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Integrative taxonomy reveals six new species of day geckos of the genus *Cnemaspis* Strauch, 1887 (Reptilia: Squamata: Gekkonidae) from geographically-isolated hill forests in Sri Lanka

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Abstract

Six new day gecko species of the genus *Cnemaspis* Strauch, 1887 are described from geographically isolated forested hills (Bambarabotuwa, Kadugannawa, Kokagala, Kudumbigala, Maragala and Walapane) in Sri Lanka based on analyses of morphological and molecular traits. We provide an updated mtDNA-based genealogy of Sri Lankan *Cnemaspis* and provide further evidence that diversity of the genus in the island may still be underestimated. The six new *Cnemaspis* species described herein are small to medium (27–40 mm SVL) in size and can be differentiated from all other Sri Lankan congeners by a suite of distinct morphometric, meristic and molecular characteristics. They are recorded from wet, cool, spacious granite caves found within rock outcrops embedded in forests distributed across low and mid-elevations (~ 25–600 m) with minimal anthropogenic disturbance. Existing data suggest that each of these geckos have a highly restricted (point endemic) distribution ranges. Further, their area of occurrence, extent of distribution, and relative a abundance appear to be low, thus all these species are categorized as Critically Endangered (CR) under IUCN Red List criteria. With the descriptions of these species, the number of *Cnemaspis* described from Sri Lanka increases to 32, all of which are endemic to the island. The discovery of these new species highlights the understudied diversity of geckos in isolated hills. Being rupicolous microhabitat specialists with a scansorial mode of life, these species are susceptible to both localized and widespread threats. Therefore, isolated hill forests of Sri Lanka, especially in the intermediate and dry zones, warrant special conservation, habitat protection, indepth research and specific management actions.

Key words

Anthropogenic threats, biogeography, conservation, endangered species, granite caves, microhabitat, natural history, mtDNA, morphology, point endemic, systematics, wildlife.

Introduction

In recent years, the number of day gecko species recognized in the Afro-Asian genus *Cnemaspis* has grown rapidly, starting from 39 species in 2000 (Das & Bauer, 2000) and now exceeding 150 species (Uetz *et al*., 2019), making it the third most diverse gecko genus in the Old World after *Cyrtodactylus* and *Hemidactylus* (Grismer *et*

al., 2014a; UETZ *et al*., 2019). Despite, the highly conservative body morphology observed in *Cnemaspis* species throughout their broad distribution, molecular phylogenetic evidence supports polyphyly, with three independent derivations of the *Cnemaspis*-morph in Africa, South Asia, and Southeast Asia (GAMBLE *et al*., 2012; GRISMER *et al*., 2014a; WOOD *et al*., 2013). Recent additions of new species have mostly derived from Southeast Asia, especially Indonesia, Laos, Thailand, and Malaysia (CHAN *et al*., 2010; GRISMER, 2010b; GRISMER *et al*., 2010a, 2014a; GRISMER & CHAN, 2010; WOOD *et al*., 2013). A number of new species have been reported from the Indian mainland (CYRIAC & UMESH, 2014; CYRIAC *et al*., 2018; MIRZA *et al*., 2014; SAYYED *et al*., 2016, 2018; SRINIVASULU *et al*., 2015) as well as from Sri Lanka (BATUWITA & UDUGAMPALA, 2017; BATUWITA *et al*., 2019; MANAMENDRA-ARACHCHI *et al*., 2007; VIDANAPATHIRANA *et al*., 2014; WICKRAMASINGHE & MUNINDRADASA, 2007; WICKRAMASINGHE *et al*., 2016).

South Asian *Cnemaspis* are generally diminutive and slender-bodied; they possess comparatively large, forward and upward-directed eyes with round pupils, broad flattened heads, and widely-splayed limbs bearing elongated, slender digits (DERANIYAGALA, 1953; MANAMENDRA-ARACHCHI *et al.*, 2007). These geckos are mostly rupicolous although a few are arboreal or ground-dwelling. Most are cryptically patterned, secretive, and either diurnal or crepuscular in activity period. Microhabitat associations are mostly restricted to shaded surfaces of rocks, caves, and trees. The anatomy of members of the genus demonstrates specialization for a scansorial mode of life with adaptations for navigating on inclined surfaces. The conservative body plan, ecological and behavioural crypsis, and microhabitat use observed within *Cnemaspis* have contributed to the masking of species boundaries and resulted in taxonomic confusion (AGARWAL *et al.*, 2017; BATUWITA & UDUGAMPALA, 2017; BATUWITA *et al*., 2019; BAUER *et al*., 2007; DE SILVA *et al*., 2019; DAS & BAUER, 1998; KARUNARATHNA *et al*., 2019).

Since the resurrection of *Cnemaspis* by SMITH (1935), the South Asian species have undergone much taxonomic revision (BAUER *et al*., 2007; MANAMENDRA-ARACHCHI *et al*., 2007). Currently, there are 26 species recognized in Sri Lanka, all of which are endemic to the island (AGARWAL *et al*., 2017; BATUWITA & UDUGAMPALA, 2017; BATUWITA *et al*., 2019; DE SILVA *et al*., 2019; KARUNARATHNA *et al*., 2019; MANAMENDRA-ARACHCHI *et al*., 2007; VIDANAPATHIRANA *et al*., 2014; WICKRAMASINGHE & MUNINDRADASA, 2007; WICKRAMASINGHE *et al*., 2016). These recent studies have suggested that the true species richness of *Cnemaspis* in Sri Lanka is yet to be documented, as many areas and habitats remain unexplored (BAUER *et al*., 2007; DE SILVA *et al*., 2019; KARUNARATHNA *et al*., 2019), which emphasizes the need for continuing taxonomic studies (AGARWAL & KARANTH, 2015; BAUER *et al*., 2007). With this recognition, we conducted field studies in numerous unexplored or under-sampled areas of Sri Lanka. Herein, we report the discovery of six species of *Cnemaspis* from three different bioclimatic zones of Sri Lanka that could not be assigned to known species.

Materials and Methods

Specimens. Museum acronyms follow SABAJ PÉREZ (2015). The type material discussed in this paper is deposited in the National Museum of Sri Lanka (NMSL), Colombo. Specimens were hand caught and were photographed in life. They were euthanized using halothane and fixed in 10% formaldehyde for two days, washed in running water and transferred to 70% ethanol for long-term storage. Tail tips were collected as tissue samples before fixation and were stored in 95% ethanol under cool conditions (10 °C). For comparison, we examined 384 *Cnemaspis* specimens (catalogued and uncatalogued) representing all recognized Sri Lankan species including all type specimens housed at the National Museum, Sri Lanka (NMSL), The Natural History Museum, London (BMNH) and in the privete collection of Anslem de Silva (ADS) and Aaron Bauer (AMB),, which has been deposited in the NMSL. Specimens that formerly belonged to the Wildlife Heritage Trust (WHT) collection and bearing WHT numbers are currently deposited in the NMSL, catalogued under their original numbers. Specimens in this study were collected during a survey on lizards of Sri Lanka under permit numbers WL/3/2/1/14/12, and WL/3/2/42/18a, b issued by the Department of Wildlife Conservation and permit numbers FRC/5, and FRC/6 issued by the Forest Department of Sri Lanka. Additional information on morphology and natural history of Sri Lankan *Cnemaspis* species was extracted from the relevant literature (AGARWAL *et al*., 2017; BATUWITA & UDUGAMPALA, 2017; BATUWITA *et al*., 2019; BAUER *et al*., 2007; DE SILVA *et al*., 2019; KARUNARATHNA *et al*., 2019; MANAMENDRA-ARACHCHI *et al*., 2007; VIDANAPATHIRANA *et al*., 2014; WICKRAMASINGHE & MUNINDRADASA, 2007; WICKRAMASINGHE *et al*., 2016). Assignment of unidentified specimens to species was based on the presence of shared morphometric and meristic characters (BATUWITA & UDUGAMPALA, 2017; BATUWITA *et al*., 2019; DE SILVA *et al*., 2019; KARUNARATHNA *et al*., 2019; MANAMENDRA-ARACHCHI *et al*., 2007; WICKRAMASINGHE & MUNINDRADASA, 2007).

Morphometric characters. Forty morphometric measurements were taken using a Mitutoyo digital Vernier calliper (to the nearest 0.1 mm), and detailed observations of scales and other structures were made through Leica Wild M3Z and Leica EZ4 dissecting microscopes. The following symmetrical morphometric characters were taken on the left side of the body: eye diameter (ED), horizontal diameter of eye ball; orbital diameter (OD), the greatest diameter of orbit; eye to nostril length (EN), the distance between anteriormost point of the orbit and the posterior border of the nostril; snout length (ES), the distance between anteriormost point of the orbit and the tip of snout; snout to nostril length (SN), the distance between tip of snout and the anteriormost point of the nostril; nostril width (NW), the maximum horizontal width of the nostrils; eye to ear distance (EE), the distance between the posterior border of eye and the anteriormost point of ear

opening; snout to axilla distance (SA), the distance between axilla and tip of snout; ear length (EL), the maximum length of the ear opening; interorbital width (IO), the shortest distance between the left and right supraciliary scale rows; inter-ear distance (IE) the distance across the head between the two ear openings; head length (HL), the distance between posterior edge of mandible and the tip of the snout; head width (HW), the maximum width of the head in-between the ears and the orbits; head depth (HD), the maximum height of the head at the level of the eye; jaw length (JL), the distance between the tip of snout and the corner of the mouth; internarial distance (IN), the smallest distance between the inner margins of nostrils; snout to ear distance (SED), the distance between the tip of snout and anteriormost point of the ear; upper-arm length (UAL), the distance between the axilla and the angle of the elbow; lower-arm length (LAL), the distance from the elbow to the wrist with palm flexed; palm length (PAL), the distance between the wrist (carpus) and the tip of longest finger excluding the claw; length of digits I–V of manus (DLM), the distance between the juncture of the basal phalanx with the adjacent digit and the tip of the digit, excluding the claw; snout-vent length (SVL) the distance between tip of snout and the anterior margin of vent; trunk length (TRL), the distance between the axilla and the groin; trunk width (TW), the maximum width of body; trunk depth (TD), the maximum depth of body; femur length (FEL), the distance between the groin and the knee; tibia length (TBL), the distance from the knee to the heel with ankle flexed; heel length (HEL), the distance between ankle (tarsus) and the tip of longest toe (excluding the claw) with both foot and tibia flexed; length of pedal digits I–V (DLP), the distance between the juncture of the basal phalanx with the adjacent digit and the digit tip, excluding the claw; tail length (TAL), the distance between the anterior margin of the vent and the tail tip; tail base depth (TBD), the maximum height of the tail base; tail base width (TBW), the widest point of the tail base.

