaks, head lighter with few darker markings. Mid dorsum with five to six yellowish elongated spots longitudinally from nape to base of tail alternating with pale indistinct white transverse markings. Each spot edged with narrow grey to black marks on the anterior side; the first yellow spot behind the head distinct, followed by a central black spot on nape. Spots on the tail orange-yellow, starting from base of the tail. Markings continue on the tail as alternating indistinct light and dark spots. Lateral part of trunk reticulated with irregular yellow, pale white and brown markings, spine like tubercles yellow. Head with a short dark stripe from the nostril to anterior margin of eye, continues behind the eye as indistinct radiating stripes, the middle one broad continuing above anterior border of ear opening. Labial scales glossy, pale yellow alternating with dark brown to black markings. Pupil dark black surrounded by a thin yellow iris edged with broad dirty brown. Limbs darker, reticulated with few lighter markings; digits alternating with light and dark bands. Ventrals uniform pale grey to white, few throat scales edged with black and yellow speckles prominent towards the sides, adult males often with a broken pale-yellow to buff band from behind postmental to start of throat parallel to the infralabials on both sides, underside of tail uniform pale grey to dirty white (Supplementary Figure S27 G).

**Distribution:** *Cnemaspis monticola* is currently known from mid to high elevation (up to 1200 m asl) moist and evergreen forests of the Wayanad Plateau in the CWG. During this study, it was recorded from multiple sites in the hills around Wayanad in Kerala.

**Ecology and natural history:** *Cnemaspis monticola* is a diurnal gecko restricted to mid to high elevation moist forests. Individuals were observed to actively use tree trunks, mud cliffs and boulders inside forests during the day. Some individuals were also found hidden under the bark of trees and under fallen logs on the forest floor in the late evening. *C. wynadensis*, *Hemidactylus* cf.

*frenatus* and *H. parvimaculatus* (Deraniyagala, 1953) were the other gekkonid lizard observed sharing the habitat of *C. monticola* in some of the sites during the study.

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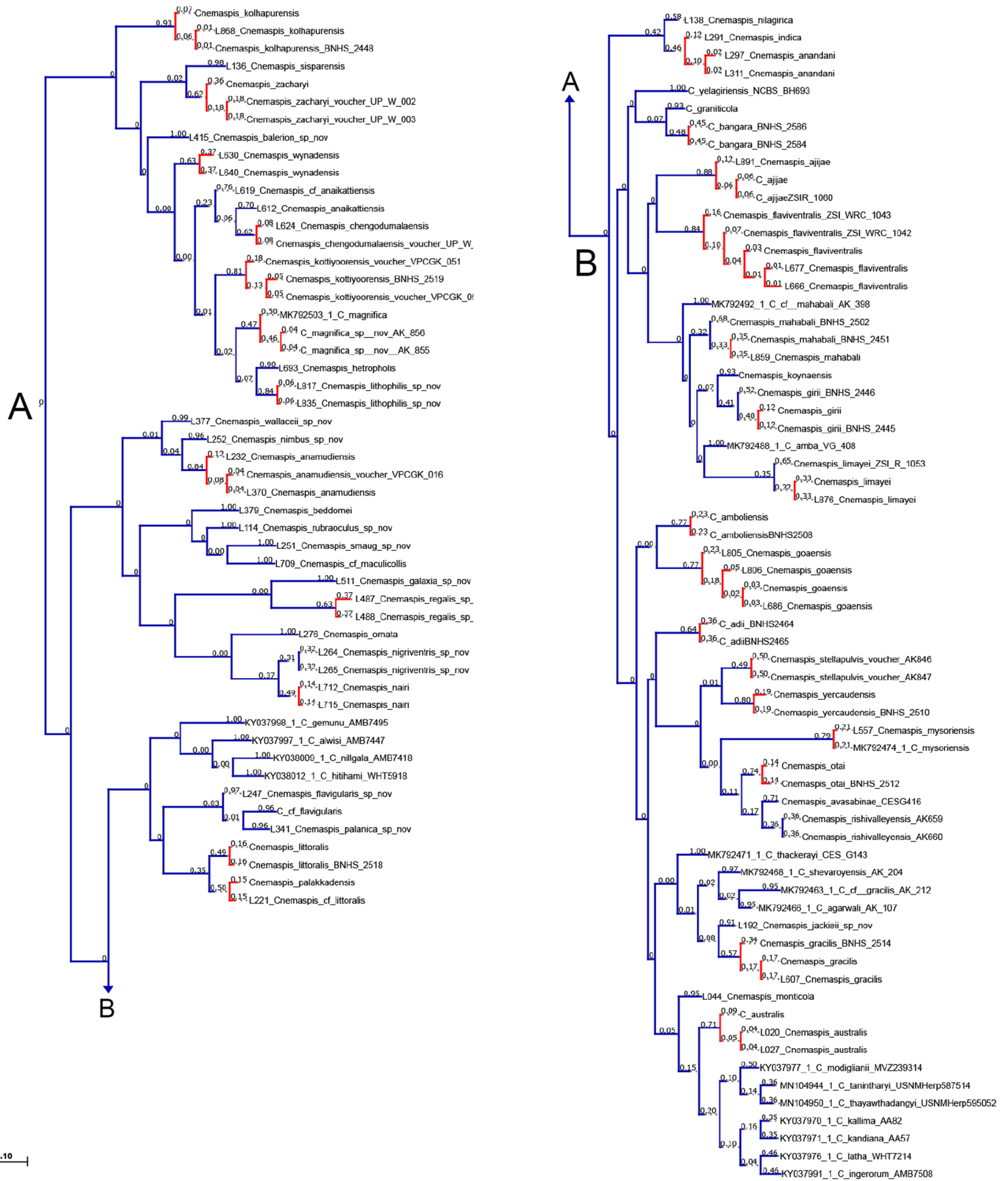
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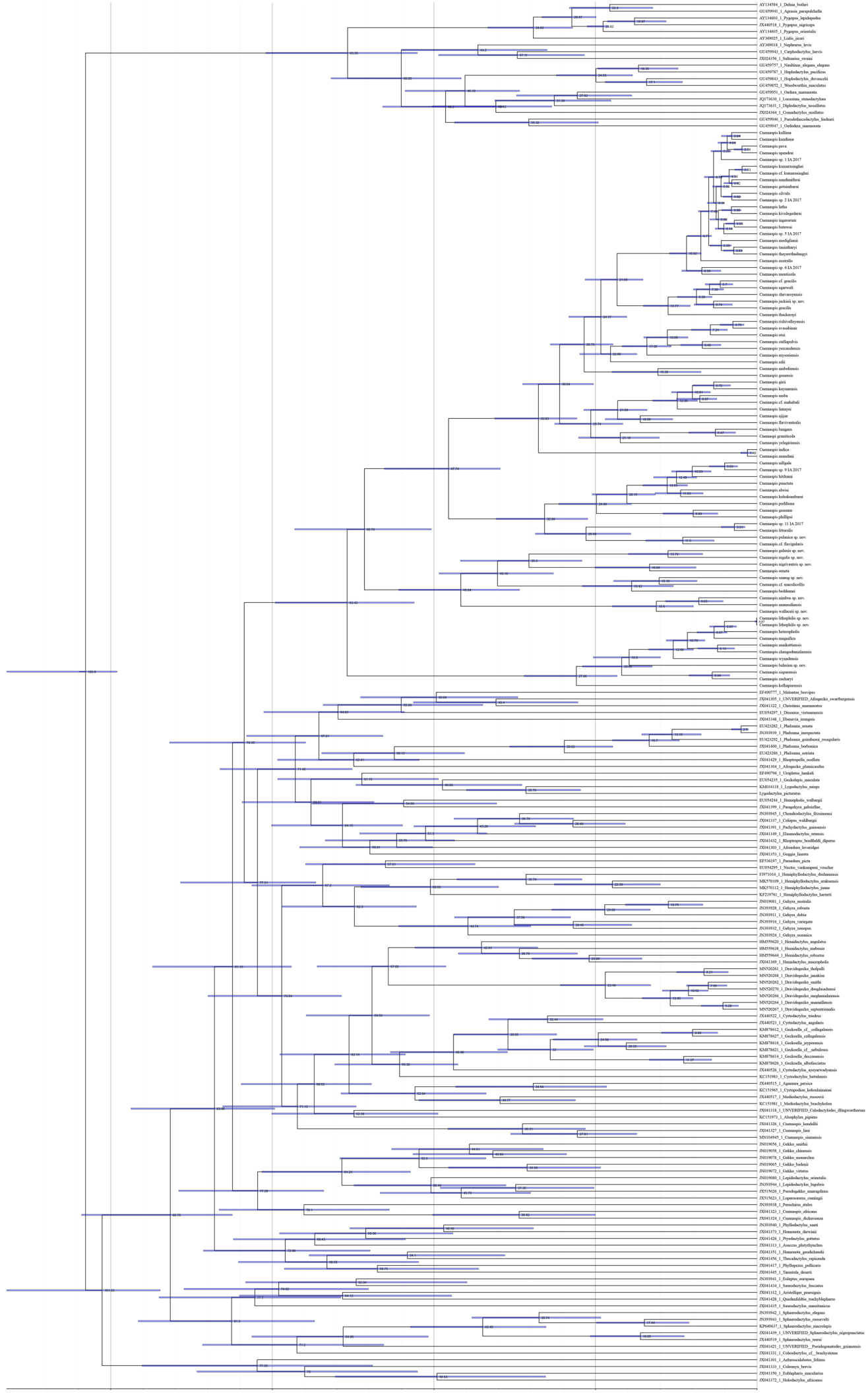
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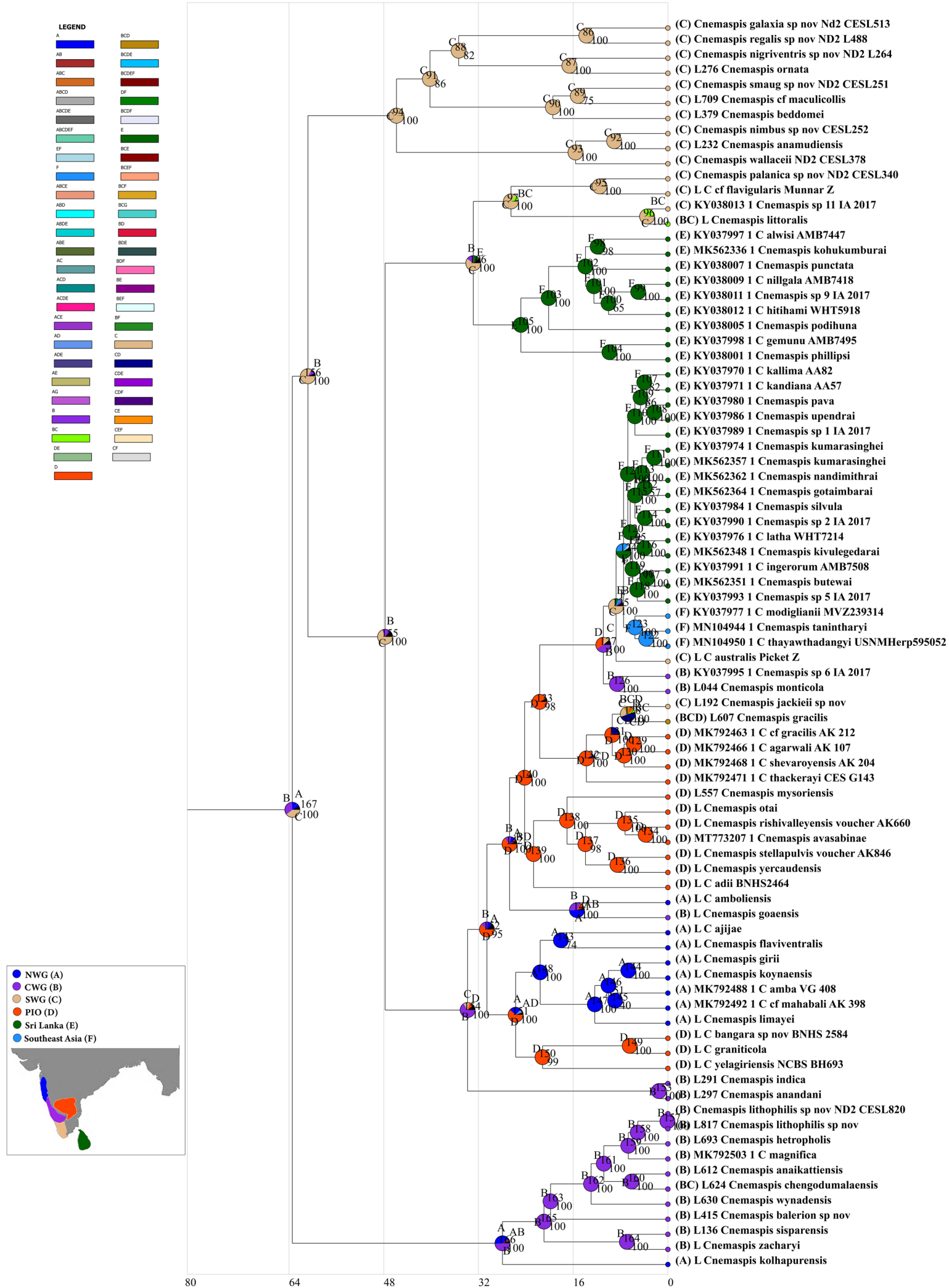
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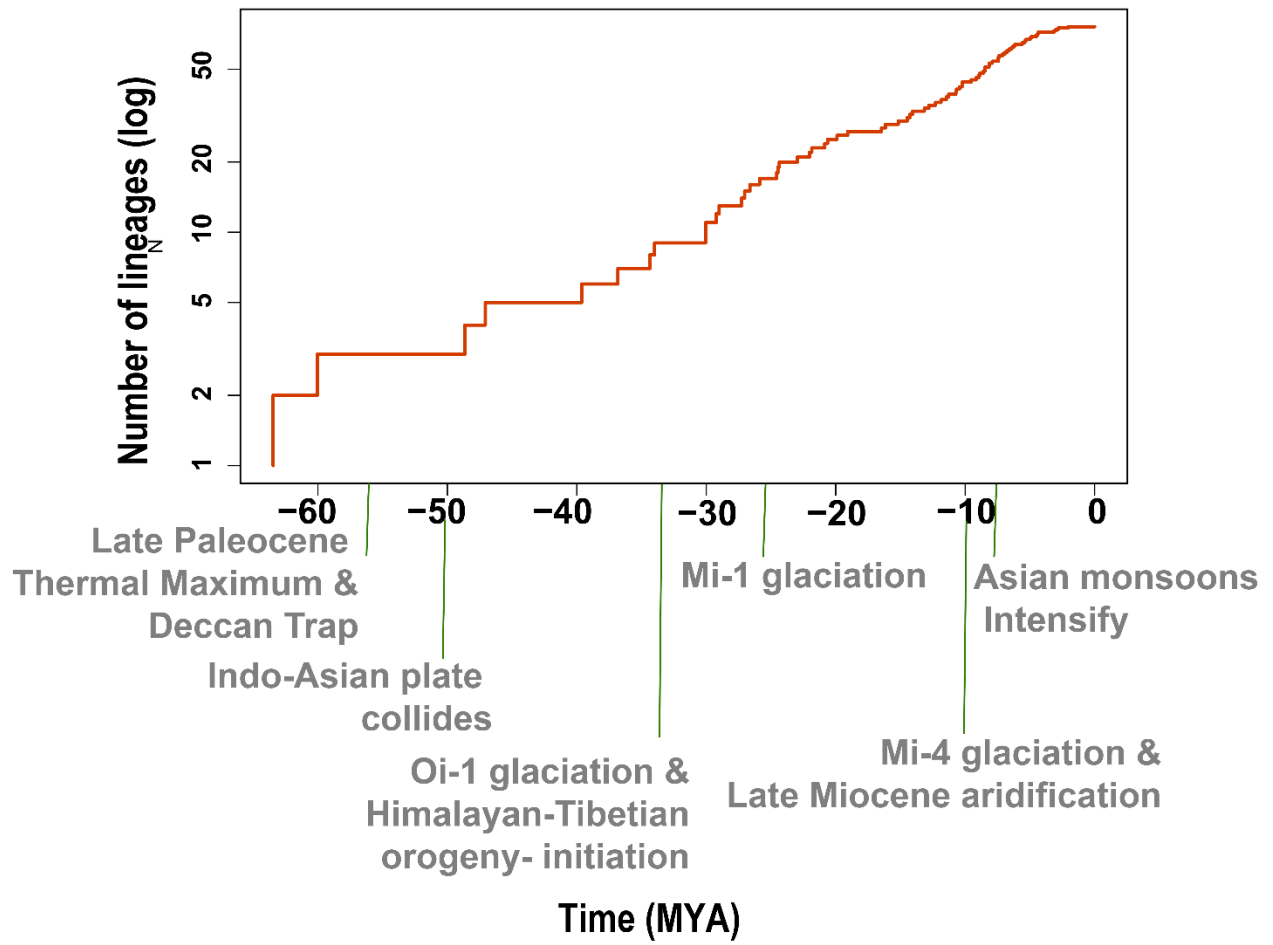
**Supplementary Figure S1.** The bPTP output trees generated from the concatenated ML trees. Blue coloured branches indicate monophyly of that lineage. The values on clades indicate the posterior probability.