Meristic characters. Thirty one discrete characters were observed and recorded using Leica Wild M3Z and Leica EZ4 dissecting microscopes on both the left and the right side of the body (reported in the form L/R): number of supralabials (SUP) and infralabials (INF) between the first labial scale and the corner of the mouth; number of interorbital scales (INOS), between the left and right supraciliary scale rows; number of postmentals (PM) bounded by chin scales, 1st infralabial on the left and right and the mental; number of chin scales (CHS) scales touching medial edge of infralabials and mental between juncture of 1st and 2nd infralabials on the left and right; number of supranasal (SUN) scales between nares; presence of the postnasal (PON) scales posterior to the naris; presence of the internasal (INT) scale between supranasals; number of supraciliary scales (SUS) above the eye; number of scales between the eye and tympanum (BET) from posteriormost point of the orbit to anterior-most point of the tympanum; number of canthal scales (CAS), number of scales from posterior-most point of naris to anterior most point of the orbit; total lamellae on manus I–V (SLM) counted from first proximal enlarged scansor greater than twice width of the largest palm scale, to distalmost lamella at tip of digits; number of dorsal paravertebral granules (PG) between pelvic and pectoral limb insertion points along a straight line immediately left of the vertebral column; number of midbody scales (MBS) from the centre of middorsal row diagonally towards the ventral scales; number of midventral scales (MVS) from the first scale posterior to the mental to last scale anterior to the vent; number of belly scales (BLS) across the venter between the lowest rows of granular dorsal scales; total lamellae on pes I–V (SLP), counted from first proximal enlarged scansor greater than twice the width of the largest heel scale, to distalmost lamella at tip of digits; number of precloacal pores (PCP) anterior to the cloaca; number of femoral pores (FP) present on the femur; number of non-pored anterior femoral scales (AFS) counted from distal end of precloacal pore row to first femoral pore; number of non-pored posterior femoral scales (PFS) counted from distal end of femoral pore row to knee; interfemoral scales (IFS) number of non-pored scales between innermost femoral pores on both femurs. In addition, we also evaluated the texture (smooth or keeled) of the ventral scales, the texture (homogeneous or heterogeneous) of the dorsal scales, the number of spinous scales on the flanks (FLSP), and characteristics such as appearance of the caudal scales (except in specimens with regenerated tails). Coloration was determined from digital images of living specimens and also from direct observations in the field.

Habitat and ecology. New species described herein were collected during field surveys conducted in various habitats of Sri Lanka (Fig. 1). During this survey, behavioural and other aspects of natural history of the focal species were observed through opportunistic and non-systematic means. Such observations were done at a minimum distance of 2–3 m away from the focal animals while taking precautions to avoid disturbances. Eggs were measured with a Mitutoyo digimatic calliper (Mituyoto Worldwide, Aurora, Illinois) to the nearest 0.1 mm. The ambient temperature and the substrate temperature were measured using a standard thermometer and a N19 Q1370 infrared thermometer (Dick Smith Electronics, Shanghai, China), respectively. The relative humidity and light intensity were measured with a QM 1594 multifunction environment meter (Digitek Instruments Co., Ltd, Hong Kong, China). To record elevation and georeference species locations, an eTrex® 10 GPS (Garmin, Johannesburg, South Africa) was used. Sex was determined by the presence (male) or absence (female) of precloacal and femoral pores. The conservation status of the species was evaluated using the 2001 IUCN Red List Categories and Criteria version 3.1 (IUCN, 2012). Habitat descriptions were based on the National Atlas and floristic regions of Sri Lanka (Gunatileke & Gunatileke, 1990; Survey Department of Sri Lanka, 2007) as well as on direct visual observations during the survey.

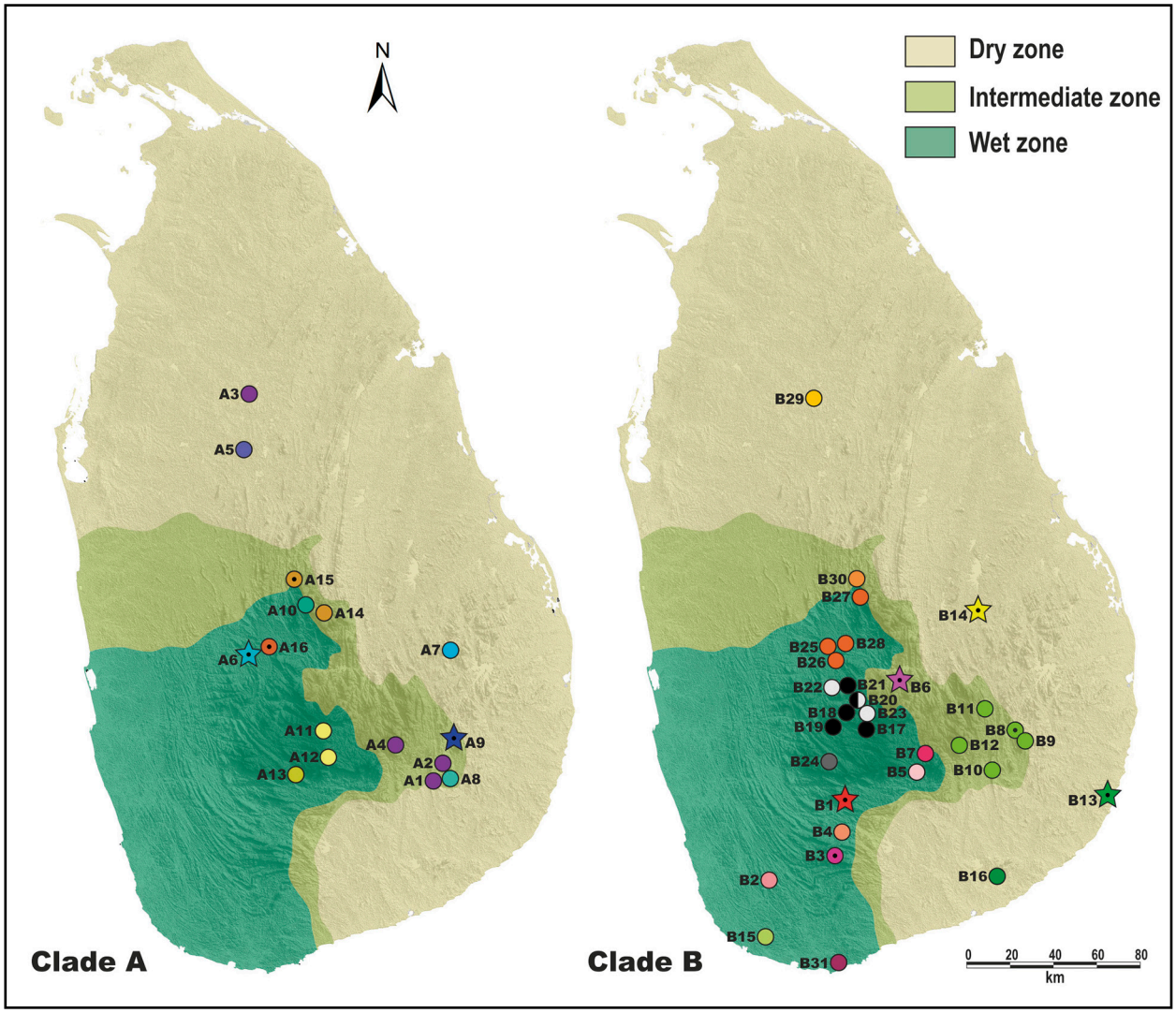

Fig. 1. Currently known distribution of *C. butewai* **sp. nov.** (Bambarabotuwa), *C. gotaimbarai* **sp. nov.** (Kokagala), *C. hitihami* **sp. nov.** (Maragalakanda), *C. kivulegedarai* **sp. nov.** (Walapane), *C. kohukumburai* **sp. nov.** (Kadugannawa), and *C. nandimithrai* **sp. nov.** (Kudumbigala) and other localities of Sri Lankan *Cnemaspis* examined in the present study. Since distributions of *Cnemaspis* clade A and clade B largely overlap, they are shown separately for each clade. For locality numbers see Table 1. Colors of icons correspond to those in Fig. 2. Star denotes localities of the new species described herein. Dot in a center of icon indicates the type locality.

DNA isolation, PCR amplification and sequencing. Total genomic DNA was extracted from ethanol-preserved tail tissue using standard phenol-chloroform-proteinase K extraction procedures with consequent isopropanol precipitation (protocols followed HILLIS *et al.*, 1996 and SAMBROOK & DAVID, 2001). The isolated total genomic DNA was visualized in agarose electrophoresis in presence of ethidium bromide. The concentration of total DNA was measured in 1 µl using NanoDrop 2000 (Thermo Scientific, USA), and consequently adjusted to ca. 100 ng DNA/µL.

To estimate species diversity of Sri Lankan *Cnemaspis* and their genealogical realtionships we amplified a 1041 bp fragment of *ND2* mitochondrial gene following AGARWAL *et al.* (2017); this gene has been widely applied in biodiversity surveys and phylogenetic studies on geckos (e.g. AGARWAL *et al.*, 2016; GRISMER *et al.*, 2012, 2014b, 2018; MURDOCH *et al.*, 2019; WOOD *et al.*, 2012 and references therein). PCR amplification was performed in 20 µl reactions using ca. 50 ng genomic DNA, 10 nmol of each primer, 15 nMol of each dNTP, 50 nMol additional MgCl2, Taq PCR buffer (10 mM Tris-HCl, pH 8.3, 50 mM KCl, 1.1 mM MgCl2 and 0.01% gelatine) and 1 U of Taq DNA polymerase. Primers used in PCR and sequencing followed AGARWAL *et al.* (2017) and included two forward primers: Metf1, used for amplification (5'-AAGCTTTCGGGCCCATACC-3'; MACEY *et al.*, 1997), and *ND2*f17, used for sequencing (5'-TGACAAAAAATTGCNCC-3'; MACEY *et al.*, 2000), and two reverse primers: CO1R1, used for amplification (5'-AGRGTGCCAATGTCTTTGTGRTT-3'; MACEY *et al.*, 1997); and *ND2*r102, used for sequencing (5'-CAGCCTAGGTGGGCGATTG-3'; GREENBAUM *et al.*, 2007). The PCR conditions followed AGARWAL *et al.* (2017).

PCR products were loaded onto 1% agarose gels in presence of ethidium bromide and visualized in agarose

gel electrophoresis. PCR products were purified using 2 µl of a 1:4 dilution of ExoSapIt (Amersham, UK) per 5 µl of PCR product prior to cycle sequencing. Purified PCR products were sequenced bidirectionally at the Genetech Sri Lanka Pvt. Ltd. Colombo. The obtained sequences were deposited in GenBank under the accession numbers MK562336 – MK562365 (Tab. 1).

Phylogenetic analyses. The *ND2* dataset of Agarwal *et al*. (2017) with addition of our newly obtained sequences was used to examine the matrilineal genealogy of *Cnemaspis* in Sri Lanka (summarized in Tab. 1). In total, we analysed *ND2* sequence data for 77 specimens, including 69 samples of ca. 30 species of Sri Lankan *Cnemaspis*, five samples of four *Cnemaspis* species from southern India and Indonesia, and three outgroup sequences of other Gekkonidae representatives which were used to root the tree.