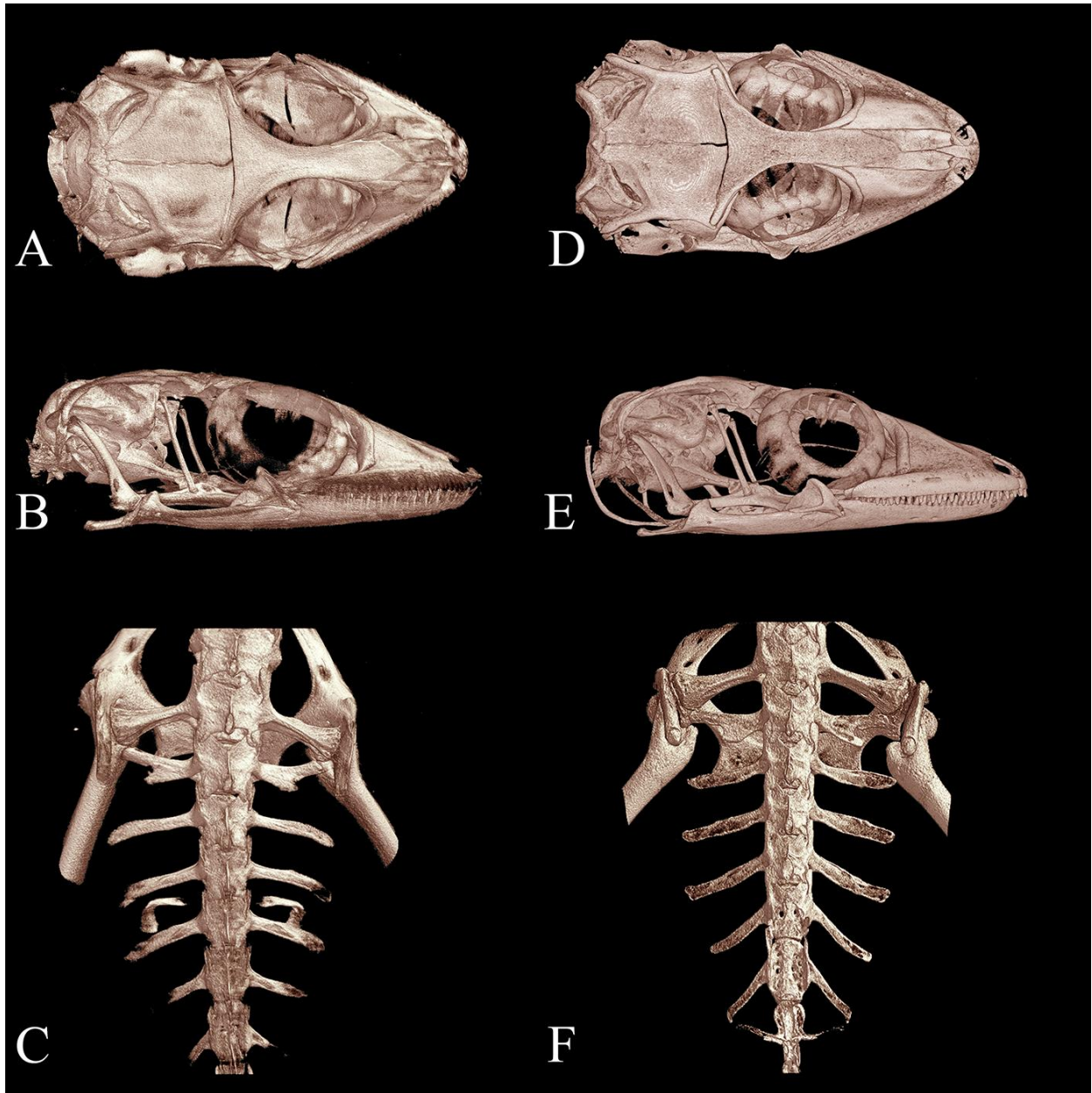
**Supplementary Figure S2.** Complete BEAST chronogram from the divergence dating analyses. Blue bars at nodes indicate 95% HPD.



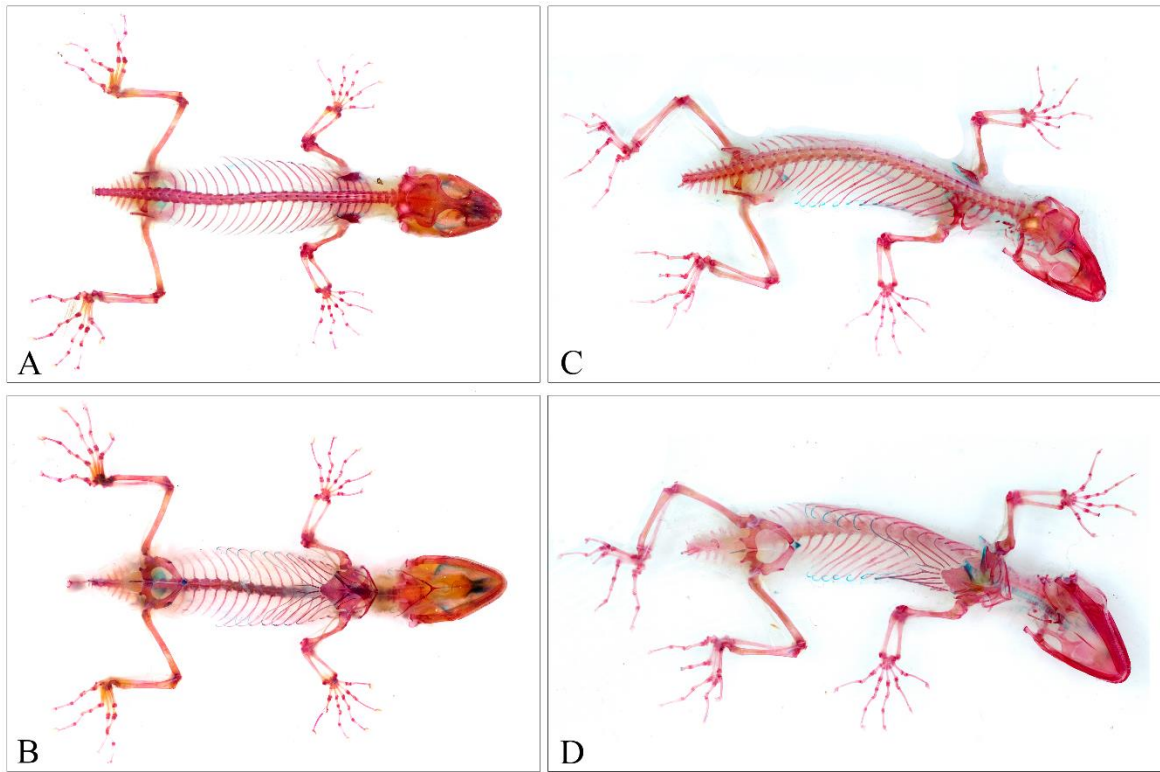
**Supplementary Figure S3.** Geographical ancestral area reconstruction on a time-calibrated phylogeny of SA *Cnemaspis* produced using RASP, showing all possible ancestral ranges at nodes.



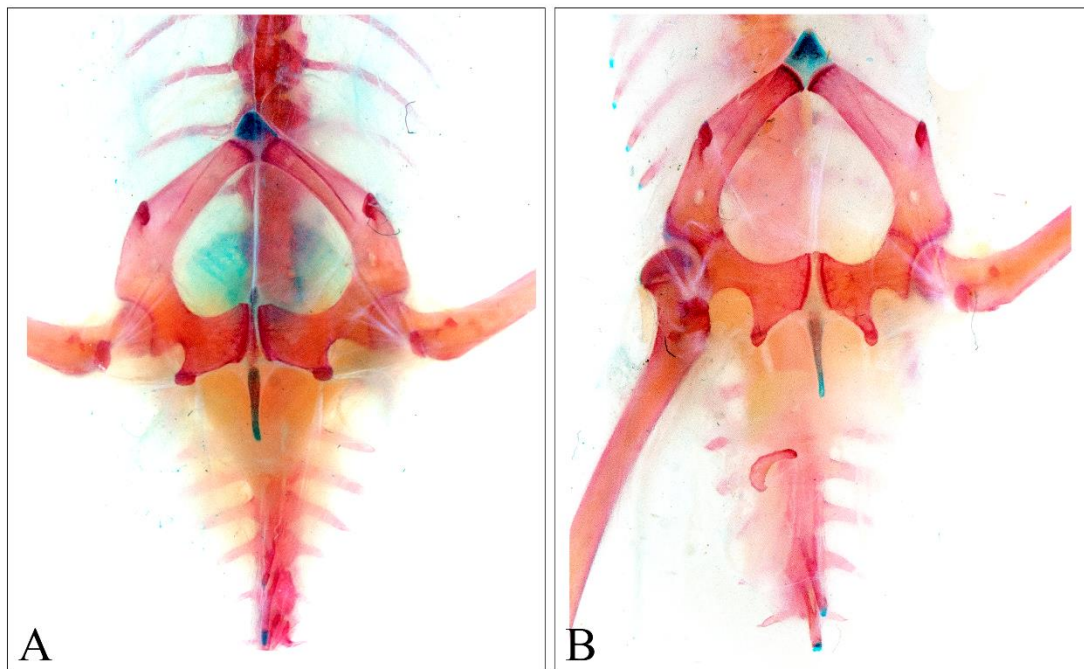
Supplementary Figure S4. Lineage-through-time plot.



**Supplementary Figure S5.** Micro-CT scan images of the male and female of *Cnemaspis cf. monticola*. A. dorsal view of skull, male, B. lateral view of skull, male, C. dorsal view of pelvic girdle showing cloacal bones in male, D. dorsal view of skull, female, E. lateral view of skull, female, F. dorsal view of pelvic girdle in female.



**Supplementary Figure S6.** Dorsal (A. male, C. female) and ventral (B. male, D. female) view of clear stained *Cnemaspis magnifica*.



**Supplementary Figure S7.** Ventral view of pelvic girdle showing position of cloacal bone in clear stained *C. magnifica* (A. female, B. male).

**Supplementary Table S1.** GenBank accession number and voucher information of *Cnemaspis* sequences used in this study (accession numbers in bold indicate new sequences generated during this study).

<b>Species</b>	<b>Locality</b>	<b>Voucher</b>	<b>16S</b>	<b>ND2</b>
<i>Cnemaspis adii</i>	Ballari, Karnataka, India	BNHS 2464	KX753654	-
<i>Cnemaspis adii</i>	Ballari, Karnataka, India	BNHS 2465	KX753655	-
<i>Cnemaspis adii</i>	Ballari, Karnataka, India	BNHS2494	-	MT188142
<i>Cnemaspis agarwali</i>	Salem, Tamil Nadu, India	AK 107	-	MK792466
<i>Cnemaspis ajiiae</i>	Satara, Maharashtra, India	ZSI WRCR/1059	KX753648	-
<i>Cnemaspis ajiiae</i>	Satara, Maharashtra, India	ZSI WRCR/1060	KX753649	-
<i>Cnemaspis ajiiae</i>	Mahabaleshwar, Satara, Maharashtra, India	CESL891	<b>MZ291571</b>	<b>MZ701830</b>
<i>Cnemaspis ajiiae</i>	Satara, Maharashtra, India	AK429	-	MK792498
<i>Cnemaspis alwisi</i>	Ritigala, Anuradhapura District, Sri Lanka	AMB7447	-	KY037997
<i>Cnemaspis amba</i>	Amba, Kolhapur, Maharashtra, India	VG 408	-	MK792488
<i>Cnemaspis amboliensis</i>	Sindhudurg, Maharashtra, India	BNHS 2505	MH174355	-
<i>Cnemaspis amboliensis</i>	Sindhudurg, Maharashtra, India	BNHS 2508	MH174356	-
<i>Cnemaspis amboliensis</i>	Sindhudurg, Maharashtra, India	VG394	-	MK792481
<i>Cnemaspis anaikattiensis</i>	Attapadi, Palakkad, Kerala, India	CESL619	<b>MZ291573</b>	-
<i>Cnemaspis anaikattiensis</i>	Attapadi, Palakkad, Kerala, India	CESL612	<b>MZ291572</b>	<b>MZ701821</b>
<i>Cnemaspis anamudiensis</i>	Idukki, Kerala, India	CESL370	<b>MZ291575</b>	-
<i>Cnemaspis anamudiensis</i>	Anamudi RF, Idukki, Kerala, India	VPCGK_016	MT217034	-
<i>Cnemaspis anamudiensis</i>	Idukki, Kerala, India	CESL232	<b>MZ291574</b>	<b>MZ701805</b>
<i>Cnemaspis anandani</i>	Nilgiris, Tamil Nadu, India	CESL311	<b>MZ291577</b>	-
<i>Cnemaspis anandani</i>	Nilgiris, Tamil Nadu, India	CESL297	<b>MZ291576</b>	<b>MZ701811</b>
<i>Cnemaspis australis</i>	Peppara, Kerala, India	CESL027	<b>MZ291579</b>	-
<i>Cnemaspis australis</i>	Peppara, Kerala, India	CESL020	<b>MZ291578</b>	<b>MZ701802</b>
<i>Cnemaspis australis</i>	Peppara, Kerala, India	ZM003	<b>MZ291570</b>	<b>MZ701834</b>
<i>Cnemaspis avasabinae</i>	Penchalakona, Nellore, Andhra Pradesh, India	CESG416	-	MT773207
<i>Cnemaspis balerion sp. nov.</i>	Kemmangundi, Chikkamagaluru, Karnataka, India	BNHS 2623 (CESL415)	<b>MZ291580</b>	<b>MZ701815</b>
<i>Cnemaspis bangara</i>	Kolar, Karnataka, India	BNHS 2584	-	MT188143
<i>Cnemaspis bangara</i>	Kolar, Karnataka, India	BNHS 2586	-	MT188144
<i>Cnemaspis beddomei</i>	Kalakkad Mundanthurai TR, Tamil Nadu, India	CESL379	<b>MZ291581</b>	<b>MZ701814</b>



<b>Species</b>	<b>Locality</b>	<b>Voucher</b>	<b>16S</b>	<b>ND2</b>
<i>Cnemaspis butewai</i>	Bambarabotuwa, Ratnapura District, Sri Lanka	NMSL 2019.07.01	-	MK562351
<i>Cnemaspis</i> cf. <i>flavigularis</i>	Idukki, Kerala, India	ZM002	<b>MZ291569</b>	<b>MZ701833</b>
<i>Cnemaspis</i> cf. <i>gracilis</i>	Yercaud, Salem, Tamil Nadu, India	AK 212	-	MK792463
<i>Cnemaspis</i> cf. <i>maculicollis</i>	Shendurney Wls, Kollam, Kerala, India	CESL709	<b>MZ291582</b>	<b>MZ701825</b>
<i>Cnemaspis</i> cf. <i>mahabali</i>	Phansad, Raigad, India	AK 398	-	MK792492
<i>Cnemaspis</i> cf. <i>palakkadensis</i>	Palakkad, Kerala, India	CESL221	<b>MZ291583</b>	-
<i>Cnemaspis chengodumalaensis</i>	Chengodumala, Kozhikode, Kerala, India	BNHS 2741	MT217043	-
<i>Cnemaspis chengodumalaensis</i>	Kozhikode, Kerala, India	CESL624	<b>MZ291584</b>	<b>MZ701822</b>
<i>Cnemaspis flavigularis</i> <b>sp. nov.</b>	Mathikettan Shola NP, Idukki, Kerala, India	CESL247	<b>MZ291585</b>	-
<i>Cnemaspis flaviventralis</i>	Goa, India	CESL666	<b>MZ291587</b>	-
<i>Cnemaspis flaviventralis</i>	Sindhudurg, Maharashtra, India	ZSI WRC R/1042	KX269819	-
<i>Cnemaspis flaviventralis</i>	Sindhudurg, Maharashtra, India	ZSI WRC R/1043	KX269820	-
<i>Cnemaspis flaviventralis</i>	Amboli, Sindhudurg, Maharashtra, India	VG02	<b>MZ291586</b>	-
<i>Cnemaspis flaviventralis</i>	Goa, India	CESL677	<b>MZ291588</b>	<b>MZ701824</b>
<i>Cnemaspis flaviventralis</i>	Amboli, Sindhudurg, Maharashtra, India	VG354	-	MK792495
<i>Cnemaspis galaxia</i> <b>sp. nov.</b>	Srivilliputhur, Virudhunagar, Tamil Nadu, India	CESL511	<b>MZ291589</b>	<b>MZ701818</b>
<i>Cnemaspis gemunu</i>	Hakgala, Nuwara Eliya, Sri Lanka	AMB7495	-	KY037998
<i>Cnemaspis girii</i>	Satara, Maharashtra, India	BNHS 2445	KX269823	-
<i>Cnemaspis girii</i>	Satara, Maharashtra, India	BNHS 2446	KX269824	-
<i>Cnemaspis girii</i>	Satara, Maharashtra, India	VG2080	<b>MZ291590</b>	-
<i>Cnemaspis girii</i>	Satara, Maharashtra, India	AK439	-	MK792491
<i>Cnemaspis goaensis</i>	Cotigaon, Goa, India	CESL686	<b>MZ291591</b>	-
<i>Cnemaspis goaensis</i>	Gund, Karnataka, India	CESL806	<b>MZ291593</b>	-
<i>Cnemaspis goaensis</i>	Goa, India	ZSI WRC R/1044	KX269825	-
<i>Cnemaspis goaensis</i>	Gund, Karnataka, India	CESL805	<b>MZ291592</b>	<b>MZ701826</b>
<i>Cnemaspis goaensis</i>	Gund, Karnataka, India	VG385	-	MK792475
<i>Cnemaspis gotaimbarai</i>	Kokagala, Ampara District, Sri Lanka	NMSL 2019.04.01	-	MK562364
<i>Cnemaspis gracilis</i>	Palakkad, Kerala, India	BNHS 2513	MH174369	-
<i>Cnemaspis gracilis</i>	Palakkad, Kerala, India	BNHS 2514	MH174370	-
<i>Cnemaspis gracilis</i>	Palakkad, Kerala, India	CESL607	<b>MZ291594</b>	<b>MZ701820</b>
<i>Cnemaspis gracilis</i>	Palakkad, Kerala, India	CES G385	-	MK792465
<i>Cnemaspis graniticola</i>	Horsley Hills, Chittoor, Andhra Pradesh, India	BNHS 2589 (CESL839)	<b>MZ291595</b>	MT188145