Nucleotide sequences were initially aligned in MAFFT v.6 (Katoh *et al.*, 2002) with default parameters, and subsequently checked by eye in BioEdit 7.0.5.2 (Hall, 1999) and MEGA 6.0 (Tamura *et al.*, 2013) and slightly adjusted. Mean uncorrected genetic distances (*p*-distances) were calculated in MEGA 6.0. MODELTEST v.3.6 (Posada & Crandall, 1998) was applied to estimate the optimal evolutionary models for the data set analysis. The best-fitting model for both BI and ML analyses was the HKY+G model of DNA evolution as suggested by the Akaike Information Criterion (AIC) for all three codon partitions of the *ND2* gene.

The matrilineal genealogy was inferred using Bayesian inference (BI) and Maximum Likelihood (ML) approaches. BI was conducted in MrBayes 3.1.2 (Ronquist & Huelsenbeck, 2003); Metropolis-coupled Markov chain Monte Carlo (MCMCMC) analyses were performed with one cold chain and three heated chains for twenty million generations and sampled every 2000 generations. Five independent MCMCMC iterations were performed and 1000 trees were discarded as burn-in. The convergence of the iterations was diagnosed by examining the likelihood plots in TRACER v1.6 (Rambaut *et al.*, 2014); the effective sample sizes (ESS) were all above 200. Nodal support was assessed by calculating posterior probabilities (BI PP). ML was conducted using the RAxML web server (http://embnet.vital-it.ch/raxml-bb/; Kozlov *et al.*, 2018). Confidence in nodal topology was estimated by non-parametric bootstrapping (ML BS) with 1000 pseudoreplicates (Felsenstein, 1985). Three nodes with BI PP values > 0.95 and LM BS values ≥ 57% were regarded as a priori; BI PP value between 0.95 – 0.90 and ML BS values between 75 – 50% were regarded as tendencies. Lower values were regarded as indicating essentially unresolved nodes (Huelsenbeck & Hillis, 1993).

Ordination of morphometric data. All morphometric measurements of the six new species were normalized to the snout-vent length (SVL). A principal component analysis (PCA) was performed on the normalized morphometric measurements via a singular-value decomposition algorithm. All morphometric variables were centered and scaled to reach unit variance. Two principal components (PCs) were extracted that explained a substantial proportion of the overall variability of the original variables. Based on those two PCs, an ordination plot was produced to visualize the separation of the species. PCA was performed using *R* (PCA: function prcomp, base package; ordination: ggbipplot function, ggbiplot package) (*R* Development Core Team, 2018).

Results

Phylogenetic analyses

Sequence and statistics. The final alignment of the *ND2* gene partial sequences contained 1041 aligned characters, of which, 401 sites were conserved and 637 sites were variable, of which 540 were found to be parsimony-informative. The transition – transversion bias (R) was estimated as 3.49. Nucleotide frequencies were 35.29% (A), 21.71% (T), 32.1% (C), and 10.83% (G) (all data given for ingroup only).

***ND2* gene genealogy.** BI and ML analyses generated essentially similar topologies, with relationships varying only in several poorly supported nodes; most of the nodes in the tree were well-resolved and supported (Fig. 2). The BI genealogy (Fig. 2) inferred the following set of phylogenetic relationships, which is generally consistent with the results of Agarwal *et al*. (2017):

All examined samples of *Cnemaspis* were clustered into two major groups, which we indicate as Clade A (*podihuna* clade of Agarwal *et al*., 2017) and Clade B (*kandiana* clade of Agarwal *et al*., 2017). These two groups are reciprocally monophyletic with high node support (1.0/100%; hereafter node support values are given for BI PP/ML BS, respectively). The Clade A includes an undescribed species *Cnemaspis* sp. 9 from Kerala State, India (southern part of Western Ghats), which forms a sister group with respect to other members of the clade A, all of which occur in Sri Lanka. The Sri Lankan members of Clade A are clustered in two reciprocally monophyletic subclades: the species group AI, joining *C. phillipsi* and *C. scalpensis* (sister species; for both of them we analyzed topotype specimens), *C. gemunu* and undescribed candidate species *Cnemaspis* sp. 7 from Ratnapura District (sister species); the second subclade joins the remaining species of the Clade A (species groups AII and AIII) (Fig. 2). The second subclade of Clade A includes *C. podihuna* (AII; Fig. 2), which is a sister lineage with respect to other species (AIII), genealogical relationships among which are poorly resolved. *Cnemaspis podihuna* in our analysis comprises four divergent mtDNA lineages, indicating that *C. podihuna* is likely a cryptic species complex. None of the analysed *C.* cf. *podihuna* lineages included material from the type locality of this

Table 1. Sequences and voucher specimens of *Cnemaspis* and outgroup taxa used in this study. For sampling localities in Sri Lanka see Fig. 1. Locality codes are given separately for members of clades A (A1–A16) and B (B1–B31). Sequences generated in this study are marked with an asterisk (*); n-dash (—) denotes no data available. (Continues on next page).

No.	Genbank A.N.	Specimen ID	Species	Country	Locality	
1	KY038004	WHT7334	*Cnemaspis* cf. *podihuna*	Sri Lanka	A1	Monaragala District, Maligawila
2	KY038005	58A	*Cnemaspis* cf. *podihuna*	Sri Lanka	A2	Monaragala District, Kukulagoda
3	KY038006	AMB7449	*Cnemaspis* cf. *podihuna*	Sri Lanka	A3	Anuradhapura District, Mihintale
4	KY038002	70A	*Cnemaspis podihuna*	Sri Lanka	A4	Budulla District, Kuruwekotha
5	KY038003	71A	*Cnemaspis podihuna*	Sri Lanka	A4	Budulla District, Kuruwekotha
6	KY037997	AMB7447	*Cnemaspis alwisi*	Sri Lanka	A5	Anuradhapura District, Ritigala
7	MK562336	NMSL2019.05.01	*Cnemaspis kohukumburai* **sp. nov.**	Sri Lanka	A6	Kandy District, Kadugannawa
8	KY038010	AMB7436	*Cnemaspis nilgala*	Sri Lanka	A7	Monaragala District, Pitakumbura, Serawa
9	KY038009	AMB7418	*Cnemaspis nilgala*	Sri Lanka	A7	Monaragala District, Pitakumbura, Serawa
10	KY038011	47A	*Cnemaspis* sp. 8	Sri Lanka	A8	Monaragala District, Maligathenna
11	KY038012	WHT5918	*Cnemaspis hitihami* **sp. nov.**	Sri Lanka	A9	Monaragala District, Kumaradola estate
12	MK562337	NMSL2019.06.01	*Cnemaspis hitihami* **sp. nov.**	Sri Lanka	A9	Monaragala District, Maragala
13	MK562338	NMSL2019.06.02	*Cnemaspis hitihami* **sp. nov.**	Sri Lanka	A9	Monaragala District, Maragala
14	MK562339	NMSL2019.06.03	*Cnemaspis hitihami* **sp. nov.**	Sri Lanka	A9	Monaragala District, Maragala
15	KY038007	AA80	*Cnemaspis punctata*	Sri Lanka	A10	Matale District, Rattota, Gammaduwa
16	KY037999	WHT7348	*Cnemaspis gemunu*	Sri Lanka	A11	Nuwara Eliya District, Near Hakgala
17	MK562340	ADS 217	*Cnemaspis gemunu*	Sri Lanka	A12	Nuwara Eliya District, Ohiya
18	MK562341	ADS 216	*Cnemaspis gemunu*	Sri Lanka	A12	Nuwara Eliya District, Ohiya
19	MK562342	ADS 218	*Cnemaspis gemunu*	Sri Lanka	A12	Nuwara Eliya District, Ohiya
20	KY037998	AMB7495	*Cnemaspis gemunu*	Sri Lanka	A11	Nuwara Eliya District, Hakgala
21	KY038000	AMB7507	*Cnemaspis* sp. 7	Sri Lanka	A13	Ratnapura District, Borangamuwa
22	KY038001	AA81	*Cnemaspis phillipsi*	Sri Lanka	A14	Matale District, Rattota, Gammaduwa
23	MK562343	ADS 220	*Cnemaspis phillipsi* s.str.	Sri Lanka	A15	Matale District, Gammaduwa
24	KY038008	WHT7268	*Cnemaspis scalpensis*	Sri Lanka	A16	Kandy District, Gannoruwa
25	MK562344	ADS 219	*Cnemaspis scalpensis* s.str.	Sri Lanka	A16	Kandy District, Gannoruwa
26	MK562351	NMSL2019.07.01	*Cnemaspis butewai* **sp. nov.**	Sri Lanka	B1	Ratnapura District, Bambarabotuwa
27	MK562352	NMSL2019.07.02	*Cnemaspis butewai* **sp. nov.**	Sri Lanka	B1	Ratnapura District, Bambarabotuwa
28	MK562353	NMSL2019.07.03	*Cnemaspis butewai* **sp. nov.**	Sri Lanka	B1	Ratnapura District, Bambarabotuwa
29	KY037992	AMB7529	*Cnemaspis* sp. 3	Sri Lanka	B2	Galle District, Haycock
30	MK562354	ADS 205	*Cnemaspis pulchra* s.str.	Sri Lanka	B3	Ratnapura District, Morningside
31	MK562355	ADS 206	*Cnemaspis pulchra* s.str.	Sri Lanka	B3	Ratnapura District, Morningside

Table 1 continued.

No.	Genbank A.N.	Specimen ID	Species	Country	Locality	
32	MK562356	ADS 207	*Cnemaspis pulchra* s.str.	Sri Lanka	B3	Ratnapura District, Morningside
33	KY037991	AMB7508	*Cnemaspis* sp. 2	Sri Lanka	B4	Ratnapura District, Masimbula, Godakawela
34	KY037993	AA87	*Cnemaspis* sp. 4	Sri Lanka	B5	Budulla District, Haputale
35	KY037994	AA87B	*Cnemaspis* sp. 4	Sri Lanka	B5	Budulla District, Haputale
36	MK562348	NMSL2019.08.01	*Cnemaspis kivulegedarai* **sp. nov.**	Sri Lanka	B6	Nuwara Eliya District, Walapane
37	MK562349	NMSL2019.08.02	*Cnemaspis kivulegedarai* **sp. nov.**	Sri Lanka	B6	Nuwara Eliya District, Walapane
38	MK562350	NMSL2019.08.03	*Cnemaspis kivulegedarai* **sp. nov.**	Sri Lanka	B6	Nuwara Eliya District, Walapane
39	KY037976	WHT7214	*Cnemaspis latha*	Sri Lanka	B7	Nuwara Eliya District, Bandarawela
40	MK562360	ADS 208	*Cnemaspis kumarasinghei* s.str.	Sri Lanka	B8	Monaragala District, Maragala
41	MK562361	ADS 209	*Cnemaspis kumarasinghei* s.str.	Sri Lanka	B9	Monaragala District, Maragala
42	KY037974	AMB7431	*Cnemaspis kumarasinghei*	Sri Lanka	B10	Monaragala District, Rahathankanda (Buttala)
43	MK562358	ADS 210	*Cnemaspis kumarasinghei*	Sri Lanka	B11	Badulla District, Udakiruwa
44	MK562359	ADS 212	*Cnemaspis kumarasinghei*	Sri Lanka	B11	Badulla District, Udakiruwa
45	KY037975	AA13	*Cnemaspis* cf. *kumarasinghei*	Sri Lanka	B12	Budulla District, Tonacombe Estate (Namunukula)
46	MK562357	ADS 211	*Cnemaspis* cf. *kumarasinghei*	Sri Lanka	B11	Badulla District, Udakiruwa
47	MK562362	NMSL2019.03.01	*Cnemaspis nandimithrai* **sp. nov.**	Sri Lanka	B13	Ampara District, Kudumbigala
48	MK562363	NMSL2019.03.02	*Cnemaspis nandimithrai* **sp. nov.**	Sri Lanka	B13	Ampara District, Kudumbigala
49	MK562364	NMSL2019.04.01	*Cnemaspis gotaimbarai* **sp. nov.**	Sri Lanka	B14	Ampara District, Kokagala
50	KY037984	AA88	*Cnemaspis silvula*	Sri Lanka	B15	Galle District, Hiyare forest reserve
51	KY037990	WHT7331	*C. ingerorum*	Sri Lanka	B16	Hambantota District, Sandagala
52	KY037969	WHT7303	*Cnemaspis upendrai*	Sri Lanka	B17	Nuwara Eliya District, Nanuoya
53	KY037985	WHT7258	*Cnemaspis upendrai*	Sri Lanka	B18	Nuwara Eliya District, Punduloya
54	KY037987	AA12	*Cnemaspis upendrai*	Sri Lanka	B19	Nuwara Eliya District, near Dimbula Junction
55	MK562345	ADS 213	*Cnemaspis upendrai*	Sri Lanka	B20	Nuwara Eliya District, Ramboda
56	KY037988	AMB7488	*Cnemaspis upendrai*	Sri Lanka	B21	Kandy District, Helboda, near Pussellawa
57	KY037986	AA83	*Cnemaspis upendrai*	Sri Lanka	B21	Kandy District, Pussellawa
58	KY037979	WHT7261	*Cnemaspis pava*	Sri Lanka	B20	Nuwara Eliya District, Ramboda
59	MK562346	ADS 214	*Cnemaspis pava*	Sri Lanka	B20	Nuwara Eliya District, Ramboda
60	KY037981	AA19	*Cnemaspis pava*	Sri Lanka	B22	Nuwara Eliya District, Ambegamuwa
61	KY037980	AMB7494	*Cnemaspis pava*	Sri Lanka	B23	Nuwara Eliya District, Labookellie
62	KY037983	AMB7505	*Cnemaspis samanalensis*	Sri Lanka	B24	Nuwara Eliya District, Upcot tea estate
63	KY037971	AA57	*Cnemaspis kandiana*	Sri Lanka	B25	Kandy District, Gannnoruwa
64	KY037972	AMB7487	*Cnemaspis kandiana*	Sri Lanka	B26	Kandy District, Gampola
65	MK562347	ADS 215	*Cnemaspis kandiana*	Sri Lanka	B27	Matale District, Rathtota
66	KY037973	AA01	*Cnemaspis kandiana*	Sri Lanka	B28	Kandy District, Loolecondera Tea Estate

Table 1 continued.

No.	Genbank A.N.	Specimen ID	Species	Country	Locality	
67	KY037982	AMB7448	*Cnemaspis retigalensis*	Sri Lanka	B29	Anuradhapura District, Mihintale
68	KY037970	AA82	*Cnemaspis kallima*	Sri Lanka	B30	Matale District, Rattota, Gammaduwa
69	KY037989	AA17	*Cnemaspis* sp. 1	Sri Lanka	B31	Matara District, Naotunna (near Thalalla)
70	KY037977	MVZ239314	*Cnemaspis modiglianii*	Indonesia	—	Sumatra, Kecematan Enggano, Pulau Enggano, near Malakoni
71	KY037978	MVZ239315	*Cnemaspis modiglianii*	Indonesia	—	Sumatra, Kecematan Enggano, Pulau Enggano, near Malakoni
72	KY038013	SB151	*Cnemaspis* sp. 9	India	—	Kerala, Thrissur District, Athirappilly Falls
73	KY037995	SB048	*Cnemaspis* sp. 5	India	—	Karnataka, Kodagu District, Kumarahalli
74	KY037996	JB239	*Cnemaspis* sp. 6	India	—	Karnataka (pet trade)
75	KY038015	2MA29	*Urocotyledon inexpectata*	Seychelles	—	—
76	MK562365	ADS 198	*Gehyra mutilata*	Sri Lanka	—	Kandy District, Kadugannawa
77	KY038014	PL17	*Ailuronyx seychellensis*	Seychelles	—	—

species (Lahugala, Eastern Province), thus the identification as *C. podihuna* is tentative.

Members of the *C. punctata* species group (AIII; Fig. 2) include *C. punctata*, *C. nilgala* (listed as *Cnemaspis* sp. 8 in AGARWAL *et al*., 2017) and its sister undescribed candidate species *Cnemaspis* sp. 8 from the Monaragala District, *C. alwisi* and its sister species from the Kandy District, described herein as *Cnemaspis kohukumburai* **sp. nov.**, and a new species from the Monaragala District, described herein as *Cnemaspis hitihami* **sp. nov.** (listed as *Cnemaspis* sp. 10 in AGARWAL *et al*., 2017). The Clade B shows generally shallower phylogenetic structuring as compared with the Clade A; a number of nodes of the clade radiation in Sri Lanka remain unresolved. The basal position in the Clade B is occupied by two undescribed Indian *Cnemapsis* species (*Cnemaspis* sp. 5 and *Cnemaspis* sp. 6 from Karnataka State) both occurring in the northern part of the Western Ghats. *Cnemaspis* sp. 6 is reconstructed as a sister lineage with respect to all other members of Clade B, and *Cnemaspis* sp. 5 is suggested as a sister lineage of Sri Lankan and Southeast Asian members of the clade. The Sumatran species *C. modiglianii* is also a member of the *kandiana* Clade B in full accordance with the results of BAUER *et al.* (2007) and AGARWAL *et al*. (2017); it is reconstructed as a sister lineage with respect to Sri Lankan radiation of the clade (Fig. 2); monophyly of the latter receives strong support (0.95/97). Phylogenetic relationships among the Sri Lankan species of the Clade B are essentially unresolved; five species groups are supported in *ND2* gene genealogy. An undescribed species, *Cnemaspis* sp. 1 from the Matara District, occupies an unresolved position in this radiation.

The first species group BI (0.96/78; Fig. 2) of Clade B, includes *C. kandiana*, *C. retigalensis*, and *C. kallima* from the northern part of Central Highlands and Anuradhapura District in northern part of Sri Lanka (Fig. 1). The second species group BII (1.0/100; Fig. 2) of Clade B comprises *C. upendrai*, *C. pava* and *C. samanalensis* from the western part of the Central Highlands of Sri Lanka. The third species group BIII (0.95/78; Fig. 2) of Clade B, includes taxa from the eastern and southern parts of Sri Lanka: *C. kumarasinghei*, *C. silvula* and sister species *Cnemaspis ingerorum* from the Hambantota District, and two new species from the Ampara District, which we describe herein as *Cnemaspis nandimithrai* **sp. nov.** and *Cnemaspis gotaimbarai* **sp. nov.** The fourth species group BIV (1.0/100; Fig. 2) of Clade B, includes *C. latha* and its sister species, described herein as *Cnemaspis kivulegedarai* **sp. nov.**; both species occur in the Central Highlands of Sri Lanka (Fig. 1). The fifth species group BV (1.0/100; Fig. 2) of Clade B, consists of a number of species from southwestern part of Sri Lanka, including *C. pulchra*, three undescribed candidate species *Cnemaspis* sp. 2 (Ratnapura District), *Cnemaspis* sp. 3 (Galle District), *Cnemaspis* sp. 4 (Badulla District), and a new species from the Ratnapura District which we describe herein as *Cnemaspis butewai* **sp. nov.**

Sequence divergence. The uncorrected *p*-distances for the *ND2* gene fragment among and within examined Sri Lankan *Cnemaspis* species are given in Tab. 2. Intraspecific distances ranged from $p=0\%$ in a number of examined species to $p=3.5\%$ in the *C. kandiana* complex and $p=4.3\%$ in the *C. podihuna* complex. AGARWAL *et al*. (2017) applied a conservative threshold of 3.7% uncorrected *p*-distance of *ND2* as indicative of putative species-level divergence. Deep divergence within *C. podihuna* and *C. kandiana* complexes likely indicates an incomplete taxonomy of these groups and a more detailed study including topotype materials on these species is required.