Species	Locality	Voucher	16S	ND2
<i>Cnemaspis heteropholis</i>	Gund, Karnataka, India	CESL693	<b>MZ291596</b>	MT180436
<i>Cnemaspis hitihami</i>	Kumaradola, Moneragala, Sri Lanka	WHT 5918	-	KY038012
<i>Cnemaspis indica</i>	Nilgiris, Tamil Nadu, India	CESL291	<b>MZ291597</b>	<b>MZ701810</b>
<i>Cnemaspis ingerorum</i>	Sri Lanka, Hambantota District, Sandagala	WHT 7331	-	KY037990
<i>Cnemaspis jackieii</i> <b>sp. nov.</b>	Near Karuppanadhi dam, Vairavankulam RF, Tamil Nadu, India	CESL192	<b>MZ291598</b>	<b>MZ701804</b>
<i>Cnemaspis kallima</i>	Rattota, Gammaduwa, Matale District, Sri Lanka	AA82	-	KY037970
<i>Cnemaspis kandiana</i>	Gannoruwa, Kandy District, Sri Lanka	AA57	-	KY037971
<i>Cnemaspis kivulegedarai</i>	Sri Lanka, Nuwara Eliya District, Walapane	NMSL 2019.08.01	-	MK562348
<i>Cnemaspis kohukumburai</i>	Sri Lanka, Kandy District, Kadugannawa	NMSL 2019.05.01	-	MK562336
<i>Cnemaspis kolhapurensis</i>	Sindhudurg, Maharashtra, India	BNHS 2447	KX269821	-
<i>Cnemaspis kolhapurensis</i>	Sindhudurg, Maharashtra, India	BNHS 2448	KX269822	-
<i>Cnemaspis kolhapurensis</i>	Sindhudurg, Maharashtra, India	CESL868	<b>MZ291599</b>	<b>MZ701829</b>
<i>Cnemaspis kolhapurensis</i>	Kolhapur, Maharashtra, India	unvouchered	-	MK792501
<i>Cnemaspis kottiyoorensis</i>	Kannur, Kerala, India	BNHS 2519	MH174363	-
<i>Cnemaspis kottiyoorensis</i>	Kannur, Kerala, India	VPCGK_052	MT217037	-
<i>Cnemaspis kottiyoorensis</i>	Kannur, Kerala, India	VPCGK_051	MT217038	-
<i>Cnemaspis koynaensis</i>	Koyna, Satara, Maharashtra, India	CESL886	<b>MZ291600</b>	-
<i>Cnemaspis koynaensis</i>	Humbarli, Satara, Maharashtra, India	CES G349	-	MK792490
<i>Cnemaspis kumarasinghei</i>	Rathataakanda (Buttala), Moneragala District, Sri Lanka	AMB7431	-	KY037974
<i>Cnemaspis kumarasinghei</i>	Udakiruwa, Badulla District, Sri Lanka	ADS 211	-	MK562357
<i>Cnemaspis latha</i>	Bandarawela, Nuwara Eliya District, Sri Lanka	WHT7214	-	KY037976
<i>Cnemaspis limayei</i>	Kolhapur, Maharashtra, India	CESL876	<b>MZ291601</b>	-
<i>Cnemaspis limayei</i>	Sindhudurg, Maharashtra, India	ZSI WRCR/1052	KX753646	-
<i>Cnemaspis limayei</i>	Sindhudurg, Maharashtra, India	ZSI WRCR/1053	KX753647	-
<i>Cnemaspis limayei</i>	Dajipur, Kolhapur, Maharashtra, India	AK362	-	MK792482

Species	Locality	Voucher	16S	ND2
<i>Cnemaspis lithophilis</i> <b>sp. nov.</b>	Mookambika, Udupi, Karnataka, India	BNHS 2625 (CESL817)	<b>MZ291602</b>	<b>MZ701827</b>
<i>Cnemaspis lithophilis</i> <b>sp. nov.</b>	Near Jog falls, Shimoga, Karnataka, India	CESL835	<b>MZ291603</b>	<b>MZ701828</b>
<i>Cnemaspis littoralis</i>	Kozhikode, Kerala, India	BNHS 2517	MH174367	-
<i>Cnemaspis littoralis</i>	Kozhikode, Kerala, India	BNHS 2518	MH174368	-
<i>Cnemaspis littoralis</i>	Kozhikode, Kerala, India	unvouchered	-	<b>MZ701831</b>
<i>Cnemaspis magnifica</i>	Sakleshpur, Hassan, Karnataka, India	unvouchered	-	MK792503
<i>Cnemaspis magnifica</i>	Sakleshpur, Hassan, Karnataka, India	AK 855	-	MT180437
<i>Cnemaspis magnifica</i>	Sakleshpur, Hassan, Karnataka, India	AK 856	-	MT180438
<i>Cnemaspis mahabali</i>	Raigad, Maharashtra, India	CESL859	<b>MZ291604</b>	-
<i>Cnemaspis mahabali</i>	Pune, Maharashtra, India	BNHS 2502	MH174352	-
<i>Cnemaspis mahabali</i>	Pune, Maharashtra, India	BNHS 2451	MH174353	-
<i>Cnemaspis modiglianii</i>	Kecamatan Enggano, Pulau Enggano, near Malakoni, Sumatra	MVZ239314	-	KY037977
<i>Cnemaspis monticola</i>	Manikunjmalai, Wayanad, Kerala, India	CESL044	<b>MZ291605</b>	<b>MZ701803</b>
<i>Cnemaspis mysoriensis</i>	Bangalore, Karnataka, India	CESL557	<b>MZ291606</b>	<b>MZ701819</b>
<i>Cnemaspis mysoriensis</i>	Bangalore, Karnataka, India	unvouchered	-	MK792474
<i>Cnemaspis nairi</i>	Pandimotta, Shendurney, Kerala, India	CESL712	<b>MZ291607</b>	-
<i>Cnemaspis nairi</i>	Thenmala, near Shendurney, Kerala, India	CESL715	<b>MZ291608</b>	-
<i>Cnemaspis nandimithrai</i>	Sri Lanka, Ampara District, Kudumbigala	NMSL 2019.03.01	-	MK562362
<i>Cnemaspis nigriventris</i> <b>sp. nov.</b>	Achankovil RF, Kerala, India	CESL265	<b>MZ291610</b>	-
<i>Cnemaspis nigriventris</i> <b>sp. nov.</b>	Achankovil RF, Kerala, India	CESL264	<b>MZ291609</b>	<b>MZ701808</b>
<i>Cnemaspis nilagirica</i>	Silent Valley NP, Palakkad, Kerala, India	CESL138	<b>MZ291611</b>	-
<i>Cnemaspis nilgala</i>	Serawa, Moneragala, Sri Lanka	AMB 7418	-	KY038009
<i>Cnemaspis nimbus</i> <b>sp. nov.</b>	Mathikettan Shola NP, Idukki, Kerala, India	CESL252	<b>MZ291612</b>	<b>MZ701807</b>
<i>Cnemaspis ornata</i>	Vairavankulam RF, Tirunelveli, Tamil Nadu, India	CESL276	<b>MZ291613</b>	<b>MZ701809</b>
<i>Cnemaspis otai</i>	Vellore, Tamil Nadu, India	BNHS 2511	MH174361	-
<i>Cnemaspis otai</i>	Vellore, Tamil Nadu, India	BNHS 2512	MH174362	-
<i>Cnemaspis otai</i>	Vellore, Tamil Nadu, India	AK668	-	MT188146
<i>Cnemaspis palakkadensis</i>	Palakkad, Kerala, India	BNHS 2790	MT762366	-

<b>Species</b>	<b>Locality</b>	<b>Voucher</b>	<b>16S</b>	<b>ND2</b>
<i>Cnemaspis palanica</i> <b>sp. nov.</b>	Kookal, Palani Hills, Dindigul, Tamil Nadu, India	BNHS 2629 (CESL341)	<b>MZ291614</b>	<b>MZ701812</b>
<i>Cnemaspis pava</i>	Labookellie, Nuwara Eliya District, Sri Lanka	AMB 7494	-	KY037980
<i>Cnemaspis phillipsi</i>	Rattota, Gammaduwa, Matale District, Sri Lanka	AA 81	-	KY038001
<i>Cnemaspis podihuna</i>	Kukulagoda, Moneragala District, Sri Lanka	58A	-	KY038005
<i>Cnemaspis punctata</i>	Matale, Rattota, Gammaduwa Sri Lanka	AA80	-	KY038007
<i>Cnemaspis regalis</i> <b>sp. nov.</b>	Kalakkad Mundanthurai TR, Tamil Nadu, India	CESL487	<b>MZ291615</b>	<b>MZ701816</b>
<i>Cnemaspis regalis</i> <b>sp. nov.</b>	Kalakkad Mundanthurai TR, Tamil Nadu, India	CESL488	-	<b>MZ701817</b>
<i>Cnemaspis rishivalleyensis</i>	Rishi Valley School, Chittoor, Andhra Pradesh, India	AK659	-	MT773218
<i>Cnemaspis rishivalleyensis</i>	Rishi Valley School, Chittoor, Andhra Pradesh, India	AK660	-	MT773219
<i>Cnemaspis rubraoculus</i> <b>sp. nov.</b>	Upper Manalar, Periyar Tiger Reserve, Kerala, India	CESL114	<b>MZ291616</b>	-
<i>Cnemaspis shevaroyensis</i>	Yercaud, Salem, Tamil Nadu, India	AK 204	-	MK792468
<i>Cnemaspis silvula</i>	Galle, Hiyare Forest Reserve, Sri Lanka	AA88	-	KY037984
<i>Cnemaspis sisparensis</i>	Silent Valley NP, Palakkad, Kerala, India	CESL136	<b>MZ291617</b>	<b>MZ701801</b>
<i>Cnemaspis smaug</i> <b>sp. nov.</b>	Mathikettan Shola NP, Idukki, Kerala, India	CESL251	<b>MZ291618</b>	<b>MZ701806</b>
<i>Cnemaspis</i> sp. 1 IA 2017	Matara, Naotunna, Sri Lanka	AA 17	-	KY037989
<i>Cnemaspis</i> sp. 11 IA 2017	Athirappilly Falls, Thrissur, Kerala, India	SB 151	-	KY038013
<i>Cnemaspis</i> sp. 3 IA 2017	Masimbula, Godakawela, Ratnapura, Sri Lanka	AMB7508	-	KY037991
<i>Cnemaspis</i> sp. 5 IA 2017	Badulla, Haputale, Sri Lanka	AA 87	-	KY037993
<i>Cnemaspis</i> sp. 6 IA 2017	Kodagu, Karnataka, India	SB 48	-	KY037995
<i>Cnemaspis</i> sp. 9 IA 2017	Moneragala, Maligathenna, Sri Lanka	47 A	-	KY038011
<i>Cnemaspis stellapulvis</i>	Yadiyur, Mandya, Karnataka, India	AK846	-	MT773215
<i>Cnemaspis stellapulvis</i>	Yadiyur, Mandya, Karnataka, India	AK847	-	MT773216

<b>Species</b>	<b>Locality</b>	<b>Voucher</b>	<b>16S</b>	<b>ND2</b>
<i>Cnemaspis tanintharyi</i>	Tanintharyi Region, Payarhtan cave, Myanmar	USNM Herp 587514	-	MN104944
<i>Cnemaspis thackerayi</i>	Yercaud, Salem, Tamil Nadu, India	CES G143	-	MK792471
<i>Cnemaspis thayawthadangyi</i>	Tanintharyi Region, Myeik Archipelago, Myanmar	USNM Herp 595052	-	MN104950
<i>Cnemaspis upendrai</i>	Pussellawa, Kandy, Sri Lanka	AA83	-	KY037986
<i>Cnemaspis wallaceii</i> <b>sp. nov.</b>	Andiparai Shola, Anamalai, Tamil Nadu, India	CESL377	<b>MZ291619</b>	<b>MZ701813</b>
<i>Cnemaspis wynadensis</i>	Wayanad, Kerala, India	CESL640	<b>MZ291621</b>	-
<i>Cnemaspis wynadensis</i>	Wayanad, Kerala, India	CESL630	<b>MZ291620</b>	<b>MZ701823</b>
<i>Cnemaspis yelagiriensis</i>	Vellore, Tamil Nadu, India	NCBS-BH693	-	MT188147
<i>Cnemaspis yercaudensis</i>	Salem, Tamil Nadu, India	BNHS 2509	MH174359	-
<i>Cnemaspis yercaudensis</i>	Salem, Tamil Nadu, India	BNHS 2510	MH174360	-
<i>Cnemaspis yercaudensis</i>	Yercaud, Salem, Tamil Nadu, India	CES G133	-	MK792473
<i>Cnemaspis zacharyi</i>	Lakkadi, Wayanad, Kerala, India	BNHS 2737	MT217040	-
<i>Cnemaspis zacharyi</i>	Lakkadi, Wayanad, Kerala, India	BNHS 2736	MT217041	-
<i>Cnemaspis zacharyi</i>	Lakkadi, Wayanad, Kerala, India	BNHS 2735	MT217042	-
<i>Cnemaspis zacharyi</i>	Lakkadi, Wayanad, Kerala, India	unvouchered	-	<b>MZ701832</b>

-: Not available.













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32	<i>C. giri</i>																					
33	<i>C. giri</i> BNHS2445																					
34	<i>C. goaensis</i>																					
35	<i>C. giri</i> BNHS2446																					
36	<i>C. goaensis</i> CESL686																					
37	<i>C. goaensis</i> CESL805																					
38	<i>C. goaensis</i> CESL806																					
39	<i>C. gracilis</i>																					
40	<i>C. gracilis</i> BNHS2514																					
41	<i>C. gracilis</i> CESL607																					
42	<i>C. graniticola</i> CESL839																					
43	<i>C. hetropholis</i> CESL693																					
44	<i>C. indica</i> CESL291																					
45	<i>C. jackieii</i> <b>sp. nov.</b> CESL192																					
46	<i>C. kolhapurensis</i>																					
47	<i>C. kolhapurensis</i> BNHS2448																					
48	<i>C. kolhapurensis</i> CESL868																					
49	<i>C. kottiyooensis</i> BNHS2519																					
50	<i>C. kottiyooensis</i> VPCGK051																					
51	<i>C. kottiyooensis</i> VPCGK052																					
52	<i>C. koynaensis</i>																					
53	<i>C. limayei</i>																					
54	<i>C. limayei</i> CESL876																					
55	<i>C. limayei</i> ZSIR/1053																					
56	<i>C. lithophilis</i> <b>sp. nov.</b> CESL817																					
57	<i>C. lithophilis</i> <b>sp. nov.</b> CESL835																					
58	<i>C. littoralis</i>																					
59	<i>C. littoralis</i> BNHS2518																					
60	<i>C. mahabali</i> BNHS2451																					
61	<i>C. mahabali</i> BNHS2502																					
62	<i>C. mahabali</i> CESL859																					
63	<i>C. monticola</i> CESL044																					
64	<i>C. mysoriensis</i> CESL557																					
65	<i>C. nairi</i> CESL712																					
66	<i>C. nairi</i> CESL715																					
67	<i>C. nigriventris</i> <b>sp. nov.</b> CESL264																					
68	<i>C. nigriventris</i> <b>sp. nov.</b> CESL265																					
69	<i>C. nilagirica</i> CESL138																					
70	<i>C. nimbus</i> <b>sp. nov.</b> CESL252																					
71	<i>C. ornata</i> CESL276																					
72	<i>C. otai</i>																					
73	<i>C. otai</i> BNHS2512																					
74	<i>C. palakkadensis</i>	0.134																				
75	<i>C. palanica</i> <b>sp. nov.</b> CESL341	0.135	0.103																			
76	<i>C. regalis</i> <b>sp. nov.</b> CESL487	0.189	0.158	0.173																		
77	<i>C. rubraoculus</i> <b>sp. nov.</b> CESL114	0.161	0.124	0.144	0.128																	
78	<i>C. sisparensis</i> CESL136	0.161	0.144	0.149	0.173	0.137																
79	<i>C. smaug</i> <b>sp. nov.</b> CESL251	0.173	0.134	0.135	0.128	0.045	0.130															
80	<i>C. wallacei</i> <b>sp. nov.</b> CESL377	0.151	0.124	0.130	0.121	0.087	0.133	0.087														
81	<i>C. wynadensis</i> CESL630	0.151	0.136	0.135	0.189	0.139	0.064	0.144	0.121													
82	<i>C. wynadensis</i> CESL640	0.154	0.141	0.139	0.187	0.130	0.069	0.135	0.118	0.009												
83	<i>C. yercaudensis</i>	0.054	0.136	0.132	0.187	0.168	0.154	0.175	0.151	0.142	0.144											
84	<i>C. yercaudensis</i> BNHS2510	0.052	0.131	0.125	0.184	0.165	0.152	0.173	0.147	0.139	0.142	0.007										
85	<i>C. zacharyi</i>	0.152	0.132	0.135	0.166	0.121	0.045	0.118	0.118	0.055	0.057	0.149	0.147									
86	<i>C. zacharyi</i> UPW002	0.154	0.134	0.137	0.168	0.118	0.043	0.121	0.116	0.055	0.057	0.152	0.149	0.002								
87	<i>C. zacharyi</i> UPW003	0.154	0.134	0.137	0.168	0.118	0.043	0.121	0.116	0.055	0.057	0.152	0.149	0.002	0.000							

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**Supplementary Table S3.** Additional gekkotan sequences used for divergence dating in this study.

<b>Species</b>	<b>Locality</b>	<b>Tissue voucher</b>	<b>GenBank</b>
<i>Aeluroscalabotes felinus</i>	Cameron Highlands, Malaysia	JB 16	JX041301
<i>Afroedura loveridgei</i>	Mozambique	GVH 3969	JX041303
<i>Agamura persica</i>	Gwadar Division, Balochistan, Pakistan	FMNH 247474	JX440515
<i>Alsophylax pipiens</i>	Khovd, 1km N of Bulgam, Mongolia	CAS 238804	KC151973
<i>Aprasia parapulchella</i>	Bendigo Whipstick, Victoria, Australia	MVD66569	GU459941
<i>Aristelliger praesignis</i>	Kingston, St. Andrew Parish, Jamaica	USNM 337563	JX041312
<i>Asaccus platyrhynchus</i>	Wilayat Nazwa, Oman	CAS 227605	JX041313
<i>Calodactylodes illingworthorum</i>	Pitakumbura, Sri Lanka	AMB7415	JX041318
<i>Carphodactylus laevis</i>	Lamb Range, Queensland, Australia	AMS 143258	GU459943
<i>Chondrodactylus fitzsimonsi</i>	Gai-as spring, Namibia	MCZ R185712	JN393945
<i>Christinus marmoratus</i>	Wirralie, Ladysmith, New South Wales, Australia	AMS 135338	JX041322
<i>Cnemaspis africana</i>	Amani, Tanga, Tanzania	CAS 168872	JX041323
<i>Cnemaspis dickersonae</i>	Uzungwa Scarp, Tanzania	MTSN 8604	JX041324
<i>Cnemaspis kendalii</i>	Selangor, Malaysia	LSHUC6562	JX041326
<i>Cnemaspis limi</i>	Pulau Tioman, Malaysia	LSHUC 6267	JX041327
<i>Cnemaspis siamensis</i>	Tanintharyi Region, Myanmar	USNM 594370	MN104945
<i>Coleodactylus cf. brachystoma</i>	São Domingos, Goiás, Brazil	CHUNB 43901	JX041331
<i>Coleonyx brevis</i>	Hudspeth County, Texas, USA	TG 00194	JX041333
<i>Colopus wahlbergii</i>	Kalamba Station, Kazungula District, Zambia	NMZ 16974	JX041337
<i>Crenadactylus ocellatus</i>	Trephina Gorge, Northern Territory, Australia	AMS R162089	JX024364
<i>Cyrtodactylus albofasciatus</i>	Kudremukh, Chikmagalur District, Karnataka, India	CES09/1109	KM878626
<i>Cyrtodactylus angularis</i>	Muang Sa Kaeo, Sa Kaeo, Thailand	FMNH 265815	JX440523
<i>Cyrtodactylus ayeyarwadyensis</i>	Rakhine State, Than Dawe District, Myanmar	CAS 216459	JX440526
<i>Cyrtodactylus battalensis</i>	Battagram City, NWFP, Pakistan	PMNH 2301	KC151983
<i>Cyrtodactylus collegalensis</i>	base of MM Hills, Chamarajanagar District, Karnataka, India	CES09/1444	KM878627
<i>Cyrtodactylus deccanensis</i>	Malshej Ghat, Thane District, Maharashtra, India	CES09/1243	KM878614
<i>Cyrtodactylus jeyporensis</i>	Arakku Valley, Visakhapatnam District, Andhra Pradesh, India	CES09/1356	KM878616
<i>Cyrtodactylus nebulosus</i>	Gupteswar, Koraput District, Orissa, India	CES09/1205	KM878621
<i>Cyrtodactylus triedrus</i>	Yakkunehela, Sri Lanka	AdS 35	JX440522

<b>Species</b>	<b>Locality</b>	<b>Tissue voucher</b>	<b>GenBank</b>
<i>Cyrtodactylus varadgirii</i>	Chikli, Navsari District, Gujarat, India	CES09/1381	KM878612
<i>Cyrtopodion kohsulaimanai</i>	Sakhi Sarwar, Pakistan	PMNH 2388	KC151965
<i>Delma butleri</i>	Coonbah, New South Wales, Australia	SAM R36144	AY134584
<i>Diplodactylus tessellatus</i>	Stonehenge area, Queensland, Australia	AMS 143855	JQ173631
<i>Dixonius vietnamensis</i>	Mondolkiri Province, Keo Seima district, Cambodia	FMNH 263003	EU054297
<i>Dravidogecko anamallensis</i>	Vaplarai, Tamil Nadu, India	ZSIK 2969	MN520264
<i>Dravidogecko douglasadamsi</i>	Manjolai estate, Tirunelveli district, Tamil Nadu, India	BNHS 2349	MN520270
<i>Dravidogecko janakiae</i>	Munnar, Idukki district, Kerala, India	BNHS 2357	MN520268
<i>Dravidogecko meghamalaiensis</i>	Meghamalai, Theni district, Tamil Nadu, India	BNHS 2347	MN520266
<i>Dravidogecko septentrionalis</i>	Lakkidi, Wayanad district, Kerala, India	BNHS 2342	MN520267
<i>Dravidogecko smithi</i>	Ponmudi, Tiruvananthapuram district, Kerala, India	ZSIK2981	MN520262
<i>Dravidogecko tholpalli</i>	Kodaikanal, Dindigul district, Tamil Nadu, India	BNHS 2352	MN520261
<i>Ebenavia inunguis</i>	Cambonia Marojejy, Madagascar	ZCMV 2099	JX041348
<i>Elasmodactylus tetensis</i>	Niassa Game Reserve, Mozambique	PEM 5551	JX041349
<i>Eublepharis macularius</i>	Pakistan	TG00081	JX041350
<i>Euleptes europaea</i>	Liguria, Italy	No ID	JN393941
<i>Garthia gaudichaudii</i>	Chile	SC 1	JX041351
<i>Geckolepis maculata</i>	Montagne d'Ambre, Madagascar	FGZC 463	EU054235
<i>Gehyra dubia</i>	Daydawn, New South Wales, Australia	AMS 152245	JN393911
<i>Gehyra mutilata</i>	El Questro, Western Australia, Australia	AMS 139934	JN019081
<i>Gehyra oceanica</i>	Ngkesill Island, Palau	USNM 559790	JN393924
<i>Gehyra robusta</i>	Queensland, Australia	AMS NR2429	JN393928
<i>Gehyra variegata</i>	Northern Territory, Australia	AMS136026	JN393916
<i>Gehyra xenopus</i>	Western Australia, Mitchell Plateau, Australia	AMS140173	JN393932
<i>Gekko badenii</i>	Vietnam	JB 13	JN019065
<i>Gekko chinensis</i>	Wuzhi Shan, Hainan Id., China	LSHUC 4209	JN019058
<i>Gekko monarchus</i>	Selangor, Kepong, FRIM, West Malaysia	LLG 4824	JN019078
<i>Gekko smithi</i>	Johor, Endau-Rompin, Peta, West Malaysia	LLG 7648	JN019056
<i>Gekko vittatus</i>	Gaua Island, Vanuatu	AMS 138865	JN019072
<i>Goggia lineata</i>	Park, Northern Cape Prov., South Africa	AMB4762	JX041353
<i>Hemidactylus angulatus</i>	Daniah village at Koulete River, Guinea	EBG 746	HM559620
<i>Hemidactylus mabouia</i>	Limpopo Prov., Huntleigh, South Africa	AMB 8301	HM559638
<i>Hemidactylus macropholis</i>	Bari Region, Puntland State, Somalia	CAS 227520	JX041369
<i>Hemidactylus robustus</i>	India (captive specimen)	JB 30	HM559644

<b>Species</b>	<b>Locality</b>	<b>Tissue voucher</b>	<b>GenBank</b>
<i>Hemiphyllocladactylus arakuensis</i>	Araku, Visakhapatnam District, Andhra Pradesh, India	BNHS 2275	MK570109
<i>Hemiphyllocladactylus dushanensis</i>	Guizhou, China	n/a	FJ971016
<i>Hemiphyllocladactylus harterti</i>	Bukit Larut, Malaysia	LSUHC 10384	KF219761
<i>Hemiphyllocladactylus jnana</i>	IISc Bangalore, Karnataka, India	CES G174	MK570112
<i>Holodactylus africanus</i>	Kajiado District, Kenya	CAS 198845	JX041372
<i>Homonota darwinii</i>	Puerto Deseado, Santa Cruz, Argentina	LJAMM 4601	JX041373
<i>Homopholis walbergii</i>	n/a	AMB 8410	EU054244
<i>Hoplodactylus duvaucelii</i>	Mercury Island, New Caledonia	FT(VUW) 174	GU459843
<i>Hoplodactylus pacificus</i>	Pupuha, New Caledonia	CD853	GU459787
<i>Kolekanos plumicaudus</i>	Parque Nacional do Iona, Cunene Prov., Angola	WDH 1	JX041304
<i>Lepidodactylus lugubris</i>	Singapore	ZRC 24847	JN393944
<i>Lepidodactylus orientalis</i>	Battagram City, NWFP, Pakistan	BPBM 19794	JN019080
<i>Lialis jicari</i>	Australia	n/a	AY369025
<i>Lucasium stenodactylum</i>	Western Australia, Australia	AMS 139897	JQ173630
<i>Luperosaurus cumingii</i>	Philippines, Cumiagi	RMB 3546	JX515623
<i>Lygodactylus miops</i>	Andohahela, Madagascar	ZSM 116/2004	KM034118
<i>Lygodactylus picturatus</i>	Watamu, coast province, Kenya	CAS223805	KF546227
<i>Matoatoa brevipes</i>	Tulear area, Madagascar	FG/MV 2002.2237	EF490777
<i>Mediodactylus brachykolon</i>	NWFP, Battagram City, Pakistan	PMNH 2165	KC151981
<i>Mediodactylus russowii</i>	Ili River, Kazakhstan	JEM 863	JX440517
<i>Nactus vankampeni</i>	East Sepik Province, Wewak, Papua New Guinea	BPBM 23365	EU054295
<i>Naultinus elegans</i>	Whangarei, New Zealand	No ID	GU459757
<i>Nephrurus levis</i>	Western Australia, Australia	AMS 140561	AY369018
<i>Oedodera marmorata</i>	Paagoumène, New Caledonia	CAS 230936	GU459947
<i>Oedura marmorata</i>	Australia, Queensland	AMS 143861	GU459951
<i>Pachydactylus gaiasensis</i>	Gai-As, Namibia	AMB 7596	JX041391
<i>Paradelma orientalis</i>	20 km N Capella, Queensland, Australia	QM J56089	AY134605
<i>Paragehyra gabriellae</i>	Grotte Ampasy, Madagascar	FGZC 2366	JX041399
<i>Paroedura picta</i>	Berenty, Madagascar	FG/MV 2002.B1	EF536197
<i>Perochirus ateles</i>	Dehpelhi Id., Pohnpei, Federated States of Micronesia	DB Dmale	JN393938
<i>Phelsuma astriata</i>	-	-	EU423286
<i>Phelsuma borbonica</i>	Réunion	JB 95	JX041400
<i>Phelsuma inexpectata</i>	Réunion (captive)	JB 56	JN393939
<i>Phelsuma ornata</i>	-	-	EU423282
<i>Phelsuma rosagularis</i>	Mauritius	n/a	EU423292
<i>Phyllocladactylus xanti</i>	Baja California Sur, Mexico	ROM 38490	JN393940
<i>Phyllopezus pollicaris</i>	das Confusões, Piauí, Brazil	MZUSP 92491	JX041417

<b>Species</b>	<b>Locality</b>	<b>Tissue voucher</b>	<b>GenBank</b>
<i>Pseudogekko smaragdinus</i>	Quezon, Philippines	KU 303995	JX515626
<i>Pseudogonatodes guianensis</i>	Loreto, Peru	KU 222142	JX041421
<i>Pseudothecadactylus lindneri</i>	Kakadu Natl. Park, NT, Australia	MVZ 99544	GU459946
<i>Ptyodactylus guttatus</i>	Egypt (captive)	TG 00072	JX041426
<i>Pygopus lepidopodus</i>	Western Australia, Australia	WBJ 1206	AY134603
<i>Pygopus nigriceps</i>	Northern Territory, Australia	MVZ 197233	JX440518
<i>Quedenfeldtia trachyblepharus</i>	Oukaimeden, Morocco	MVZ 178121	JX041428
<i>Ramigekko swartbergensis</i>	Swartberg Mts., Western Cape Prov., South Africa	JB 47	JX041305
<i>Rhoptropella ocellata</i>	Richtersveld National Park, Northern Cape, South Africa	CAS 186351	JX041429
<i>Rhoptropus diporus</i>	Brandberg Wes Myn, Namibia	MCZ R183737	JX041432
<i>Saltuarius swaini</i>	Lamb Range, Queensland, Australia	AMS 143262	JX024356
<i>Saurodactylus fasciatus</i>	Zumi, Morocco	DJH M616	JX041434
<i>Saurodactylus mauritanicus</i>	NW of Ain Beni Mather, Morocco	DJH Sm61	JX041435
<i>Sphaerodactylus elegans</i>	Monroe County, Florida, USA	YPM 14795	JN393942
<i>Sphaerodactylus macrolepis</i>	Puerto Rico	TG0099	KP640637
<i>Sphaerodactylus nigropunctatus</i>	Long Island, Bahamas	FLMNH 144010	JX041439
<i>Sphaerodactylus roosevelti</i>	USA, Puerto Rico	CAS 198428	JN393943
<i>Sphaerodactylus torrei</i>	Cuba	JB 34	JX440519
<i>Tarentola deserti</i>	unknown	JB 44	JX041445
<i>Thecadactylus rapicauda</i>	St. Croix, U.S. Virgin Islands	USNM 561446	JX041456
<i>Uroplatus henkeli</i>	Nosy Be, Madagascar	FG/MV 2000.C1	EF490796
<i>Woodworthia maculata</i>	Titahi Bay, New Zealand	RAH 292	GU459852

**Supplementary Table S4:** Mensural (mm) and meristic data for the holotype series of the 12 newly identified species. Abbreviations are listed in Materials and Methods. \* = digit incomplete; L&R = Left & Right; r = regrown tail.