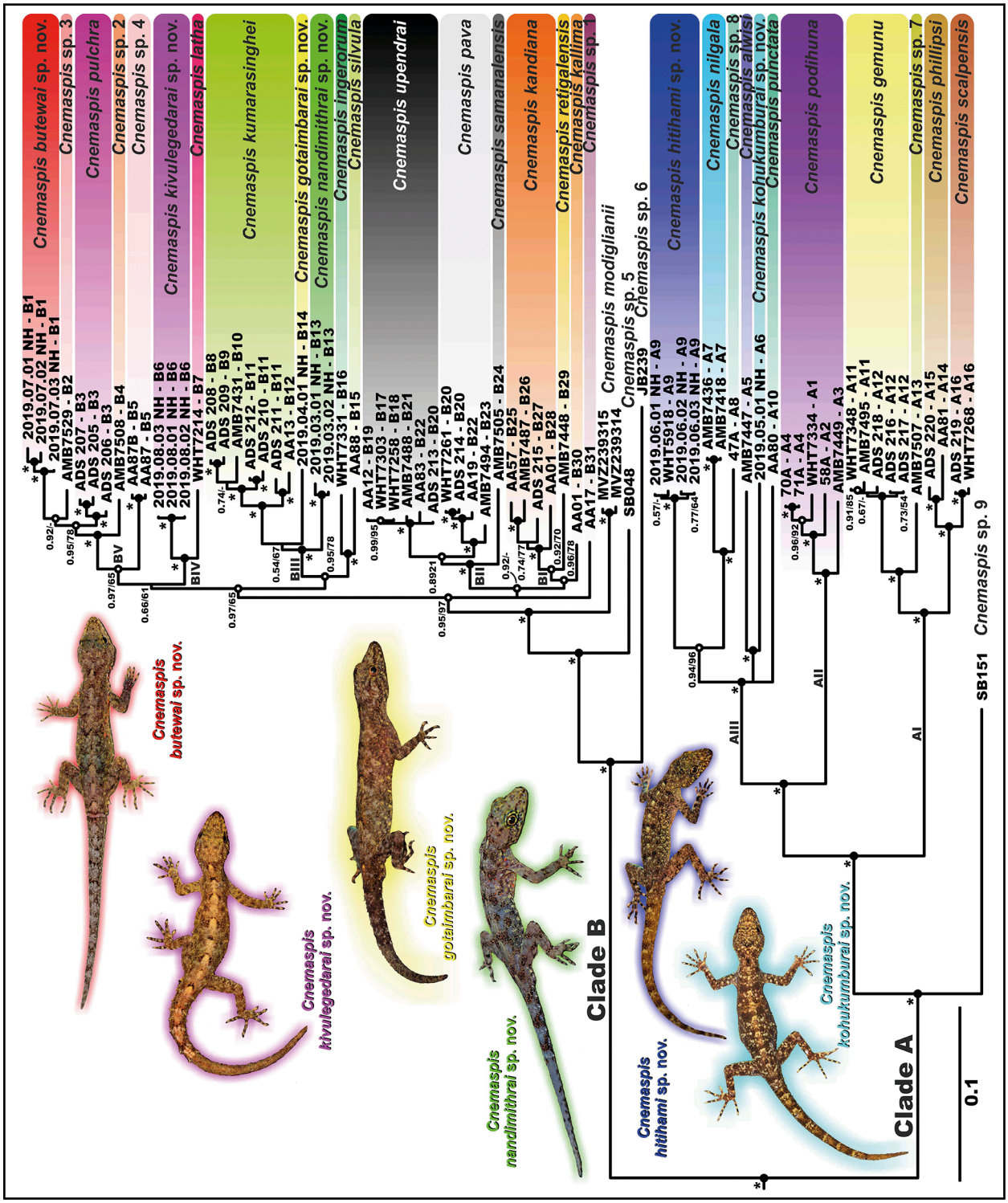

Fig. 2. Bayesian inference tree of *Cnemaspis* derived from the analysis of 1041 bp of *ND2* gene sequences. For voucher specimen information and GenBank accession numbers see Table 1. Numbers at tree nodes correspond to BI PP/ML BS support values, respectively; an asterisk (*) indicates strongly supported nodes (BI PP = 1.0; ML BS > 95%). Outgroup taxa not shown. Colors of clades and locality numbers correspond to those in Fig. 1. Photos showing the six new species of *Cnemaspis* described herein taken by Majintha Madawala and Suranjan Karunarathna.

The interspecific distances within Sri Lankan *Cnemaspis* varied from $p = 2.8\%$ (between *C. pulchra* and *Cnemaspis* sp. 3) to $p = 29.5\%$ (between *C. latha* and *C. alwisi*) (Tab. 2). The newly discovered lineages of Sri Lankan *Cnemaspis* are highly divergent from other congeners with interspecific distances varying from $p = 5.1\%$ (between *Cnemaspis kivulegedarai* **sp. nov.** and *C. latha*) to $p = 29.4\%$ (between *Cnemaspis gotaimbarai* **sp. nov.** and *C. alwisi*), and are thus notably higher than the $p = 3.7\%$ divergence proposed by Agarwal *et al*. (2017) (Tab. 2).

Table 2. Uncorrected *p*-distance (percentage) between the sequences of *ND2* mtDNA gene (below the diagonal), estimate errors (above the diagonal) and intraspecific genetic *p*-distance (on the diagonal) of Sri Lankan *Cnemaspis* species included in phylogenetic analyses.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1 *C. butewai* **sp. nov.**	**1.0**	0.6	0.7	0.8	0.9	0.9	0.8	0.8	1.1	0.9	0.9	0.9	0.9	0.8	1.0	0.8	0.9	0.9	0.8	1.4	1.5	1.5	1.5	1.5	1.7	1.4	1.5	1.5	1.6	1.6
2 *Cnemaspis* sp. 3	4.9	—	0.5	0.6	0.8	0.8	0.7	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.9	0.8	0.9	0.8	0.7	1.5	1.4	1.5	1.5	1.5	1.7	1.5	1.5	1.5	1.6	1.7
3 *C. pulchra*	4.6	2.8	**0.9**	0.6	0.9	0.8	0.8	1.0	1.2	0.9	1.0	1.0	0.8	0.8	0.9	0.8	1.0	0.8	0.8	1.5	1.4	1.5	1.5	1.6	1.7	1.5	1.7	1.7	1.7	1.7
4 *Cnemaspis* sp. 2	6.1	4.0	3.1	—	0.8	0.7	0.7	0.8	0.9	0.8	0.8	0.9	0.7	0.7	0.8	0.7	0.9	0.8	0.8	1.4	1.5	1.4	1.5	1.5	1.6	1.4	1.5	1.5	1.7	1.7
5 *Cnemaspis* sp. 4	7.8	7.4	7.1	7.2	**0.0**	0.7	0.7	0.7	1.0	0.8	0.7	0.9	0.7	0.8	0.8	0.7	0.8	0.7	0.8	1.4	1.4	1.5	1.5	1.5	1.7	1.4	1.5	1.5	1.6	1.6
6 *C. kivulegedarai* **sp. nov.**	7.7	7.4	6.6	6.3	6.9	**0.0**	0.6	0.8	1.0	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.8	1.4	1.5	1.5	1.6	1.5	1.6	1.4	1.4	1.4	1.6	1.6
7 *C. latha*	8.2	8.1	7.6	7.5	7.4	5.1	—	0.7	1.0	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.7	1.3	1.4	1.5	1.5	1.4	1.5	1.4	1.4	1.3	1.5	1.5
8 *C. kumarasinghei*	9.9	9.0	9.4	9.0	8.5	8.5	8.9	**2.6**	0.7	0.7	0.8	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.7	1.3	1.3	1.4	1.4	1.4	1.5	1.3	1.4	1.3	1.5	1.5
9 *C. gotaimbarai* **sp. nov.**	11.2	10.2	10.4	9.9	10.3	10.1	10.1	8.1	—	0.8	0.8	0.8	0.9	0.9	1.0	0.9	1.0	0.9	1.0	1.3	1.3	1.4	1.4	1.4	1.6	1.5	1.5	1.4	1.5	1.6
10 *C. nandimithrai* **sp. nov.**	9.4	8.3	8.1	8.2	7.6	7.7	8.1	6.8	7.9	**0.7**	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	1.3	1.4	1.4	1.4	1.4	1.5	1.4	1.5	1.4	1.5	1.6
11 *C. ingerorum*	9.0	8.4	8.4	7.5	7.6	7.2	8.2	8.7	8.6	8.0	—	0.7	0.8	0.8	0.9	0.8	0.9	0.7	0.6	1.4	1.5	1.5	1.5	1.4	1.6	1.5	1.5	1.4	1.6	1.7
12 *C. silvula*	10.0	8.9	8.9	8.2	8.5	7.8	8.5	8.3	9.0	7.5	5.9	—	0.8	0.8	0.8	0.7	0.8	0.7	0.7	1.4	1.4	1.4	1.5	1.4	1.6	1.4	1.5	1.4	1.6	1.6
13 *C. upendrai*	8.0	8.0	7.4	7.2	7.8	6.5	7.3	7.7	9.8	8.4	7.6	7.9	**0.3**	0.6	0.7	0.6	0.8	0.7	0.8	1.4	1.4	1.4	1.5	1.4	1.6	1.3	1.4	1.3	1.6	1.6
14 *C. pava*	7.5	7.9	7.5	8.0	7.8	6.7	6.7	7.9	9.8	8.2	7.1	8.2	3.7	**1.4**	0.7	0.6	0.7	0.7	0.8	1.4	1.5	1.5	1.5	1.5	1.6	1.4	1.4	1.5	1.6	1.6
15 *C. samanalensis*	9.4	9.2	8.7	8.9	8.7	7.8	8.3	8.7	10.8	9.0	9.0	8.7	5.6	5.8	—	0.7	0.9	0.8	0.8	1.4	1.4	1.5	1.5	1.4	1.6	1.3	1.4	1.4	1.6	1.6
16 *C. kandiana*	8.5	8.3	7.6	8.3	8.0	6.8	7.9	8.3	9.9	7.7	7.9	8.1	6.1	5.9	7.7	**3.5**	0.7	0.5	0.7	1.4	1.4	1.4	1.4	1.4	1.6	1.3	1.4	1.4	1.5	1.6
17 *C. retigalensis*	9.7	8.9	8.8	8.8	8.0	7.1	8.8	8.1	10.6	8.5	8.7	8.7	7.4	7.4	8.5	6.5	—	0.7	0.7	1.4	1.4	1.4	1.5	1.5	1.6	1.4	1.5	1.5	1.6	1.6
18 *C. kallima*	7.8	7.6	6.7	7.4	7.1	5.8	6.5	7.8	9.3	7.3	7.1	8.1	5.7	5.6	6.5	5.4	5.9	—	0.7	1.4	1.4	1.4	1.5	1.4	1.6	1.3	1.4	1.4	1.5	1.6
19 *Cnemaspis* sp. 1	7.3	7.7	7.0	7.7	6.5	6.7	7.1	7.8	9.6	7.6	6.7	7.3	5.9	6.3	7.0	7.0	7.5	5.4	—	1.4	1.5	1.5	1.5	1.5	1.7	1.3	1.4	1.3	1.6	1.6
20 *C. hitihami* **sp. nov.**	27.4	26.9	25.6	26.9	26.6	26.8	27.1	27.4	27.6	27.0	27.1	26.9	25.5	26.3	26.8	25.7	26.5	26.2	25.9	**0.2**	1.0	1.1	0.9	1.0	1.2	1.1	1.2	1.2	1.2	1.3
21 *C. nilgala*	27.7	27.7	26.2	27.8	26.8	26.7	27.4	27.4	27.7	27.0	27.9	27.4	26.1	26.7	27.0	26.5	27.8	27.5	26.8	12.4	**0.0**	0.9	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
22 *Cnemaspis* sp. 8	28.3	28.1	26.7	27.5	27.2	26.9	27.4	27.3	28.3	27.0	27.8	27.0	26.0	26.6	26.9	26.2	27.6	26.6	26.3	11.9	7.5	—	1.1	1.1	1.0	1.1	1.2	1.3	1.3	1.3
23 *C. alwisi*	29.4	28.9	28.1	29.1	28.5	28.3	29.5	28.6	29.4	28.8	29.2	29.1	27.2	28.3	28.5	27.9	28.7	28.2	27.5	12.0	13.0	12.2	—	1.0	1.2	1.1	1.2	1.2	1.1	1.1
24 *C. kohukumburai* **sp. nov.**	29.1	28.4	28.2	28.9	28.3	28.1	28.5	28.1	29.0	28.3	29.2	29.1	27.5	28.6	28.3	28.0	28.5	27.8	27.7	13.7	14.9	14.3	11.9	—	1.2	1.1	1.4	1.4	1.3	1.3
25 *C. punctata*	29.4	28.6	27.7	28.2	28.7	28.3	29.0	28.9	29.3	28.1	28.8	29.1	27.0	27.9	29.0	28.5	29.5	28.2	28.0	13.9	13.4	13.1	13.1	14.9	—	1.2	1.3	1.3	1.3	1.3
26 *C. podihuna*	27.1	26.8	25.6	26.6	26.7	26.0	26.7	27.5	28.9	26.8	26.8	27.0	26.4	26.9	27.0	26.5	27.3	26.0	25.6	16.7	16.8	16.1	17.0	17.6	18.0	**4.3**	1.1	1.2	1.2	1.2
27 *C. gemunu*	27.3	26.9	25.8	26.4	26.0	26.3	26.8	26.9	28.2	27.5	27.4	27.6	25.7	26.8	27.1	26.2	27.2	25.9	26.0	18.8	19.5	18.9	18.3	19.3	20.5	19.8	**0.4**	0.7	0.9	0.9
28 *Cnemaspis* sp. 7	25.8	25.3	24.3	25.0	24.6	24.4	24.8	24.8	25.9	25.7	25.5	25.8	23.9	25.0	24.9	24.5	25.1	24.0	23.8	16.9	17.8	18.0	17.4	18.3	19.0	18.5	6.8	—	1.0	1.0
29 *C. phillipsi*	27.7	27.4	26.6	27.2	26.5	26.4	27.2	27.2	27.9	27.6	27.4	27.3	25.9	26.9	27.3	26.3	27.6	26.6	26.3	18.7	17.5	17.6	17.8	19.5	19.0	18.3	10.7	9.7	**2.2**	0.7
30 *C. scalpensis*	27.7	27.3	26.6	27.2	26.6	26.6	27.2	27.2	28.2	27.4	27.7	27.7	26.3	27.4	27.9	26.4	27.8	27.3	26.6	18.5	17.9	17.9	18.0	19.9	19.6	18.8	10.6	10.3	4.5	**0.2**