	<i>Cnemaspis balerion</i> sp. nov.	<i>Cnemaspis lithophilis</i> sp. nov.	<i>Cnemaspis rubraoculus</i> sp. nov.	<i>Cnemaspis nimbus</i> sp. nov.	<i>Cnemaspis wallaceii</i> sp. nov.	<i>Cnemaspis smaug</i> sp. nov.
	BNHS2623	BNHS2624	BNHS2612	BNHS2614	BNHS2613	BNHS2615
Sex	M	M	M	M	M	M
SVL	45.0	44.9	45.8	48.2	45.9	50.4
AGL	19.9	18.91	19.4	20.47	19.73	21.84
BW	10.8	8.71	8.55	9.18	7.12	9.08
CL	9.0r	8.79	8.3	8.85	8.51	9.71
TL	48.2	53.93	24.51r	32.66	46.48	65.78
TW	5.7	4.6	5.4	6.06	5.43	5.84
HL	12.4	12.39	13.03	13.61	12.6	14.06
HW	8.8	8.65	9.55	9.55	8.35	10.11
HD	5.3	5.18	5.87	6.04	5.29	6.26
EL	1.0	1.14	1.12	0.86	0.88	1.31
FL	6.7	6.67	6.42	7.78	6.47	7.89
ED	2.6	3.05	2.65	2.84	2.53	3.15
EN	4.4	4.21	4.54	4.32	4.46	5.41
ES	5.5	5.52	5.72	5.63	5.53	7.02
EE	4.9	4.19	5.18	5.61	4.24	4.74
IN	2.0	1.67	1.84	1.78	1.67	2.21
IO	4.4	4.73	4.28	4.28	3.69	4.77
LamF1 L&R	10 & 10	12 & 12	9 & 10	11 & 11	11 & 11	11 & 11
LamF4 L&R	20 & 20	25 & 25	16 & 16	21 & 21	20 & 20	19 & 19
LamT1 L&R	10 & 10	12 & 12	9 & 9	9 & 11	10 & 10	10 & 10
LamT4 L&R	22 & 22	28 & 28	19 & 19	23 & 23	23 & 23	21 & 21
LamT5 L&R	19 & 20	23 & 23	17 & 17	18 & 18	18 & 18	19 & 18
SL Lt	7	8	6	7	7	9
SL Rt	8	8	6	7	6	9
IL Lt	8	8	6	7	7	8
IL Rt	8	8	6	7	7	8
Scales betn 1st pair of Pmental	1	1	1	1	2	1
PVT	abs.	abs.	12	16	18	30
DTR	abs.	15	8	14	14	19
MVSR	24	24	33	27	29	30
VS	123	128	133	141	154	143
PP L, R	abs.	abs.	6	6	8	8
SBPP	abs.	abs.	abs.	0	0	abs.
FP (L, R)	8,8	7,6	abs.	abs.	abs.	abs.
SB FP&PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.
SBFP	14	13	abs.	abs.	abs.	abs.
PCT	abs.	0	1	1	1	2
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0
Ventral forearm scales	0	0	0	0	0	0



	<i>Cnemaspis balerion</i> <b>sp. nov.</b>	<i>Cnemaspis lithophilis</i> <b>sp. nov.</b>	<i>Cnemaspis rubraoculus</i> <b>sp. nov.</b>	<i>Cnemaspis nimbus</i> <b>sp. nov.</b>	<i>Cnemaspis wallaceii</i> <b>sp. nov.</b>	<i>Cnemaspis smaug</i> <b>sp. nov.</b>
	BNHS2623	BNHS2624	BNHS2612	BNHS2614	BNHS2613	BNHS2615
Keeled (1) smooth (0)						
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	1	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0	0
Preloacal pores continuous (1) or separated (0)	abs.	abs.	1	1	1	1
Preloacal pores elongate (1) or round (0)	abs.	abs.	0	0	0	0
femoral pores elongate (1) or round (0)	1	1	abs.	abs.	abs.	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	1	1	1	1
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	1	0	0	0	0	0
Dorsal tubercles keeled (1) or not keeled (0)	abs.	1	1	1	1	1
Tubercles linearly arranged (1) or more random (0)	abs.	0	0	1	1	1
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	0	0	0
Tubercles present (1) or	0	0	0	0	0	0

	<i>Cnemaspis balerion</i> sp. nov.	<i>Cnemaspis lithophilis</i> sp. nov.	<i>Cnemaspis rubraoculus</i> sp. nov.	<i>Cnemaspis nimbus</i> sp. nov.	<i>Cnemaspis wallaceii</i> sp. nov.	<i>Cnemaspis smaug</i> sp. nov.
	BNHS2623	BNHS2624	BNHS2612	BNHS2614	BNHS2613	BNHS2615
absent (0) on lower flanks						
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	abs.	abs.	abs.	abs.	0	1
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	0
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	abs.	abs.	1	1	1	1

	<i>Cnemaspis regalis</i> sp. nov.	<i>Cnemaspis galaxia</i> sp. nov.	<i>Cnemaspis nigriventris</i> sp. nov.	<i>Cnemaspis flavigularis</i> sp. nov.	<i>Cnemaspis palanica</i> sp. nov.	<i>Cnemaspis jackieii</i> sp. nov.
	BNHS2617	BNHS2626	BNHS2619	BNHS2621	BNHS 2628	BNHS 2620
Sex	M	M	M	M	M	M
SVL	36.1	32.6	36.1	29.8	28.3	31.1
AGL	15.15	13.85	15.35	14.4	12.68	13.52
BW	6.97	6.48	6.82	5.3	4.76	5.09
CL	7.42	6.2	7.15	5.9	5.48	6.53
TL	21.04*	29.42*	7.3*	16.3*	35.77	31.59r
TW	4.38	3.36	3.9	3.3	3.24	2.51
HL	10.29	7.8	10.25	8.2	7.61	7.82
HW	7.23	5.64	6.81	5.4	5.35	5.35
HD	4.63	3.53	4.53	3.1	2.85	3.08
EL	0.53	0.53	0.7	0.6	0.42	0.8
FL	6.14	4.62	5.72	4.8	4.52	5.72
ED	1.96	2.03	2.23	1.5	1.61	1.6
EN	3.62	2.86	3.72	2.8	3.01	3.05
ES	4.8	3.88	4.68	3.9	3.99	3.5
EE	3.2	2.54	3.38	3.5	3.33	3.18
IN	1.58	0.98	1.49	1.6	1.35	1.37
IO	3.7	2.41	3.97	3.1	2.77	2.73
LamF1 L&R	12 & 12	10 & 9	12 & 13	8 & 8	9 & 9	9 & 8
LamF4 L&R	19 & 19	21 & 21	23 & 23	13 & 14	15 & 15	17 & 16

	<i>Cnemaspis regalis</i> sp. nov.	<i>Cnemaspis galaxia</i> sp. nov.	<i>Cnemaspis nigriventris</i> sp. nov.	<i>Cnemaspis flavigularis</i> sp. nov.	<i>Cnemaspis palanica</i> sp. nov.	<i>Cnemaspis jackieii</i> sp. nov.
	BNHS2617	BNHS2626	BNHS2619	BNHS2621	BNHS 2628	BNHS 2620
LamT1 L&R	11 & 10	9 & 9	11 & 11	8 & 9	9 & 9	9 & 9
LamT4 L&R	27 & 27	23 & 24	25 & 24	17 & 17	18 & 18	21 & 21
LamT5 L&R	24 & *	21 & 21	23 & 22	14 & 13	15 & 16	* & 17
SL Lt	9	7	8	9	8	7
SL Rt	9	7	7	9	8	7
IL Lt	8	7	8	8	7	7
IL Rt	8	7	7	8	7	7
Scales betn 1st pair of Pmental	PM touching	1	1	1	1	PM touching
PVT	12	18	16	abs.	abs.	11
DTR	8	8	14	abs.	abs.	9
MVSR	44	28	40	22	17	31
VS	148	153	159	108	105	125
PP L, R	8	7	6	abs.	abs.	2,2
SBPP	abs.	abs.	abs.	abs.	abs.	1
FP (L, R)	abs.	abs.	abs.	10, 11	14, 15	5, 5
SB FP&PP (L, R)	abs.	abs.	abs.	abs.	abs.	9, 9
SBFP	abs.	abs.	abs.	12	8	abs.
PCT	1	1	1	1	1	1
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0	0
Precloacal pores continuous (1) or separated (0)	1	1	1	abs.	abs.	0
Precloacal pores elongate (1) or round (0)	0	0	0	abs.	abs.	0
femoral pores elongate (1) or round (0)	abs.	abs.	abs.	0	1	1
Row of large scales under 1st toe till end	0	0	0	0	0	0

	<i>Cnemaspis regalis</i> <b>sp. nov.</b>	<i>Cnemaspis galaxia</i> <b>sp. nov.</b>	<i>Cnemaspis nigriventris</i> <b>sp. nov.</b>	<i>Cnemaspis flavigularis</i> <b>sp. nov.</b>	<i>Cnemaspis palanica</i> <b>sp. nov.</b>	<i>Cnemaspis jackieii</i> <b>sp. nov.</b>
	BNHS2617	BNHS2626	BNHS2619	BNHS2621	BNHS 2628	BNHS 2620
of feet present (1); absent (0)						
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	0	0	0	1	1	0
Dorsal tubercles keeled (1) or not keeled (0)	1	1	0	abs.	abs.	1
Tubercles linearly arranged (1) or more random (0)	1	1	1	abs.	abs.	0
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	abs.	1	0
Tubercles present (1) or absent (0) on lower flanks	0	0	0	1	1	1
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	1	1	0	0	0	1
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	1	1	1	1	1	1

**Supplementary Table S5:** Mensural (mm) and meristic data for the paratype series of the 12 newly identified species. Abbreviations are listed in Materials and Methods. \* = digit incomplete; L&R = Left & Right; r = regrown tail.

	<i>Cnemaspis balerion</i> sp. nov.		<i>Cnemaspis lithophilis</i> sp. nov.				<i>Cnemaspis rubraoculus</i> sp. nov.	
	CESL 417	CESL 416	BNHS 2625	CESL 819	CESL 820	CESL 835	CESL 116	CESL 114
Sex	F	M	F	F	M	F	F	F
SVL	43.2	44.2	43.6	40.8	43.6	49.9	45.5	43.6
AGL	20.0	19.35	19	16.42	17.26	22.07	18.47	17.68
BW	11.6	10.55	8.3	8.78	8.39	12.72	11.41	11.55
CL	9.5*	8.5*	8.2	7.98	8.43	10.16	8.21	8.02
TL	36.6	17.56	49	48.05	51.03r	54.58r	44.66	45.1
TW	5.0	4.95	3.9	4.17	4.5	6.52	6.11	6.35
HL	11.9	12.09	11.7	10.97	11.95	13.61	12.82	12.34
HW	8.5	8.56	8.56	7.81	8.61	9.71	9.78	9.12
HD	5.0	5.24	5.15	4.58	5.13	5.59	6	5.44
EL	1.0	0.94	1.04	1.09	1.1	1.43	1.03	0.79
FL	7.0	6.42	6.8	5.97	6.91	7.88	6.21	6.08
ED	2.3	2.34	3.03	2.82	2.98	3.37	2.69	2.51
EN	4.1	4.21	4.14	3.84	4.45	4.85	4.48	4.36
ES	5.3	5.33	5.48	5.01	5.59	5.98	5.67	5.31
EE	4.4	4.41	4.03	3.88	4.06	4.69	5.39	4.9
IN	2.5	2.09	1.6	1.61	1.72	2.03	1.83	1.79
IO	4.6	4.27	4.34	4.22	4.35	4.82	4.25	4.19
LamF1 L&R	10 & 10	11 & 10	13 & 13	12 & 12	12 & 12	13 & 13	9 & 8	9 & 9
LamF4 L&R	19 & 20	20 & 20	25 & 25	25 & 25	25 & 25	25 & 26	15 & 15	15 & 16
LamT1 L&R	10 & 10	10 & 10	12 & 12	12 & 12	12 & 12	12 & 12	8 & 8	9 & 9
LamT4 L&R	23 & 22	22 & 23	27 & 28	27 & 27	28 & 28	29 & 28	18 & 18	19 & 19
LamT5 L&R	20 & 20	19 & 20	* & 22	23 & 23	22 & 22	24 & 23	15 & 15	16 & 17
SL Lt	7	8	9	8	8	8	6	6
SL Rt	8	8	8	9	8	8	6	6
IL Lt	7	7	8	8	8	8	6	6
IL Rt	8	8	8	8	8	7	6	6
Scales betn 1st pair of Pmental	1	1	1	1	2	2	1	1
PVT	abs.	abs.		abs.	abs.	abs.	14	14
DTR	abs.	abs.	15	14	16	14	9	10
MVSR	23	22	26	28	26	26	36	37
VS	127	121	129	127	126	128	128	122
PP L, R	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SBPP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
FP (L, R)	abs.	8,9	abs.	abs.	6,7	abs.	abs.	abs.

	<i>Cnemaspis balerion</i> sp. nov.		<i>Cnemaspis lithophilis</i> sp. nov.				<i>Cnemaspis rubraoculus</i> sp. nov.	
	CESL 417	CESL 416	BNHS 2625	CESL 819	CESL 820	CESL 835	CESL 116	CESL 114
SB FP&PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SBFP	abs.	16	abs.	abs.	12	abs.	abs.	abs.
PCT	abs.	abs.	0	0	0	0	1	1
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Precloacal pores continuous (1) or separated (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Precloacal pores elongate (1) or round (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
femoral pores elongate (1) or round (0)	abs.	1	abs.	abs.	1	abs.	abs.	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0	0	1	1
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	1	1	0	0	0	0	0	0
Dorsal tubercles keeled (1) or not keeled (0)	abs.	abs.	1	1	1	1	1	1
Tubercles linearly arranged (1) or more random (0)	abs.	abs.	0	0	0	0	0	0
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	0	0	0	0	0
Tubercles present (1) or absent (0) on lower flanks	0	0	0	0	0	0	0	0
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0	0	0

	<i>Cnemaspis balerion</i> sp. nov.		<i>Cnemaspis lithophilis</i> sp. nov.				<i>Cnemaspis rubraoculus</i> sp. nov.	
	CESL 417	CESL 416	BNHS 2625	CESL 819	CESL 820	CESL 835	CESL 116	CESL 114
Caudal tubercles encircle tail (1) or not (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1	1	1
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	abs.	abs.	abs.	abs.	abs.	abs.	1	1

	<i>Cnemaspis nimbus</i> sp. nov.		<i>Cnemaspis wallaceii</i> sp. nov.	<i>Cnemaspis smaug</i> sp. nov.			
	CESL 252	CESL 357	CESL 378	CESL 353	BNHS 2616	CESL 355	CESL 251
Sex	M	M	F	M	F	M	F
SVL	45.1	40.5	46.2	46.4	43.6	46.4	52.0
AGL	19.47	14.75	20.91	21.34	19.58	18.14	23.14
BW	9.6	7.87	8	8.7	8.3	7.78	9.65
CL	8.31	7.23	8.88	9.27	8.9	9.14	9.51
TL	19.61*	11.65*	42.65r	53.13r	48.86	34.23*	17.22*
TW	5.97	5.15	4.25	5.27	4.26	4.15	4.14
HL	12.46	11.86	12.32	12.6	11.61	11.47	13.25
HW	9.13	8.08	8.44	8.84	8.12	8.64	9.9
HD	5.6	4.56	5.33	5.67	5.13	4.91	5.65
EL	0.69	0.71	0.79	0.96	0.91	0.86	0.97
FL	6.63	5.84	7.05	7.38	6.96	6.22	7.83
ED	2.85	2.25	2.64	2.85	2.55	2.71	2.82
EN	4.41	4.13	4.33	4.98	4.23	4.67	4.74
ES	5.53	5.02	5.48	6.21	5.7	5.64	6.42
EE	5.09	4.8	4.46	4.27	3.81	3.97	4.25
IN	1.53	1.35	1.82	2.06	1.94	2.16	1.74
IO	3.85	4.09	3.75	4.48	3.81	4.01	3.45
LamF1 L&R	11 & 10	10 & 9	10 & 10	10 & 10	10 & 11	11 & 11	11 & 11
LamF4 L&R	20 & 19	20 & 20	19 & 20	19 & 18	19 & 19	19 & 19	19 & 19
LamT1 L&R	10 & 10	10 & 10	10 & 10	10 & 11	10 & 9	10 & 10	9 & 11
LamT4 L&R	22 & 22	23 & 23	22 & 22	21 & 22	21 & 21	20 & 21	21 & 22
LamT5 L&R	19 & *	17 & 17	18 & 18	18 & 18	18 & 18	18 & 18	18 & 18

	<i>Cnemaspis nimbus</i> sp. nov.		<i>Cnemaspis</i> <i>wallaceii</i> sp. nov.	<i>Cnemaspis smaug</i> sp. nov.			
	CESL 252	CESL 357	CESL 378	CESL 353	BNHS 2616	CESL 355	CESL 251
SL Lt	7	7	7	7	7	9	9
SL Rt	7	7	7	7	7	9	8
IL Lt	7	7	7	7	8	8	8
IL Rt	7	8	7	7	7	8	8
Scales betn 1st pair of Pmental	1	1	3	1	1	1	1
PVT	17	16	20	27	28	28	30
DTR	12	13	15	20	20	22	20
MVSR	27	26	28	34	31	30	33
VS	139	134	156	145	142	150	148
PP L, R	5	4	abs.	7	abs.	7	abs.
SBPP	0	0	0	abs.	abs.	abs.	abs.
FP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SB FP&PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SBFP	abs.	abs.	abs.	abs.	abs.	abs.	abs.
PCT	1	1	1	2	2	2	2
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	1	1	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0
Preloacal pores continuous (1) or separated (0)	1	1	abs.	1	abs.	1	abs.
Preloacal pores elongate (1) or round (0)	0	0	abs.	0	abs.	0	abs.
femoral pores elongate (1) or round (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	1	1	1	1	1	1	1
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	0	0	0	0	0	0	0
Dorsal tubercles keeled (1) or not keeled (0)	1	1	1	1	1	1	1
Tubercles linearly arranged (1) or more random (0)	1	1	1	1	1	1	1
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	0	0	0	0



	<i>Cnemaspis nimbus</i> sp. nov.		<i>Cnemaspis</i> <i>wallaceii</i> sp. nov.	<i>Cnemaspis smaug</i> sp. nov.			
	CESL 252	CESL 357	CESL 378	CESL 353	BNHS 2616	CESL 355	CESL 251
Tubercles present (1) or absent (0) on lower flanks	0	0	0	0	0	0	0
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	abs.	abs.	0	1	1	1	1
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	0	0	0	0
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	1	1	1	1	1	1	1

	<i>Cnemaspis regalis</i> sp. nov.						<i>Cnemaspis galaxia</i> sp. nov.	
	CESL 487	CESL 488	CESL 489	CESL 495	BNHS 2618	CESL 502	CESL 511	CESL 513
Sex	F	F	M	M	F	M	F	M
SVL	35.5	35.8	34.7	35.0	36.5	34.4	33.5	31.5
AGL	13.94	13.38	14.25	14.81	15.9	13.62	13.58	12.3
BW	6.55	7.72	7.26	6.86	9.25	7.01	6.83	6.31
CL	6.8	7.52	7.26	6.95	7.05	6.71	6.1	6.12
TL	35.2r	41.81	43.58	46.32	36.7r	47.3	35.6	33.36r
TW	3.88	3.92	4.11	4.06	4.02	4.11	2.65	3.35
HL	10.23	10.62	9.65	10.04	10.05	10.08	7.69	7.77
HW	6.71	6.85	6.52	6.94	6.9	6.72	5.58	5.75
HD	3.93	4.32	4.06	4.39	4.2	4.19	3.07	3.32
EL	0.55	0.68	0.73	0.58	0.75	0.66	0.64	0.49
FL	5.7	6.34	5.77	5.58	6.11	5.59	4.69	5.06
ED	2.1	2.0	1.84	1.95	2.05	2.11	2.21	2.15
EN	3.82	4.04	3.64	3.84	3.74	3.54	3.26	2.95
ES	4.3	4.75	4.54	4.57	4.61	4.51	4.12	4.2
EE	3.4	3.3	3.06	3.1	3.3	3.39	2.75	2.69
IN	1.66	1.74	1.4	1.73	1.62	1.5	1.26	1.48
IO	3.18	3.34	3.22	3.45	3.45	3.25	3.09	2.79
LamF1 L&R	11 & 11	11 & 11	11 & 11	12 & 11	12 & 12	12 & 11	11 & 10	10 & 10
LamF4 L&R	20 & 24	23 & 21	21 & 24	22 & 22	22 & 21	23 & 23	21 & 20	21 & 22
LamT1 L&R	10 & 10	11 & 10	11 & 11	10 & 10	10 & 11	10 & 10	10 & 11	9 & 9

	<i>Cnemaspis regalis</i> sp. nov.						<i>Cnemaspis galaxia</i> sp. nov.	
	CESL 487	CESL 488	CESL 489	CESL 495	BNHS 2618	CESL 502	CESL 511	CESL 513
LamT4 L&R	24 & 25	25 & 24	25 & 24	24 & 27	25 & 25	26 & 26	24 & 23	25 & 24
LamT5 L&R	23 & 22	23 & 23	24 & 24	23 & 24	22 & 22	24 & 24	20 & 21	21 & 21
SL Lt	9	9	8	8	8	8	7	7
SL Rt	9	7	8	7	8	8	7	7
IL Lt	8	8	8	7	7	7	8	6
IL Rt	8	7	8	7	7	7	8	6
Scales betn 1st pair of Pmental	1	1	1	PM touching	PM touching	1	1	1
PVT	13	14	14	14	12	13	17	18
DTR	8	8	7	9	8	9	8	8
MVSR	42	40	41	43	40	42	31	27
VS	150	154	151	149	152	148	156	159
PP L, R	abs.	abs.	6	7	abs.	7	abs.	7
SBPP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
FP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SB FP&PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SBFP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
PCT	1	1	1	1	1	1	1	1
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Precloacal pores continuous (1) or separated (0)	abs.	abs.	1	1	abs.	1	1	1
Precloacal pores elongate (1) or round (0)	abs.	abs.	0	0	abs.	0	0	0
femoral pores elongate (1) or round (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0	0	0	0
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	0	0	0	0	0	0	0	0
Dorsal tubercles keeled (1) or not keeled (0)	1	1	1	1	1	1	1	1

	<i>Cnemaspis regalis</i> sp. nov.						<i>Cnemaspis galaxia</i> sp. nov.	
	CESL 487	CESL 488	CESL 489	CESL 495	BNHS 2618	CESL 502	CESL 511	CESL 513
Tubercles linearly arranged (1) or more random (0)	1	1	1	1	1	1	1	1
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	0	0	0	0	0
Tubercles present (1) or absent (0) on lower flanks	0	0	0	0	0	0	0	0
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	1	1	1	1	1	1	1	1
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1	1	1
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	1	1	1	1	1	1	1	1

	<i>Cnemaspis nigriventris</i> sp. nov.		<i>Cnemaspis flavigularis</i> sp. nov.		
	CESL 264	CESL 265	BNHS 2622	CESL 247	CESL 249
Sex	M	M (juv.)	F	M	M
SVL	38.2	25.8	33.1	27.6	25.5
AGL	16.5	10.35	15.8	12.2	10.8
BW	6.7	4.35	6.8	4.7	4.1
CL	7.33	5.28	5.3	5.2	4.8
TL	2.6*	9.77*	*	18.7*	11.0*
TW	4.18	2.32	*	3.3	2.7
HL	10.43	7.7	8.3	7.7	6.9
HW	7.11	5.3	5.6	5.2	4.6
HD	4.58	3.38	3.2	3.1	2.5
EL	0.68	0.29	0.6	0.6	0.4
FL	5.81	3.98	5.0	4.3	2.9
ED	2.35	1.98	1.6	1.3	1.1
EN	3.97	2.84	2.7	2.7	2.1
ES	5.13	3.56	3.3	3.7	3.3
EE	3.61	2.6	2.7	3.2	2.6
IN	1.54	1.29	1.0	1.2	0.9

	<i>Cnemaspis nigriventris</i> sp. nov.		<i>Cnemaspis flavigularis</i> sp. nov.		
	CESL 264	CESL 265	BNHS 2622	CESL 247	CESL 249
IO	3.89	2.91	3.1	3.0	2.2
LamF1 L&R	12 & 12	12 & 13	8 & 8	7 & 8	8 & 8
LamF4 L&R	22& 23	23 & 22	14 & 14	14 & 14	13 & 14
LamT1 L&R	11 & 11	12 & 10	9 & 9	7 & 8	7 & 8
LamT4 L&R	25 & 24	24 & 25	16 & 18	16 & 17	17 & 17
LamT5 L&R	22 & 21	22 & 21	14 & 15	14 & 13	14 & 12
SL Lt	8	8	8	9	8
SL Rt	7	8	8	8	7
IL Lt	8	8	7	8	9
IL Rt	8	7	7	7	7
Scales betn 1st pair of Pmental	1	1	1	1	1
PVT	15	16	abs.	abs.	abs.
DTR	13	14	abs.	abs.	abs.
MVSR	38	38	22	21	23
VS	155	154	108	104	106
PP L, R	7	abs.	abs.	abs.	abs.
SBPP	abs.	abs.	abs.	abs.	abs.
FP (L, R)	abs.	abs.	abs.	12, 11	12, 11
SB FP&PP (L, R)	abs.	abs.	abs.	abs.	abs.
SBFP	abs.	abs.	abs.	10	10
PCT	1	1	1	1	1
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0
Preloacal pores continuous (1) or separated (0)	1	abs.	abs.	abs.	abs.
Preloacal pores elongate (1) or round (0)	0	abs.	abs.	abs.	abs.
femoral pores elongate (1) or round (0)	abs.	abs.	abs.	0	0
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	0	0	1	1	1
Dorsal tubercles keeled (1) or not keeled (0)	0	0	abs.	abs.	abs.
Tubercles linearly arranged (1) or more random (0)	1	1	abs.	abs.	abs.
Spine-like tubercles on flank present (1) or absent (0)	0	0	abs.	abs.	abs.
Tubercles present (1) or absent (0) on lower flanks	0	0	1	1	1

	<i>Cnemaspis nigriventris</i> sp. nov.		<i>Cnemaspis flavigularis</i> sp. nov.		
	CESL 264	CESL 265	BNHS 2622	CESL 247	CESL 249
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	0	0	0	0	0
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	1	1	1	1	1

	<i>Cnemaspis palanica</i> sp. nov.			<i>Cnemaspis jackieii</i> sp. nov.	
	CESL 339	CESL 340	BNHS 2629	CESL 192	CESL 193
Sex	F	M	F	M	F
SVL	29.6	27.2	30.6	30.6	31.3
AGL	13.86	11.36	14.66	14.1	13.34
BW	5.43	5.09	6.25	5.53	5.74
CL	4.89	5.68	5.38	6.06	6.19
TL	11.24*	27.2*	35.23	18.22*	38.29
TW	2.68	2.8	2.91	2.75	3.11
HL	7.58	7.87	7.74	7.54	7.52
HW	5.11	5.1	5.31	4.93	5.24
HD	3.16	3.03	3.29	2.55	2.25
EL	0.48	0.4	0.54	0.7	0.7
FL	4.41	4.08	4.37	5.28	4.62
ED	1.52	1.41	1.47	1.49	1.74
EN	3.09	2.52	3.12	2.84	2.54
ES	3.87	3.54	3.98	3.22	3.63
EE	3.29	3.26	3.35	2.52	2.84
IN	1.26	1.09	1.2	0.93	1.2
IO	2.94	2.57	3.09	2.47	2.57
LamF1 L&R	9 & 9	8 & 8	9 & 9	9 & 9	10 & 9
LamF4 L&R	15 & 15	14 & 14	14 & 15	17 & 17	18 & 16
LamT1 L&R	8 & 8	9 & 9	9 & 9	9 & 10	9 & 9
LamT4 L&R	17 & 18	17 & 17	18 & 18	* & 21	22 & 21
LamT5 L&R	16 & 15	15 & 15	15 & 15	18 & 17	17 & 17
SL Lt	8	7	8	8	7
SL Rt	7	7	7	7	8

	<i>Cnemaspis palanica</i> sp. nov.			<i>Cnemaspis jackieii</i> sp. nov.	
	CESL 339	CESL 340	BNHS 2629	CESL 192	CESL 193
IL Lt	7	8	8	7	7
IL Rt	7	7	7	7	7
Scales betn 1st pair of Pmental	1	1	1	PM touching	PM touching
PVT	abs.	abs.	abs.	12	11
DTR	abs.	abs.	abs.	8	8
MVSR	18	16	18	28	28
VS	106	104	103	119	122
PP L, R	abs.	abs.	abs.	2,1	abs.
SBPP	abs.	abs.	abs.	2	abs.
FP (L, R)	abs.	12, 12	abs.	5, 6	abs.
SB FP&PP (L, R)	abs.	abs.	abs.	11,10	abs.
SBFP	abs.	7	abs.	abs.	abs.
PCT	1	1	1	1	1
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0
Preloacal pores continuous (1) or separated (0)	abs.	abs.	abs.	0	abs.
Preloacal pores elongate (1) or round (0)	abs.	abs.	abs.	0	abs.
femoral pores elongate (1) or round (0)	abs.	1	abs.	1	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	1	1	1	0	0
Dorsal tubercles keeled (1) or not keeled (0)	abs.	abs.	abs.	1	1
Tubercles linearly arranged (1) or more random (0)	abs.	abs.	abs.	0	0
Spine-like tubercles on flank present (1) or absent (0)	1	1	1	0	0
Tubercles present (1) or absent (0) on lower flanks	1	1	1	1	1
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	0	0	0	1	1
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1

	<i>Cnemaspis palanica</i> sp. nov.			<i>Cnemaspis jackieii</i> sp. nov.	
	CESL 339	CESL 340	BNHS 2629	CESL 192	CESL 193
Postcloacal tubercle, indistinct (0); Postcloacal tubercle distinct (1)	1	1	1	1	1

**Supplementary Table S6.** Mensural (mm) and meristic data of examined specimens for known species re-descriptions. Abbreviations are listed in Materials and Methods. \* = digit incomplete; L&R = Left & Right; r = regrown; / = missing data.

	<i>Cnemaspis beddomei</i>				<i>Cnemaspis nairi</i>			<i>Cnemaspis ornata</i>		
	CESL 379	CESL 380	CESL 381	ZSI 5859	CESL 715	CESL 712	CESL 280	CESL 281	CESL 283	CESL 276
Sex	M	F	M	M	F	M	F	M	M	M
SVL	52.5	43.8	49.4	44.5	40.4	40.5	39.3	46.1	43.4	41.1
TRL	23.05	19.88	20.7	17.83	15.13	17.64	15.25	18.82	18.4	17.01
BW	8.7	8.34	10.23	10.37	7.29	7.11	6.5	8.4	7.66	6.41
CL	9.58	8.21	9.61	*	7.48	8.06	7.6	9.21	8.27	9.15
TL	49.23r	46.76	57.35	*	28.98*	25.7r	27.9	41.38	31.87	*
TW	5.08	4.45	5.05	*	3.13	4.57	3.36	4.2	3.49	*
HL	13.93	11.96	13.63	14.02	11.12	10.94	11.23	13.52	12.7	11.32
HW	9.45	8.32	9.29	9.11	7.33	7.65	7.2	8.59	8.4	7.2
HH	6.17	5.06	5.89	5.74	4.83	4.62	4.7	5.58	5.12	5.03
EL	1.14	0.84	0.91	0.97	0.61	0.63	1.04	1.15	1.26	1.15
FL	7.72	7.04	7.9	7.83	6.61	6.13	6.9	7.53	7.2	7.85
OD	3.43	2.62	3.14	2.83	2.87	2.36	2.5	2.87	2.67	2.83
NE	5.09	4.26	4.93	5.1	4.34	4.21	3.6	4.32	3.92	3.72
SE	6.38	5.35	6.16	6.08	5.33	5.33	5	5.91	5.29	5.11
EE	4.7	4.43	4.56	4.73	3.63	3.79	3.5	4.33	4.13	3.68
IN	2.03	1.88	1.87	2.08	1.68	1.61	1.45	1.79	1.66	1.59
IO	4.48	3.74	4.39	4.55	3.96	4.09	2.7	3.49	3.42	2.63
L Manus	10,16,19,20,15	12,17,19,20,16	11,15,18,20,15	*	13,19,23,25,20	13,20,24, *19	14,21,23,24,19	13,20,22,24,20	14,21,23,25,21	14,20,22,23,19
R Manus	10,16,19,20,15	12,16,18,20,15	12,16,18,20,15	*	13,19,24,25,20	13,20,24,26,20	13,21,23,25,20	13,20,23,25,19	14,21,24,26,21	13,18,21,23,19
L Pes	9,16,20,22,17	11,17,22,23,17	10,17,22,23,17	*	12,21,26,27,23	12,21,26,27,24	12,23,26,29,24	13,21,27,30,24	14,23,27,29,24	13,20,25,28,23
R Pes	9,15,19,21,18	10,18,20,21,17	10,17,22,23,18	*	12,21,25,27,25	12,19,26,28,25	14,22,25,28,23	12,22,26,31,24	13,22,26,30,23	13,20,25,28,23
SL Lt	6	6	7	*	9	9	8	8	8	9
SL Rt	6	6	6	*	9	9	8	7	7	9
IL Lt	7	7	7	*	8	8	8	8	7	8
IL Rt	7	7	7	*	8	8	8	8	7	8
Scales between 1st pair of Postmental	1	1	1	1	1	1	1	1	1	1
PVT	18	18	19	*	22	20	21	22	21	23
DTR	11	10	12	*	18	16	12	13	12	14
MVSR	34	32	30	*	32	33	37	33	36	34
VS	161	156	160	*	143	147	165	162	160	157
PP (L, R)	6	abs.	6	7	abs.	8	abs.	7	abs.	7
SBPP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.



	<i>Chenaspis beddomei</i>			<i>Chenaspis nairi</i>			<i>Chenaspis ornata</i>			
	CESL 379	CESL 380	CESL 381	ZSI 5859	CESL 715	CESL 712	CESL 280	CESL 281	CESL 283	CESL 276
SB FP& PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
FP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Scale between Femoral Pores (SBFP)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
PCT	1	1	1	1	1	1	1	1	1	1
Ventral scales keeled (1) or smooth (0)	1	1	1	1	0	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	1	1	1	1	0	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	1	1	1	1	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	1	1	1	1	0	0	0	0	0	0
Precloacal pores continuous (1) or separated (0)	1	abs.	1	1	1	1	1	1	1	1
Precloacal pores elongate (1) or round (0)	0	abs.	0	0	abs.	0	0	0	0	0
femoral pores elongate (1) or round (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	1	1	1	1	0	0	1	1	1	1
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	0	0	0	0	0	0	0	0	0	0
Dorsal tubercles keeled (1) or not keeled (0)	1	1	1	1	1	1	1	1	1	1
Tubercles linearly arranged (1) or more random (0)	1	1	1	1	1	1	1	1	1	1
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	0	0	0	0	0	0	0
Tubercles present (1) or absent (0) on lower flanks	0	0	0	0	0	0	0	0	0	0

	<i>Chenaspis beddomei</i>				<i>Chenaspis nairi</i>				<i>Chenaspis ornata</i>			
	CESL 379	CESL 380	CESL 381	ZSI 5859	CESL 715	CESL 712	CESL 280	CESL 281	CESL 283	CESL 276		
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0		
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0		
Caudal tubercles encircle tail (1) or not (0)	0	0	0	0	0	1	1	1	1	1		
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1	1	1	1	1		
Enlarged femoral scales present (1) or absent (0)	1	1	1	0	0	1	1	1	1	1		
Postcloacal tubercle, indistinct (0); Postcloacal tubercle big, distinct (1)	1	1	1	1	1	1	1	1	1	1		