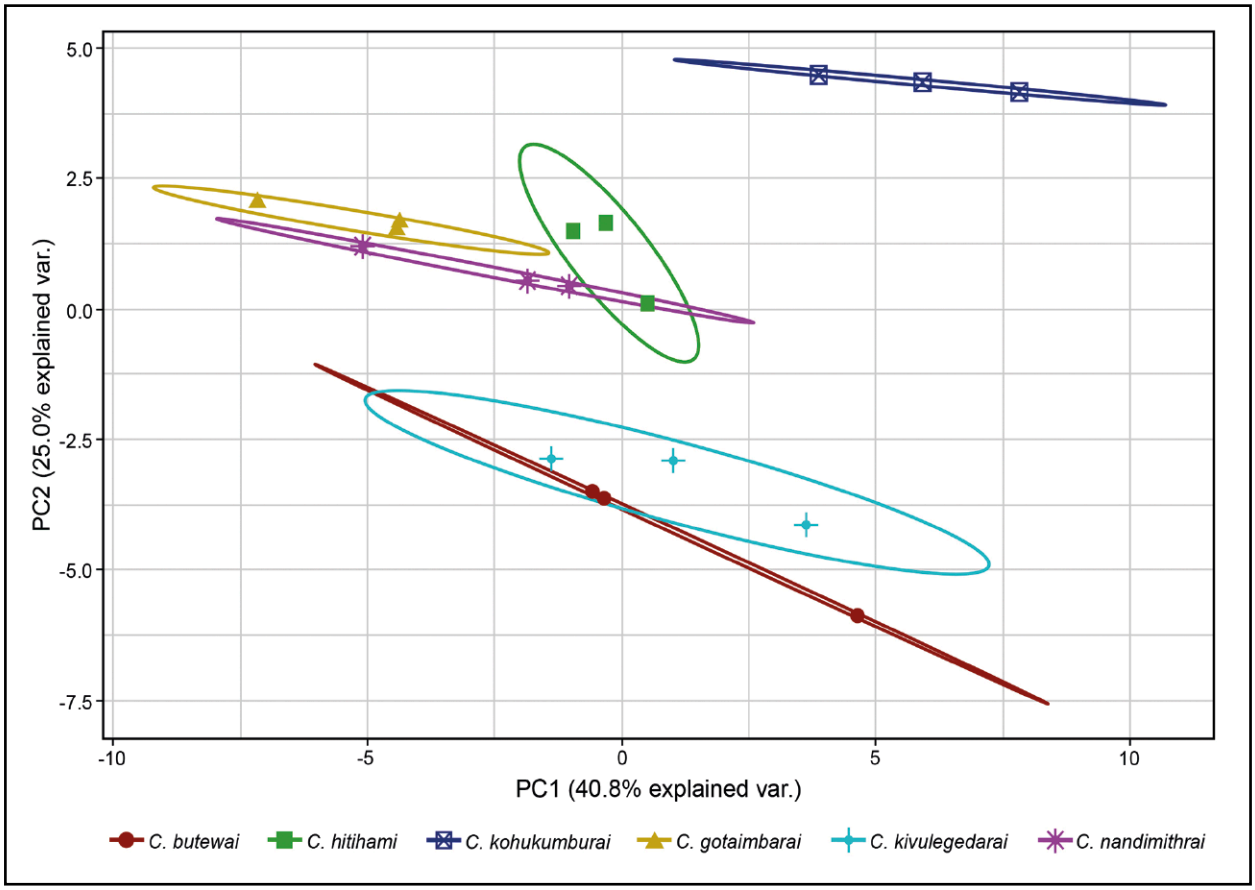

Fig. 3. Principal component analysis (PCA) on morphometric variables of the six new species. The ellipses represent 95% confident intervals around the centroids.

Taxonomy

The results of our phylogenetic analyses of *ND2* mtDNA gene fragment are largely concordant with the previously published trees of Bauer *et al.* (2007) and Agarwal *et al.* (2017). In addition to the data reported in Agarwal *et al.* (2017) our sampling adds six more previously unknown mtDNA lineages of Sri Lankan *Cnemaspis*, five of which correspond to undescribed candidate species. With addition of *C. pulchra* for which our study presents the first DNA data, *C. nilgala* and *C. ingerorum*, originally reported as *Cnemaspis* sp. 8 and *Cnemaspis* sp. 2 in the work by Agarwal *et al.* (2017) and recently described by Karunarathna *et al.* (2019) and Batuwita *et al.* (2019), respectively, our genealogy includes 18 nominal species of Sri Lankan *Cnemaspis* and additionaly reports on 12 currently undescribed candidate species. As we demonstrate below, six of them show significant morphological differences from all other congeners and can be easily distinguished from currently recognized *Cnemaspis* species occurring in Sri Lanka. Their divergence in *ND2* gene fragment from all congeners for which comparable genetic data are available is greater than 5.2%. These genetic distances are consistent with observed morphological differentiation and are greater than the proposed species-level divergence threshold of 3.7% of substitutions in the *ND2* gene. These data suggest that these six lineages of *Cnemaspis* from Sri Lanka represent currently undescribed species new to science which we describe below.

Morphophonemic analyses

The PCA produced two PCs that collectively explained 65.8% of the overall variability of the morphometric measurements of the six new species (Fig. 3). The PC 1 explained 40.8 % of the variability while PC 2 accounted for 25% of the variability. The six new species showed substantial separation in the ordination space based on the morphometric data.

Systematics

Cnemaspis nandimithrai sp. nov.

ZooBank urn:lsid:zoobank.org:act:76DAB508-4201-4FB4-B05F-5AB9BAD6C5D0

Nandimithras' day gecko (English)
Nandimithrage diva-seri hoona (Sinhala)

Figs. 4 – 6; Table 3.

Holotype. NMSL.2019.03.01, adult male, 27.9 mm SVL (Fig. 4), collected from granite cave in Kudumbigala, Kumana, Ampara District, Eastern Province, Sri Lanka (6.667519° N, 81.747839° E, WGS1984; elevation 28 m; around 10.00 hrs) on 15 August 2018 by Suranjan Karunarathna and Anslem de Silva.

Paratypes. NMSL.2019.03.02, adult male, 31.7 mm SVL, and NMSL.2019.03.03, adult female, 29.7 mm SVL, collected from granite cave in Kudumbigala, Kumana, Ampara District, Eastern Province, Sri Lanka (6.658708° N, 81.753736° E, WGS1984; elevation 31 m; around 11.00 hrs), on 15 August 2018 by Suranjan Karunarathna and Anslem de Silva.

Diagnosis. *Cnemaspis nandimithrai* **sp. nov.**, can be readily distinguished from its Sri Lankan congeners by a combination of the following morphometric and meristic characteristics as well as color pattern: maximum SVL 31.7 mm; dorsum with homogeneous, smooth granular scales; 2/2 supranasals, 2 internasals and 1/1 postnasal present; 3 enlarged postmentals; postmentals bounded by 5 chin scales; chin, gular, pectoral and abdominal scales smooth, subimbricate; 25–27 belly scales across midbody; 3–4 weakly developed tubercles on posterior flank; 95–99 paravertebral granules linearly arranged; 2–4 precloacal pores, 2–4 femoral pores on each side in males, separated by 9–11 unpored anterior femoral scales, 5–7 unpored posterior femoral scales; 108–112 ventral scales; 87–89 midbody scales; subcaudals smooth, median row comprising an irregular series of oval shaped, small scales; 5–6 supralabials; 6 infralabials; 12–13 total lamellae on fourth digit of manus, and 19 total lamellae on fourth digit of pes.

Comparisons with other species. Among species of the *C. kandiana* clade *sensu* AGARWAL *et al*. (2017), *Cnemaspis nandimithrai* **sp. nov.** differs by having smooth ventral scales *versus* keeled scales in *C. pava* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, *C. pulchra* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, *C. samanalensis* WICKRAMASINGHE & MUNINDRADASA, 2007, *C. silvula* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, *C. tropidogaster* (BOULENGER, 1885), and *C. upendrai* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, and also in having smooth gular scales *versus* keeled in *C. amith* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007; it can also be diagnosed from *C. ingerorum* BATUWITA, AGARWAL & BAUER, 2019, *C. kallima* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, *C. kandiana* (KELAART, 1852), *C. menikay* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, and *C. retigalensis* WICKRAMASINGHE & MUNINDRADASA, 2007 by having homogeneous (*versus* heterogeneous) dorsal scales; the new species differs from *C. kumarasinghei* WICKRAMASINGHE & MUNINDRADASA, 2007, and *C. latha* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007 by having a greater number of belly scales (25–27 *versus* 17–21 and 13–15, respectively), having a lower number of supralabial scales (5–6 *versus* 7–8 and 7–8, respectively), and having greater number of paravertebral granules (95–99 *versus* 61–68 and 72–79, respectively); further it can be differentiated from *C. kumarasinghei* by having a lower number of ventral scales (108–112 *versus* 120–134).