	<i>Chenaspis sisparsensis</i>				<i>Chenaspis anaikattiensis</i>				<i>Chenaspis wynadenensis</i>			
	CESL 136	CESL 137	CESL 610	CESL 612	CESL 613	ZSI 25601	ZSI 25602	CESL 629	CESL 630	CESL 640	CESL 641	
Sex	M	M	M	F	M	M	F	F	F	M	F	
SVL	68.6	67.0	56.4	60.6	58.4	58.7	56.2	35.0	33.8	36.1	23.3	
TRL	28.1	27.61	23.03	25.29	22.8	23.24	21.61	15.74	15.16	16.81	10.39	
BW	13.94	13.55	10.36	14.15	10.77	12.09	10.92	5.74	5.79	7.01	3.87	
CL	15.26	13.42	12.22	13.26	11.77	11.31	10.81	6.06	5.78	6.02	3.98	
TL	50.3*	43.59	76.48	63.85	55.45	58.2r	56.24	*	39.69	26.57r	20.96	
TW	8.2	7.43	5.98	5.61	5.19	4.65	4.53	3.32	3.52	3.65	1.86	
HL	18.95	15.4	15.47	16.4	14	15.56	16.01	9.39	9.19	9.67	6.83	
HW	13.84	12.95	10.27	11.39	10.19	11.34	11.41	6.12	6.34	6.82	4.75	
HH	8.43	8.44	6.38	6.94	7.37	7.41	7.33	3.97	4.21	4.51	3.14	
EL	2.23	1.68	1.67	1.52	1.69	1.41	1.63	0.79	0.86	0.94	0.58	
FL	12.06	12.17	9.71	10.63	8.74	9.81	9.39	4.96	4.45	4.92	3.18	
OD	4.59	4.1	3.47	4.18	3.38	3.46	3.43	1.88	1.76	1.79	1.36	
NE	7.1	6.2	5.86	6.19	5.13	6.19	6.05	3.42	3.25	3.35	2.43	
SE	8.61	8.39	7.24	7.89	6.6	7.53	7.19	4.21	3.98	4.21	3.13	
EE	6.46	5.4	5.31	5.81	4.89	5.31	5.36	4.03	3.28	3.6	2.76	
IN	2.68	2.8	2.18	2.58	2.09	2.22	2.64	1.41	1.32	1.49	1.03	
IO	6.43	5.15	5.28	6.32	4.16	5.28	5.64	3.15	3.05	3.11	2.2	
L Manus	15,23,25,2	*	15,24,26	14,24,25	16,24,26	15,24,26	14,23,26	8,12,14,	8,12,14,	7,11,13,1	8,11,13	
	6,23		,27,23	,27,22	,27,23	,27,24	,26,22	16,12	16,12	4,12	,14,11	

	<i>Cnemaspis sisparensis</i>			<i>Cnemaspis anakattiensis</i>			<i>Cnemaspis wynadensis</i>				
	CESL 136	CESL 137	CESL 610	CESL 612	CESL 613	ZSI 25601	ZSI 25602	CESL 629	CESL 630	CESL 640	CESL 641
R Manus	15,23,24,2 7,24	15,24,26 *,27,23	15,23,26 *,26,24	15,24,26 *,27,24	15,24,26 *,26,23	16,24,26 *,26,23	15,24,26 *,27,23	9,12,15, 16,12	8,12,15, 14,12	7,11,13,1 4,12	8,11,13 *,14,12
L Pes	15,24,26,2 9,25	14,20,23,2 6,22	14,23,27 *,29,26	15,22,26 *,28,27	15,22,26 *,29,27	13,23,26 *,28,25	15,23,27 *,29,26	9,14,16, 19,14	8,14,16, 18,14	8,12,14,1 7,15	8,12,16 *,17,15
R Pes	*	13,20,25,2 6,24	15,23,27 *,26	13,23,26 *,29,26	15,22,27 *,29,27	13,22,26 *,28,25	15,22,28 *,29,27	8,14,16, *,15	8,13,15, 16,14	8,12,15,1 7,15	8,12,15 *,18,15
SL Lt	7	7	8	8	7	7	8	5	5	6	5
SL Rt	8	8	8	7	8	7	8	5	6	6	5
IL Lt	7	8	8	7	8	8	8	5	6	6	6
IL Rt	7	7	8	7	7	8	7	6	6	6	6
Scales between 1st pair of Postmental	3	2	3	3	3	3	3	3	2	3	3
PVT	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
DTR	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
MVSR	30	28	29	32	31	32	28	21	20	18	20
VS	141	143	148	151	153	149	147	118	117	113	115
PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SBPP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SB FP& PP (L, R)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
FP (L, R)	7,7	8,7	8,8	8,7	8,7	8,7	8,7	abs.	abs.	5,4	abs.
Scale between Femoral Pores (SBFP)	19	17	16	abs.	16	15	abs.	abs.	abs.	1,5	abs.
PCT	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Pectoral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Precloacal pores continuous (1) or separated (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
Precloacal pores elongate (1) or round (0)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
femoral pores elongate (1) or round (0)	1	1	1	abs.	1	1	abs.	abs.	abs.	1	abs.
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0	0	0	0	0	0	0
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	1	1	1	1	1	1	1	1	1	1	1
Dorsal tubercles keeled (1) or not keeled (0)	0	0	1	1	1	1	1	abs.	abs.	abs.	abs.
Tubercles linearly arranged (1) or more random (0)	0	0	0	0	0	0	0	abs.	abs.	abs.	abs.
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	0	0	0	0	0	0	0	0
Tubercles present (1) or absent (0) on lower flanks	0	0	0	0	0	0	0	0	0	0	0
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	0	0	0	0	0	0	0	0	0	0	0
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1	1	1	1	1	1
Enlarged femoral scales present (1) or absent (0)	1	1	1	1	1	1	1	1	1	1	1

	<i>Cnemaspsis sisparensis</i>			<i>Cnemaspsis anakattiensis</i>			<i>Cnemaspsis wynadenensis</i>				
	CESL 136	CESL 137	CESL 610	CESL 612	CESL 613	ZSI 25601	ZSI 25602	CESL 629	CESL 630	CESL 640	CESL 641
Postloacal tubercle, indistinct (I)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.

	<i>Cnemaspsis australis</i>												
	CESL 139	CESL 291	CESL 292	M	CESL 020	CESL 027	M	CESL 107	CESL 702	F	M	M	CESL 711
Sex	M	M	F	M	M	M	M	M	F	F	M	M	M
SVL	34.1	33.0	35.6	30.4	34.9	29.2	29.2	30.4	30.4	30.4	30.9	28.4	28.4
TRL	16.16	15.46	16.8	13.4	11.8	12.7	12.7	13.6	13.6	13.6	13.8	12.6	12.6
BW	6.87	6.86	8.51	5.7	4.4	5.5	5.5	5.5	5.5	5.5	5.1	5.0	5.0
CL	5.36	5.66	5.86	6.0	4.5	5.3	5.3	5.7	5.7	5.7	5.8	5.3	5.3
TL	25.75	42.64	36.35	15.6*	6.3*	15.9*	15.9*	35.97	35.97	35.97	27.9r	10.8*	10.8*
TW	3.94	3.75	3.88	3.0	2.0	2.9	2.9	2.9	2.9	2.9	3.2	2.8	2.8
HL	8.35	8.41	9.12	8.5	6.0	8.3	8.3	8.6	8.6	8.6	8.7	7.9	7.9
HW	6.38	6.36	6.61	5.7	3.1	5.1	5.1	5.1	5.1	5.1	5.7	4.8	4.8
HH	3.85	4.02	4.08	3.5	2.9	3.3	3.3	3.3	3.3	3.3	3.4	3.2	3.2
EL	0.54	0.49	0.46	0.6	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.6	0.6
FL	4.6	4.56	4.48	4.8	4.0	4.3	4.3	4.7	4.7	4.7	4.9	4.3	4.3
OD	1.78	1.8	2.03	1.7	1.3	1.4	1.4	1.6	1.6	1.6	1.8	1.3	1.3
NE	3.23	3.14	3.32	3.2	2.5	3.1	3.1	3.3	3.3	3.3	3.4	3.1	3.1
SE	4.14	4.07	4.51	4.1	3.5	4.1	4.1	4.1	4.1	4.1	4.3	3.9	3.9
EE	3.32	3.14	3.28	3.1	2.1	2.7	2.7	2.9	2.9	2.9	3.1	2.6	2.6
IN	1.38	1.46	1.53	1.15	0.71	1.03	1.03	1.18	1.18	1.18	1.36	0.99	0.99
IO	3.37	3.47	3.49	3.15	2.54	2.87	2.87	3.08	3.08	3.08	3.25	2.72	2.72
L Manus	7,10,12,11,9	8,10,12,12,9	8,10,11,11,8	9,12,14,15,12	9,12,13,15,12	8,11,12,13,12	8,11,12,13,12	10,12,13,15,13	9,11,12,14,12	9,11,12,14,12	9,12,12,14,12	9,12,12,14,12	9,12,12,14,12
R Manus	7,10,11,12,10	7,9,11,12,10	8,9,10,12,9	9,12,13,14,12	9,12,13,14,12	9,12,13,14,13	9,12,13,14,13	9,12,13,13,12	8,11,12,13,12	8,11,12,13,12	8,11,12,13,11	8,11,12,13,11	8,11,12,13,11
L Pes	8,10,12,13,12	8,10,13,13,12	8,11,13,14,12	8,12,16,17,16	8,12,16,17,16	8,12,16,17,16	8,12,16,17,16	8,13,16,17,15	8,11,13,15,14	8,11,13,15,14	8,12,15,16,14	8,12,15,16,14	8,12,15,16,14
R Pes	8,10,12,13,12	8,11,13,14,12	8,10,13,14,11	8,12,16,17,16	8,13,16,17,15	9,11,15,16,14	9,11,15,16,14	9,11,13,17,13	8,11,13,15,13	8,11,13,15,13	9,11,15,16,14	9,11,15,16,14	9,11,15,16,14
SL Lt	7	7	7	9	8	8	8	9	9	9	8	8	8
SL Rt	7	7	7	8	7	8	8	8	8	8	8	8	8
IL Lt	6	6	6	8	8	7	7	8	8	8	7	7	7
IL Rt	6	6	6	8	8	8	8	8	8	8	7	8	8
Scales between 1st pair of Postmental	1	1	1	1	1	1	1	1	1	1	1	1	1
PVT	abs.	abs.	abs.	14	14	16	16	15	15	15	16	14	14
DTR	abs.	abs.	abs.	14	13	12	12	15	15	15	13	15	15
MVSR	20	17	19	31	32	30	30	35	35	35	30	32	32
VS	101	94	103	130	131	131	131	136	136	136	131	133	133
PP (L, R)	abs.	abs.	abs.	2	3	3	3	abs.	abs.	abs.	2	3	3
SBPP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SB FP& PP (L, R)	abs.	abs.	abs.	12,13	11,12	13,13	13,13	abs.	abs.	abs.	11,11	13,12	13,12
FP (L, R)	5,5	3,4	abs.	4,4	3,3	4,4	4,4	abs.	abs.	abs.	4,4	4,5	4,5
Scale between Femoral Pores (SBFP)	19	22	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.

	<i>Cnemaspis indica</i>					<i>Cnemaspis australis</i>				
	CESL 139	CESL 291	CESL 292	CESL 020	CESL 027	CESL 107	CESL 702	CESL 708	CESL 711	
PCT	1	1	1	1	1	1	1	1	1	
Ventral scales keeled (1) or smooth (0)	0	0	0	1	1	1	1	1	1	
Ventral forearm scales Keeled (1) smooth (0)	0	0	0	0	0	0	0	0	0	
Ventral lower leg scales keeled (1) smooth (0)	0	0	0	1	1	1	1	1	1	
Gular scales keeled (1) or smooth (0)	1	1	1	0	0	0	0	0	0	
Pectoral scales keeled (1) or smooth (0)	1	1	1	1	1	1	1	1	1	
Precloacal pores continuous (1) or separated (0)	abs.	abs.	abs.	1	1	1	abs.	1	1	
Precloacal pores elongate (1) or round (0)	abs.	abs.	abs.	0	0	0	abs.	0	0	
femoral pores elongate (1) or round (0)	0	0	abs.	1	1	1	abs.	1	1	
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0	0	0	0	0	
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	1	1	1	0	0	0	0	0	0	
Dorsal tubercles keeled (1) or not keeled (0)	abs.	abs.	abs.	1	1	1	1	1	1	
Tubercles linearly arranged (1) or more random (0)	abs.	abs.	abs.	0	0	0	0	0	0	
Spine-like tubercles on flank present (1) or absent (0)	0	0	0	1	1	1	1	1	1	
Tubercles present (1) or absent (0) on lower flanks	0	0	0	1	1	1	1	1	1	
Subcaudals keeled (1) or smooth (0)	0	0	0	1	1	1	1	1	1	
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	1	1	1	1	1	1	
Caudal tubercles encircle tail (1) or not (0)	0	0	0	1	1	1	1	1	1	
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1	1	1	1	
Enlarged femoral scales present (1) or absent (0)	1	1	1	0	0	0	0	0	0	
Postcloacal tubercle, indistinct (0); Postcloacal tubercle big, distinct (1)	1	1	1	1	1	1	1	1	1	

	<i>Cnemaspis monticola</i>					<i>Cnemaspis goaensis</i>							
	CESL 043	CESL 044	CESL 053	CESL 637	CESL 639	CESL 686	CESL 687	CESL 806	CESL 807	ZSI 22100	ZSI 22213	ZSI 22214	ZSI 22215
Sex	M	M	M	M	M	M	F	M	F	M	M	M	M
SVL	32.6	30.6	31.7	25.5	30.4	28.2	30.3	31.9	30.6	/	/	/	/
TRL	15.32	13.7	14.97	11.1	14.8	12.8	13.8	14.2	13.8	/	/	/	/
BW	6.33	5.5	5.6	4.67	5.8	4.4	5.7	5.8	5.9	/	/	/	/
CL	6.35	5.8	5.85	5.42	5.5	5.5	5.3	5.9	5.3	/	/	/	/
TL	33.26r	*	45.47	39	27.74	33.9	28.6r	39.2r	30.1r	/	/	/	/
TW	3.62	*	3.91	3.1	3.2	2.8	2.7	3.3	2.8	/	/	/	/
HL	9.18	8.3	9.08	8.7	8.76	8.2	8.3	9	8.1	/	/	/	/
HW	5.71	5.3	5.82	4.6	5.75	4.6	5	5.3	4.7	/	/	/	/
HH	3.6	3.6	3.21	2.85	3.28	3.1	3.1	3.6	3.1	/	/	/	/
EL	0.67	0.48	0.69	0.42	0.49	0.4	0.5	0.7	0.5	/	/	/	/

	<i>Chenaspis monticola</i>						<i>Chenaspis goaensis</i>							
	CESL 043	CESL 044	CESL 054	CESL 053	CESL 637	CESL 639	CESL 686	CESL 687	CESL 806	CESL 807	ZSI 22100	ZSI 22213	ZSI 22214	ZSI 22215
FL	5.05	4.8	5.14	5.02	4.6	4.75	4.3	4.5	4.9	4.5	/	/	/	/
OD	2.13	1.9	2.21	1.95	1.55	1.8	1.6	1.7	1.9	1.8	/	/	/	/
NE	3.45	3.1	3.53	3.3	2.6	3.2	3.3	3.2	3.5	3.1	/	/	/	/
SE	4.33	4.1	4.39	4.18	3.47	3.9	4.1	4	4.5	3.8	/	/	/	/
EE	3.33	3.1	3.54	3.2	2.8	2.94	2.6	2.7	2.9	2.7	/	/	/	/
IN	1.05	0.84	1.08	0.98	0.75	0.86	0.9	1	1.2	1	/	/	/	/
IO	3.62	3.5	3.65	3.5	2.9	3.32	2.8	3.1	3.4	3	/	/	/	/
		10,12,14,	10,12,	10,12,	10,12,	10,12,	8,11,1	10,12,	10,12,	10,13,	10,13,			
L Manus	10,12,14,	14,14,	14,15,	10,12,1	14,14,	9,11,14,14,	5,15,1	9,12,14,	13,14,	10,13,1	15,15,	/	/	/
	15,13	13	13	4,14,13	13	12	2	15,9	13	4,15,15	9	/	/	/
R Manus	9,12,14,1	14,14,	14,14,	9,12,14,	14,14,	9,11,13,14,	3,15,1	10,11,1	13,15,	10,13,1	/	/	9,12,14,1	/
	5,12	12	13	15,13	13	12	3	3,15,12	13	3,15,14	/	/	5,14	/
L Pes	10,13,17,	16,18,	15,16,	9,12,14,	15,17,	9,12,14,17,	6,18,1	9,12,16,	7,18,1	10,13,1	10,12,		9,14,17,2	10,13,15,
	18,17	16	15	17,14	16	14	6	18,16	6	6,19,18	15	/	0,16	18,16
R Pes	10,12,16,	17,18,	17,18,	8,13,15,	14,17,	9,11,13,15,	5,18,1	10,13,1	6,19,1	10,13,1	/	/	10,13,16,	10,13,16,
	18,16	17	17	18,16	15	14	6	6,18,15	7	6,18,17	/	/	19,17	20,16
SL Lt	8	8	8	8	8	7	8	9	8	9	8	9	8	9
SL Rt	8	8	8	8	8	7	8	9	9	9	8	9	9	8
IL Lt	7	7	7	7	8	6	8	9	8	8	9	9	8	8
IL Rt	7	7	7	7	7	6	8	8	9	9	8	9	8	9
Scales between 1st pair of Postmental	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PVT	12	11	10	9	11	12	abs.	abs.	abs.	abs.	/	/	/	/
DTR	11	10	10	11	9	8	8	6	7	8	/	/	/	/
MVSR	28	25	26	25	26	28	24	20	25	22	21	21	20	22
VS	122	125	123	119	119	118	118	119	116	118	119	115	118	117
PP (L, R)	3	4	3	3	3	3	3	abs.	3	abs.	3	2	3	3
SBPP	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
SB FP& PP (L, R)	12,11	9,10	10,10	10,10	10,9	11,10	9,10	abs.	10,10	abs.	10,10	10,10	10,11	9,9
FP (L, R)	5,5	5,5	4,5	3,3	4,4	4,4	3,3	abs.	3,3	abs.	4,3	3,2	3,3	3,3
Scale between Femoral Pores (SBFP)	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.	abs.
PCT	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ventral scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ventral forearm scales keeled (1) smooth (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ventral lower leg scales keeled (1) smooth (0)	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gular scales keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	<i>Chenaspis monticola</i>					<i>Chenaspis goaensis</i>								
	CESL 043	CESL 044	CESL 054	CESL 053	CESL 637	CESL 639	CESL 686	CESL 687	CESL 806	CESL 807	ZSI 22100	ZSI 22213	ZSI 22214	ZSI 22215
Pectoral scales keeled (1) or smooth (0)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Precloacal pores continuous (1) or separated (0)	1	1	1	1	1	1	1	abs.	1	abs.	1	1	1	1
Precloacal pores elongate (1) or round (0)	1	1	1	1	1	1	abs.	1	1	abs.	1	1	1	1
femoral pores elongate (1) or round (0)	1	1	1	1	1	1	abs.	1	1	abs.	1	1	1	1
Row of large scales under 1st toe till end of feet present (1); absent (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dorsal pholidosis homogeneous (1) or heterogeneous (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dorsal tubercles keeled (1) or not keeled (0)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tubercles linearly arranged (1) or more random (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spine-like tubercles on flank present (1) or absent (0)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tubercles present (1) or absent (0) on lower flanks	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Subcaudals keeled (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single median row of keeled subcaudals (1) or smooth (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caudal tubercles encircle tail (1) or not (0)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Enlarged median subcaudal scale row (1) or not (0)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Enlarged femoral scales present (1) or absent (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Postcloacal tubercle, indistinct (0); Postcloacal tubercle big, distinct (1)	1	1	1	1	1	1	1	1	1	1	1	1	1	1

**Supplementary Table S7.** Comparative account for diagnosis within members of the *wynadensis* clade. Abbreviations are listed in Materials and Methods; / = missing data.

	<i>C. kolhapurensis</i>	<i>C. sisparensis</i>	<i>C. anaikattiensis</i>	<i>C. zacharyi</i>	<i>C. chengodumalaensis</i>	<i>C. kotiyooorensis</i>	<i>C. magnifica</i>	<i>C. heteropholis</i>	<i>C. wynadensis</i>	<i>C. balerion sp. nov.</i>	<i>C. lithophilis sp. nov.</i>
Max SVL	40 mm	68.6 mm	60.6 mm	65 mm	49 mm	41.6 mm	58 mm	44.4 mm	36.1 mm	45 mm	49.9 mm
LamF4 Manus	11–15	26–27	26–27	23–26	20–24	18–20	22–25	20–22	14–16	19–20	25–26
LamT4 Pes	15–17	26–29	26–29	23–27	21–26	20–23	24–28	24–25	16–19	22–23	27–29
SL	6–7	7–8	7–8	6–7	6–8	6–7	6–8	6–7	5–6	7–8	8–9
Scales between 1st pair of Postmental	1–2	2–3	3	2–3	3	1–3	3	3	2–3	1	1–2
MVSR	19–23	28–30	28–32	25–28	19–23	21–23	24–26	20–25	18–21	22–24	24–28
VS	–	139–143	147–153	155–162	147–152	/	133–160	119–123	113–118	121–127	126–129
FP	24–28	7–8	7–8	5–6	6–8	4–6	6–7	5–6	4–5	8–9	6–7
preloacal-femoral pores	abs.	17–19	15–16	21–24	14–16	13–16	15–16	16–18	13–16	14–16	12–13
Scale between Femoral Pores (SBFP)	1	1	1	1	0	0	0	0	1	1	0
Mid dorsal pholidosis homogeneous (1) or heterogeneous (0)	abs.	0	1	0	1	1	1	1	abs.	abs.	1
Dorsolateral tubercles keeled (1) or not keeled (0)	abs.	0	1	0	1	1	1	1	abs.	abs.	1



**Supplementary Table S8:** Comparative account for diagnosis within members of the *beddomei* clade. Abbreviations are listed in Materials and Methods; / = missing data.

	<i>Cnemaspis beddomei</i>	<i>Cnemaspis nairi</i>	<i>Cnemaspis ornata</i>	<i>Cnemaspis aaronbaueri</i>	<i>Cnemaspis anamudiensis</i>	<i>Cnemaspis maculicollis</i>	<i>Cnemaspis wallacei</i>	<i>Cnemaspis smaug</i>	<i>Cnemaspis rubraoculus</i>	<i>Cnemaspis regalis</i>	<i>Cnemaspis nimbus</i>	<i>Cnemaspis nigriventris</i>	<i>Cnemaspis galaxia</i>
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.	sp. nov.
Max SVL	52.5	40.5	46	34.6	58.2	52.7	46.2	52	45.8	36.5	48.2	38.2	33.5
LamF4 Manus	19-20	25-26	23-26	23-25	19-21	20-24	19-20	18-19	15-16	20-24	19-21	22-23	20-22
LamT4 Pes	21-23	27-28	28-31	24-25	20-23	23-24	22-23	20-22	18-19	24-27	22-23	24-25	23-25
SL	6-7	8-9	7-9	6-7	6-8	7-8	6-7	7-9	6	7-9	7-8	7-8	6-8
Scales between 1st pair of Postmental	1	1	1	1	1	1	2-3	1	1	0-1	1	1	1
PVT	18-19	20-22	21-23	18-19	/	/	18-20	27-30	12-14	12-14	16-17	15-16	17-18
DTR	10-12	16-18	12-14	9-12	/	/	14-15	19-22	8-10	7-9	12-14	13-14	8
MVSR	30-34	32-33	33-37	31-33	/	/	28-29	30-34	33-37	40-44	26-27	38-40	27-31
VS	154-161	143-147	157-165	135-140	/	/	154-156	142-150	122-133	148-154	134-141	154-159	153-159
PP	6-8	7-8	6-7	7-8	2-3	10	8	7-8	6	6-7	4-6	6-7	7
PCT	1	1	1	1	1	1	1	2	1	1	1	1	1
Row of large scales under 1st toe till end of feet present (1); absent (0)	1	0	1	0	1	1	1	1	1	0	1	0	0
Dorsal tubercles keeled (1) or not keeled (0)	1	1	1	0	1	0	1	1	1	1	1	0	1
Tubercles linearly arranged (1) or more random (0)	1	1	1	1	0	0	1	1	0	1	1	1	1
Caudal tubercles encircle tail (1) or not (0)	0	0	1	1	0	0	0	1	0	1	0	0	1

**Supplementary Table S9:** Comparative account for diagnosis within members of the *littoralis* clade. Abbreviations are listed in Materials and Methods; / = missing data.

	<i>Cnemaspis littoralis</i>	<i>Cnemaspis palakkadensis</i>	<i>Cnemaspis flavigularis</i>	<i>Cnemaspis palanica</i> sp. nov.
Max SVL	31.6 mm	34 mm	33.1 mm	30.6 mm
LamF4 Manus	13-14	12-15	13-14	14-15
LamT4 Pes	15-16	14-17	16-18	17-18
SL	9-10	7-8	7-9	7-8
MVSR	26	32-38	21-23	16-18
VS	122	130-134	104-108	103-106
FP	15-18	15-16	10-12	12-15
SBFP	/	14	10-12	7-8
PCT	1	0	1	1
Spine-like tubercles on flank present (1) or absent (0)	1	0	0	1
Tubercles present (1) or absent (0) on lower flanks	1	0	1	1

**Supplementary Table S10:** Comparative account for diagnosis within members of the *gracilis* clade. Abbreviations are listed in Materials and Methods; / = missing data.

	<i>Cnemaspis gracilis</i>	<i>Cnemaspis agarwali</i>	<i>Cnemaspis thackerayi</i>	<i>Cnemaspis shevaroyensis</i>	<i>Cnemaspis jackieii</i> sp. nov.
SVL	33 mm	33 mm	41 mm	34 mm	31.3 mm
LamF4 Manus	17	13-17	16-19	15-16	16-18
LamT4 Pes	22	17-20	21-24	16-20	21-22
SL	6-7	5-9	6-10	6-8	7-8
PVT	/	12-17	12-14	13-17	11-12
DTR	11-14	9-11	11-14	10-14	8-9
MVSR	23-25	24-26	22-25	21-24	28-31
VS	111-116	102-117	105-122	111-118	119-125
PP	2	4	5-6	2-4	3-4
SBPP	2-3	1	1-2	2-3	1-2
FP	3-5	4-6	5-9	4	5-6
SB FP& PP	/	8	1-6	7-9	9-11

## APPENDIX II: Comparative material examined

- Cnemaspis adii*: BNHS 2464, BNHS 2465 and BNHS 2494 from near Hampi, Bellari District, Karnataka state, India.
- Cnemaspis agarwali*: BNHS 2337, BNHS 2338, BNHS 2336, and BNHS 2339 (paratypes) from near Kidayur road, Sankari, Salem District, Tamil Nadu state, India.
- Cnemaspis ajiiae*: BNHS 2456 (holotype), BNHS 2457 (paratype) and CESL 891 from Satara District, Maharashtra, India.
- Cnemaspis amba*: BNHS 2542, BNHS 2543 and BNHS 2544 (paratypes) from near Amba, Kolhapur District, Maharashtra, India.
- Cnemaspis amboliensis*: BNHS 2458 (holotype); BNHS 2459, BNHS 2504, BNHS 2506, BNHS 2507, BNHS 2508, and BNHS 2505 (paratypes) from Amboli, Sindhudurg District, Maharashtra, India.
- Cnemaspis anaikattiensis*: ZSI 25601 (holotype); and ZSI 25602 (paratype) from Anaikatti Hills, Coimbatore district, Tamil Nadu; CESL 610, CESL 612 and CESL 613 from near Attappadi, Kerala, India.
- Cnemaspis anamudiensis*: CESL 232 and CESL 236, from near Mannavan Shola, Idukki district, Kerala; CESL 238, CESL 239, CESL 240 and CESL 370 from near Rajamala, Munnar, Idukki district, Kerala, India.
- Cnemaspis anandani*: CESL 297, CESL 460 and CESL 461 from near Thai shola, Kundah, Nilgiris district, Tamil Nadu; CESL 310, CESL 311, CESL 312, CESL 313 and CESL 314 from near Kothagiri village, Nilgiris district, Tamil Nadu, India.
- Cnemaspis australis*: BMNH 82.5.22.67 (holotype) from Tirunelveli district, Tamil Nadu, India; CESL 020, CESL 027, CESL 107, CESL 702 from Peppara Wildlife Sanctuary, Kerala; CESL 708, from Ponmudi, Kerala and CESL 711, from near Shendurney Wildlife Sanctuary, Kerala, India.
- Cnemaspis bangara*: BNHS 2584 (holotype); BNHS 2585, BNHS 2586 and BNHS 2587 (paratypes), from near Kolar, Kolar District, Karnataka, India.
- Cnemaspis beddomei*: BMNH 1946.9.4.83 (lectotype); BMNH 1946.9.4.82, BMNH 1946.9.4.84 and BMNH 1946.9.4.85 (paralectotypes); ZSI 5859 (Syntype) from Tirunelveli district, Tamil Nadu, India; CESL 379, CESL 381 and CESL 380 from Kakachi, Tirunelveli district, Tamil Nadu, India.
- Cnemaspis chengodumalaensis*: BNHS 2740 (holotype) BNHS 2741 and BNHS 2742 (paratypes), from Chengodumala, Kozhikode district, Kerala; BNHS 2743 and BNHS 2744 (paratypes) from the Thuruthamala, Balussery, Kozhikode district, Kerala, India; CESL 623, CESL 624 and CESL 625 from near Kakkayam, Kozhikode district, Kerala, India.
- Cnemaspis flaviventralis*: BNHS 2442 (holotype), BNHS 2443 and BNHS 2444 (paratypes); CESL 865, CESL 866 and CESL 867 from Amboli, Sindhudurg District, Maharashtra, India; CESL 666, CESL 677 and CESL 679 from near Bondla, Goa, India.
- Cnemaspis girii*: BNHS 2299 (holotype), BNHS 2079, BNHS 2081, BNHS 2078, BNHS 2080 (paratypes) and CESL 863 from Kaas Plateau, Satara District, Maharashtra, India.
- Cnemaspis goaensis*: ZSI 22100 (holotype), ZSI 22213, ZSI 22214, ZSI 22215 and ZSI 22216 (paratypes) from Cancona, South Goa district, Goa, India; CESL 686 and CESL 687 from South Goa district, Goa, India; CESL 806 and CESL 807 from Gund, Uttara Kanada District, Karnataka, India.

*Cnemaspis gracilis*: CESL 606, CESL 607, BNHS 2513 and BNHS 2514 from Palakkad District, Kerala, India.

*Cnemaspis graniticola*: BNHS 2588 (holotype); BNHS 2590, BNHS 2592, BNHS 2591 and BNHS 2589 (paratypes), from near Horsley Hills, Chittoor District, Andhra Pradesh, India.

*Cnemaspis heteropholis*: CESL 692, CESL 802 and CESL 864 from Uttar Kannada District, Karnataka; CESL 693 and CESL 700, from South Goa District, Goa, India.

*Cnemaspis indica*: BMNH 46.11.22.22b (lectotype), BMNH 46.11.22.22a and BMNH 46.11.22.22c (paralectotypes), BNHS 1252-10, BNHS 1252-1, from Nilgiris, Tamil Nadu, India. CESL 139, from near Sispara peak; Kerala, India; CESL 291 and CESL 292 from near Upper Bhavani, CESL 307, from near Doddabetta Peak, BNHS 2515, BNHS 2516, from Ooty, Tamil Nadu, India.

*Cnemaspis kolhapurensis*: BNHS 1855 (holotype); BNHS 1843, BNHS 1844, BNHS 1845, BNHS 1846 and BNHS 1847 (paratypes) from Dajipur, Kolhapur District, Maharashtra, India. CESL 868, BNHS 2447 and BNHS 2448, from Amboli, Sindhudurg District, Maharashtra, India.

*Cnemaspis kottiyooorensis*: BNHS 2519 from Kannur, Kerala and BNHS 2747 from Devarakolli, Madikeri, Kodagu district, Karnataka, India.

*Cnemaspis koynaensis*: BNHS 2538, BNHS 2541, BNHS 2539 and BNHS 2540 (paratypes); CESL 886, CESL 887, CESL 888 and CESL 890 from near Koyna, Satara District, Maharashtra, India.

*Cnemaspis limayei*: BNHS 2454 (holotype); BNHS 2455 (paratype), from near Phondaghat, Sindhudurg District, Maharashtra, India; CESL 871, CESL 872, CESL 876 and CESL 877 from near Dajipur, Sindhudurg District, Maharashtra, India.

*Cnemaspis littoralis*: BNHS 2517 and BNHS 2518 from the Kozhikode, Kerala, India.

*Cnemaspis magnifica*: BNHS 2545, BNHS 2546 and BNHS 2547 (paratypes) from Sakleshpur, Hassan District, Karnataka, India.

*Cnemaspis mahabali*: BNHS 2449 (holotype); BNHS 2502, BNHS 2450, BNHS 2451 and BNHS 2503 (paratypes), from near Tamhini, Pune District, Maharashtra, India.

*Cnemaspis monticola*: BMNH 74.4.29.372 (holotype) from Waynad, Kerala, India; CESL 043, CESL 044, from Manikunjmalai, Wayanad, Kerala; CESL 053 from near Puthurvayal, Kerala; CESL 054, from Chembra, Kerala, CESL 637 and CESL 639, from near Wayanad Wildlife Sanctuary, Wayanad district, Kerala, India.

*Cnemaspis mysoriensis*: CESL 009, CESL 556 and CESL 557 from Bengaluru, Karnataka, India.

*Cnemaspis nairi*: FMNH 216572, FMNH 216573, (paratypes), from Ponmudi, Kerala; CESL 712, collected from Pandimotta, Kerala and CESL 715, from Ambanad, Kerala, India.

*Cnemaspis nilagirica*: CESL 138 from Silent Valley NP, Palakkad, Kerala, India.

*Cnemaspis ornata*: BMNH 74.4.29.400 (lectotype); BMNH 74.4.29.401 and BMNH 74.4.29.405 (paralectotypes) from “South Tinnevely Hills”; CESL 280, CESL 276, CESL 281 and CESL 283 from Vairavankulam Reserve Forest, Tirunelveli district, Tamil Nadu, India.

*Cnemaspis otai*: BNHS 2511 and BNHS 2512 from Vellore Fort, Vellore District, Tamil Nadu state, India.

*Cnemaspis shevaroyensis*: BNHS 2530, BNHS 2531 and BNHS 2529 (paratypes) from near Yercaud, in the Shevaroy, Salem District, Tamil Nadu state, India.

*Cnemaspis sisparensis*: BMNH 74.4.29.383 (holotype) from “Sholakal, the foot of Sispara Ghat,”; CESL 136 and CESL 137 from near Wallakad, Silent Valley National Park, Kerala, India.

***Cnemaspis thackerayi***: BNHS 2527, BNHS 2526 and BNHS 2528 (paratypes), from near Yercaud town, in the Shevaroyis, Salem District, Tamil Nadu state, India.

***Cnemaspis wynadensis***: BMNH 74.4.29.355 (lectotype) from 'moist forests of Wynaad', Kerala; CESL 640 and CESL 641 from near Wayanad wildlife Sanctuary; CESL 629 and CESL 630 from near Mepadi, Wayanad district, Kerala, India.

***Cnemaspis yercaudensis***: BNHS 2533, BNHS 2532 and BNHS 2534, from near Kollimalai, Namakkal District, Tamil Nadu state, India.

***Cnemaspis zacharyi***: BNHS 2735 (holotype); BNHS 2736 and BNHS 2737 (paratypes), from Lakkidi, Wayanad district, Kerala; BNHS 2738 from Settukunnu and BNHS 2739 (paratypes) from Meppadi, Wayanad District, Kerala, India.