Among species of the *C. podihuna* clade *sensu* AGARWAL *et al*. (2017), the new species differs from *C. alwisi* WICKRAMASINGHE & MUNINDRADASA, 2007, *C. gemunu* BAUER, DE SILVA, GREENBAUM & JACKMAN, 2007, *C. godagedarai* DE SILVA, BAUER, BOTEJUE & KARUNARATHNA, 2019, *C. kandambyi* BATUWITA & UDUGAMPALA, 2017, *C. molligodai* WICKRAMASINGHE & MUNINDRADASA, 2007, *C. nilgala* KARUNARATHNA, BAUER, DE SILVA, SURASINGHE, SOMARATNA, MADAWALA, GABADAGE, BOTEJUE, HENKANATHTHEGEDARA & UKUWELA, 2019, *C. phillipsi* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, *C. podihuna* DERANIYAGALA, 1944, *C. punctata* MANAMENDRA-ARACHCHI, BATUWITA & PETHIYAGODA, 2007, *C. rajakarunai* WICKRAMASINGHE, VIDANAPATHIRANA & RATHNAYAKE, 2016, *C. rammalensis* VIDANAPATHIRANA, RAJEEV, WICKRAMASINGHE, FERNANDO & WICKRAMASINGHE, 2014, and *C. scalpensis* (FERGUSON, 1877) by having smaller and more irregularly shaped subcaudal scales (*versus* clearly enlarged hexagonal or subhexagonal scales), and by the presence (*versus* absence) of precloacal pores except in *C. kandambyi*, *C. molligodai* and *C. podihuna*, which can be differentiated from *C. nandimithrai* **sp. nov.** by having a greater number of belly scales (23–25 *versus* 16–17, 15–19, and 13–20, respectively).

Description of Holotype. An adult male, 27.9 mm SVL. Body slender, relatively short (TRL 40.8% of SVL). Head relatively large (HL 30.4% of SVL, HL 74.5% of TRL), narrow (HW 16.3% of SVL, HW 53.7% of HL), depressed (HD 11.6% of SVL, HD 38.2% of HL) and distinct from neck. Snout relatively long (ES 78.2% of HW, ES 41.9% of HL), more than twice length of eye diameter (ED 46.9% of ES), more than half length of jaw (ES 70.5% of JL), snout slightly concave in lateral view; eye relatively small (ED 19.7% of HL), larger than the ear (EL 16.2% of ED), pupil rounded; orbit length less than eye to ear distance (OD 92.9% of EE) and less than length of digit IV of manus (OD 72.2% of DLM IV); supraocular ridges neither prominent or absent; ear opening very small (EL 3.2% of HL), deep, taller than wide, larger than nostrils; single row of scales separate orbit from supralabials; interorbital distance is narrow (IO 89.0% of ES), shorter than head length (IO 37.3% of HL); eye to nostril distance greater than the eye to ear distance (EN 128.6% of EE).

Dorsal surface of trunk with smooth homogeneous granules, 94 in paravertebral row; 108 smooth midventral scales; 89 midbody scales; 4/3 weakly developed tubercles on the flanks; ventrolateral scales not enlarged; granules on snout very smooth, larger than those on interorbital and occipital regions; canthus rostralis not pronounced, 12/12 smoothly rounded scales from eye to nostril; scales of the interorbital region ovaland smooth; tubercles present on the sides of the neck but absent around the ear; ear opening vertically oval, slanting from anterodorsal to posteroventral, 18/17 scales between an-

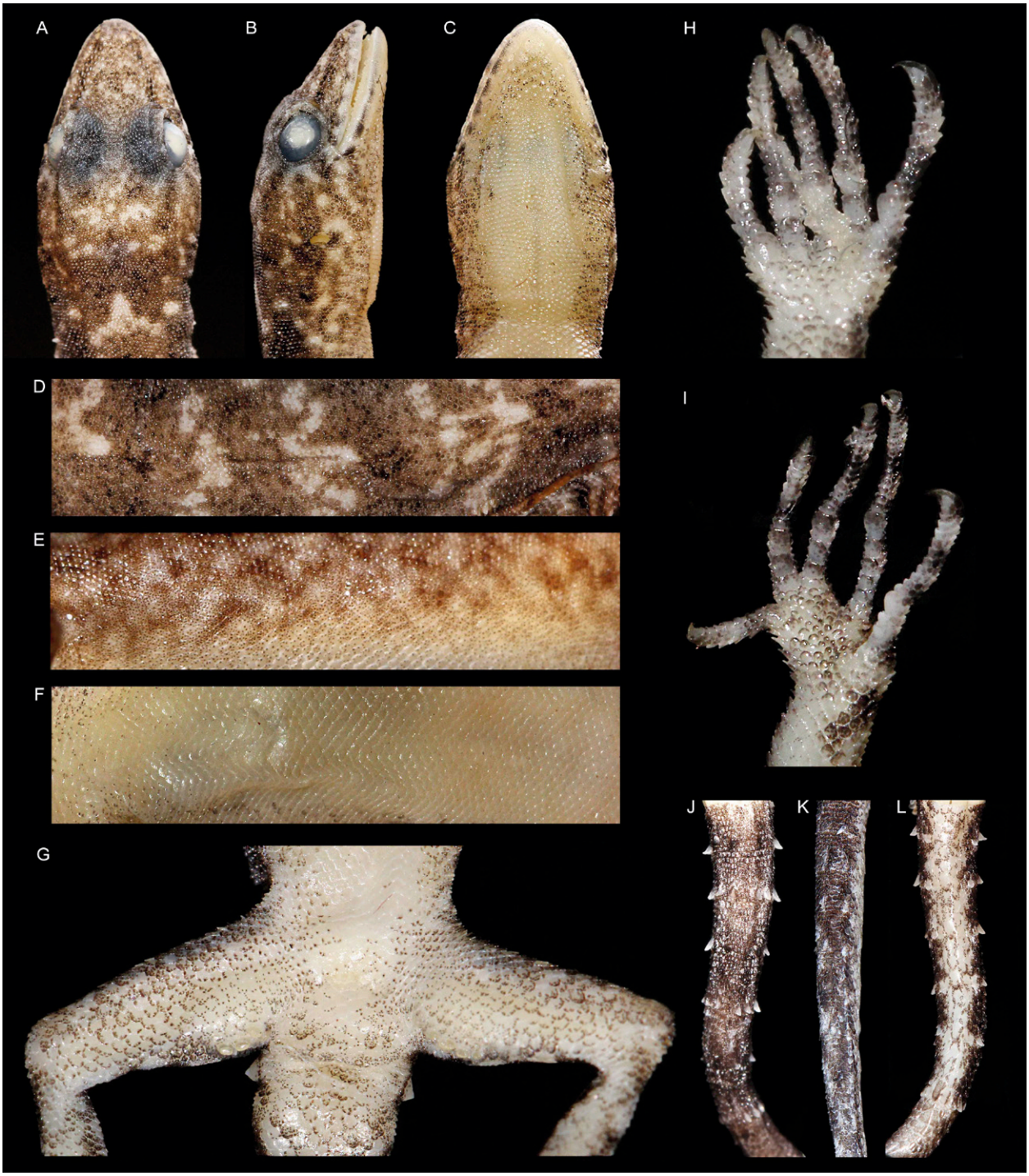

Fig. 4. Close-ups of *Cnemaspis nandimithrai* **sp. nov.** male holotype (NMSL.2019.03.01) (A) dorsal head, (B) lateral head, (C) ventral head, (D) homogeneous dorsal scales, (E) scaleson lateral surface of trunk, (F) smooth ventral scales, (*g*) cloacal characters with precloacal pores and femoral pores (H) subdigital lamellae on manus, (I) subdigital lamellae on pes, (J) dorsal scalation of tail, (K) lateral side of tail, and (l) oval shaped subcaudals (Photos: Suranjan Karunarathna).

terior margin of the ear opening and the posterior margin of the eye. Supralabials 6/6, infralabials 6/6, becoming smaller towards the gape. Rostral scale wider than long, partially divided (75%) by a median groove, in contact with first supralabial. Nostrils separated by 2/2 enlarged supranasals, 2 internasals and 1/1 postnasal; no enlarged scales behind the supranasals. Nostrils oval, dorsolaterally orientated, not in contact with first supralabials.

Mental subrhomboidal in shape, as wide as long, posteriorly in contact with 3 enlarged postmentals (smaller than mental, and larger than chin scales); postmentals in contact and bordered posteriorly by five unkeeled chin scales (smaller than nostrils), in contact with the 1st infralabial; ventral scales smaller than chin scales. Smooth, rounded, juxtaposed scales on the chin and the gular region; pectoral and abdominal scales smooth, subimbri-

Table 3. Morphometric and Meristic data of holotype and two paratypes of *Cnemaspis nandimithrai* **sp. nov.** from Kudumbigala, Ampara District, Sri Lanka (Abbreviations: L – left, R – right, M – male, F – female).

Measurements (mm)	NMSL 2019.03.01 Holotype (M)	NMSL 2019.03.02 Paratype (M)	NMSL 2019.03.03 Paratype (F)	Counts	NMSL 2019.03.01 Holotype (M)	NMSL 2019.03.02 Paratype (M)	NMSL 2019.03.03 Paratype (F)
ED	1.7	1.7	1.8	FLSP (L/R)	4/3	4/4	4/4
OD	2.2	2.2	2.3	SUP (L/R)	6/6	5/6	6/5
EN	3.1	3.2	3.1	INF (L/R)	6/6	6/6	6/6
ES	3.6	2.5	3.6	INOS	31	33	34
SN	0.9	0.9	1.1	PM	3	3	3
NW	0.2	0.1	0.1	CHS	5	5	5
EE	2.4	2.6	2.5	SUN (L/R)	2	2	2
SA	12.8	13.9	14.5	PON (L/R)	1	1	1
EL	0.3	0.6	0.5	INT	2	2	2
IO	3.2	3.4	3.4	SUS (L/R)	14/15	14/13	12/14
IE	3.5	3.7	3.7	BET (L/R)	18/17	18/18	19/18
HL	8.5	9.1	8.8	CAS (L/R)	12/12	12/12	12/12
HW	4.6	4.8	4.9	TLM (i) (L/R)	10/10	9/10	9/9
HD	3.2	3.3	3.4	TLM (ii) (L/R)	15/15	15/15	14/14
JL	5.1	5.5	5.4	TLM (iii) (L/R)	17/17	18/17	18/18
IN	1.2	1.1	1.1	TLM (iv) (L/R)	13/13	12/12	12/12
SED	8.0	8.1	8.3	TLM (v) (L/R)	10/10	10/10	11/11
UAL	3.9	4.1	4.5	PG	95	96	99
LAL	3.9	3.9	4.1	MBS	89	87	87
PAL	2.8	2.9	3.1	MVS	108	111	112
DLM (i)	1.5	1.5	1.6	BLS	25	25	27
DLM (ii)	2.1	2.2	1.9	TLP (i) (L/R)	8/8	8/8	9/9
DLM (iii)	2.8	2.8	2.9	TLP (ii) (L/R)	13/13	14/13	14/14
DLM (iv)	3.1	3.1	3.2	TLP (iii) (L/R)	18/18	17/18	17/17
DLM (v)	2.4	2.4	2.5	TLP (iv) (L/R)	19/19	19/19	19/19
SVL	27.9	31.7	29.7	TLP (v) (L/R)	16/16	16/16	17/17
TRL	11.4	13.8	12.2	PCP	4	2	—
TW	4.7	4.8	4.9	FP (L/R)	4/3	2/2	—
TD	2.6	2.7	2.9	AFS (L/R)	11/11	9/10	—
FEL	5.6	5.7	5.9	PFS (L/R)	5/5	7/6	—
TBL	5.1	5.2	5.5				
HEL	5.2	5.2	5.4				
DLP (i)	1.4	1.5	1.3				
DLP (ii)	2.1	2.1	2.0				
DLP (iii)	3.3	3.3	3.4				
DLP (iv)	3.6	3.7	3.7				
DLP (v)	2.7	2.8	2.8				
TAL	33.9	34.8	36.2				
TBW	2.9	3.0	2.6				
TBD	2.3	2.3	2.1				

cate to imbricate towards precloacal region, abdominal scales slightly larger than dorsals; 25 belly scales across venter; smooth scales around vent and base of tail, subimbricate; 4 precloacal pores; 4/3 femoral pores; 11/11 unpored anterior femoral scales between pores on each side; 5/5 enlarged posterior femoral scales. Original tail of holotype longer than the snout-vent length (TAL 121.3% of SVL); hemipenial bulge greatly swollen (TBW 2.9 mm), heterogeneous scales on the dorsal aspect of the tail directed backwards, spine-like tubercles present at base of tail; tail with 4–5 enlarged flattened obtuse scales forming whorls; a small post-cloacal spur on each side, dorsoventrally flattened and narrow; subcaudals small, smooth, oval, arranged inamedian series.

Forelimbs moderately short, slender (LAL 14.0% of SVL, UAL 14.1% of SVL); hind limbs long, tibia shorter than the femur (TBL 18.2% of SVL, FEL 20.1% of SVL). Anterior and posterior surfaces of upper arm with keeled and less imbricate scales, scales of the anterior surface twice as largre as those of other faces of limb; dorsal and anterior surfaces of lower arm with keeled and less imbricate scales, ventral and posterior surfaces

with unkeeled imbricate scales. Scales on dorsal surface of the femur smooth and granular, less imbricate scales on anterior, posterior and ventral surfaces, scales on anterior and ventral surfaces twice the size of those of other faces of limbs. Dorsal, posterior and ventral surfaces of tibia with smooth, less imbricate scales, anterior surface with keeled subimbricate scales, scales of the ventral surface twice as large as those of the other faces of the limb. Dorsal and ventral scales on manus and pes with keeled granules; dorsal surfaces of digits with granular scales. Digits elongate and slender with inflected distal phalangeal joint, all bearing slightly recurved claws. Subdigital lamellae entire (except divided at first interphalangeal joint), unnotched; total lamellae on manus (left/right): digit I, 10/10, digit II, 15/15, digit III, 17/17, digit IV, 13/13, digit V, 10/10; total lamellae on pes (left/right): digit I, 8/8, digit II, 13/13, digit III, 18/18, digit IV, 19/19, digit V, 16/16; interdigital webbing absent; length of digits of manus (left): I (1.5 mm), II (2.1 mm), V (2.4 mm), III (2.8 mm), IV (3.1 mm); length of digits of pes (left): I (1.4 mm), II (2.1 mm), V (2.7 mm), III (3.3 mm), IV (3.6 mm).

Variation of the type series. The SVL of adult specimens in the type series ($n=3$) ranges from 27.9 to 31.7 mm; supralabials 5–6; interorbital scales 31–34; supraciliaries 12–15; scales from eye to tympanum 17–19; total lamellae on digit I of the manus 9–10, lamellae on digit II of manus 14–15, lamellae on digit III of manus 17–18, lamellae on digit IV of manus 12–13, lamellae on digit V of manus 10–11; total lamellae on digit I of pes 8–9, lamellae on digit II of pes 13–14, lamellae on digit III of pes 17–18, lamellae on digit V of pes 16–17; ventral scales 108–112; belly scales across venter 25–27; midbody scales 87–89; paravertebral granules 95–99; precloacal pores in males 2–4; femoral pores in males 2–4; unpored anterior femoral scales in males 9–11, and unpored posterior femoral scales in males 5–7.

Color of living specimens. The color of the head, body and limbs on the dorsal side generally varies from light grey to light brown, 5 irregular black bands on the dorsum of the body (Fig. 5); an oblique black line is present between the eye and the nostrils on either side; 2 straight, dark brown postorbital stripes on each side extend from the eyes posteroventrally, and a dark longitudinal line is present on the occipital area; there is a narrow subtrangle shaped, brown patch on the occipital area with scattered cream white spots; 4 distinct, irregular cream spots on the lateral surfaces of the trunk; tail grey-white on the dorsum, with 3 faded brown cross-bands present in the first half; the pupil is circular and black with surrounding red and white margins, with supraciliaries scales being yellowish; supralabials and infralabaials are cream colored with black spots; mid-gular scales are dark yellow without dark spots; pectoral, abdominal, cloacal and subcaudal scales are immaculate white; dorsal of limbs have brown patches; manus and pes with cream white and black cross stripe arrangement.

Color of preserved specimens. Dorsally dark brown with pale colored, pale irregular brown bands and white irregular lines are distinct; ventral surface completely cream colored with some scales on thigh, tail base and arms with dark brown margins.

Etymology. The specific epithet is an eponym Latinized (*nandimithrai*) in the masculine genitive singular, honouring 'Nandimithra Yodaya' (a gladiator, one of the ten giant warriors of King Dutugemunu's army) for his valiant services to his king and his contribution to rebuilding the Kudumbigala monastery (granite caves, especially Maha Sudharshana Lena), later gifted to the Buddhist Monks.

Habitat and ecology. Kudumbigala Sanctuary (6.658114°–6.681811° N and 81.726844°–81.762328° E; altitude ranges from 12 to 67 m) is dominated by a tropical dry mixed semi-evergreen forest with a *Manilkara*-dominant floristic community (Gunatileke & Gunatileke, 1990), and is approximately 800 ha in size, situated in the lowland dry zone (Eastern Province, Ampara District) of eastern Sri Lanka. The mean annual rainfall varies between 1,000 and 1,500 mm, received mainly during the northeast monsoon (November–February). The mean annual temperature of the area is 29.8–31.4 ºC. The Kudumbigala monastic complex was built in 246 BC as a refuge for Buddhist monks and includes over 200 caves (Fig. 6). Our surveys suggest that *C. nandimithrai* **sp. nov.** was rare in this locality given the low encounter rate of 7 (±0.1) geckos per man-hour. After surveying a total area of 50 ha, we only found this species in four distinct locations within the type locality. Microhabitat associations of this species were restricted to rock outcrops and the interior of granite caves in forested areas, and are found up to a height of up to 8 m on vertical surfaces. These microhabitats were well-shaded (light intensity 0–643 Lux), relatively moist (relative humidity: 71–83%), cool and shady (ambient temeratur: 30.5–32.2 °C, rock-surface temperature: 26.6–28.4 °C, canopy cover: 60–75%). The geckos were active during daylight hours (0800–1700 h) and, when disturbed, sought refuge in the rock crevices. The new species was sympatric (at both the local habitat and microsite scales) with two other micro-endemic cave-dwelling geckos (*Calodactylodes illingworthorum* and *Hemidactylus hunae*) and other generalist species (*Cnemaspis podihuna*, *Gehyra mutilata*, *Hemidactylus depressus*, *H. frenatus*, *H. triedrus*, *H. parvimaculatus*). Eggs were observed in granite rock crevices, typically laid in pairs. The eggs were pure white in color almost spherical in shape (mean diameter 4.8 ± 0.02 mm), with a slightly flattened side attached to the rocky substrate. So far, this species has only been recorded from rock outcrops and granite caves at the type locality, many of which have been human occupied since the stoneage until the colonial period. It is likely that this species is distributed throughout the Kudumbigala and nearby habitats, but occupancy is restricted to granite caves and rock outcrops.

Fig. 5. *Cnemaspis nandimithrai* **sp. nov.** male holotype (NMSL.2019.03.01) in life *in-situ* (A) dorsolateral view of the full body displaying color pattern, and showing ectoparasites in red, (B) ventral aspect depicting gular and abdomen color (Photos: Nimantha Abeyarathna).

Conservation status. Application of the IUCN Red List criteria indicates that *C. nandimithrai* **sp. nov.** is Critically Endangered (CR) due to having an area of occupancy (AOO) < 10 km^2 (four locations, 0.1 km^2 in total assuming a 100 m radius around the georeferenced location) and an extent of occurrence (EOO) < 100 km^2 (2.2 km^2) in the lower elevations of Eastern Province. The low numbers we recorded in our survey also implies that the species is rare, thus, warrants a higher conservation status [Applicable criteria is B2-b (iii)].

Phylogenetic position. A member of *C. kandiana* Clade B; the new species belongs to *C. kumarasinghei* species group (BIII) (Fig. 2), within which it is most closely related to the new species *C. gotaimbarai* **sp. nov.** (*p*-distance 7.9%), *C. ingerorum* (*p*-distance 8.0%) and *C. kumarasinghei* (*p*-distance 6.8%) (see Tab. 2).

Geographical distance. *Cnemaspis nandimithrai* **sp. nov.** most closely resembles *C. gotaimbarai* **sp. nov.**, *C. ingerorum* and *C. kumarasinghei* the type localities of which are ~48 km (Maragala in Monaragala District), ~ 102 km (Kokagala in Ampara District) and ~ 61 km (Sandagala in Hambantota District) straight line distance from Kudumbigala in Panama.

Cnemaspis gotaimbarai sp. nov.

ZooBank urn:lsid:zoobank.org:act:54D8F176-3105-479A-9474-2951D8654309

Gotaimbaras' day gecko (English)
Gotaimbarage diva-seri hoona (Sinhala)

Figs. 7–9; Table 4.

Holotype. NMSL.2019.04.01, adult male, 32.9 mm SVL (Fig. 7), collected from granite cave in Kokagala, Padiyatalawa in Ampara District, Eastern Province, Sri Lanka (7.439517° N, 81.207967° E, WGS1984; elevation 292 m; around 14.00 hrs) on 22 October 2018 by Suranjan Karunarathna and Anslem de Silva.

Paratypes. NMSL.2019.04.02, adult male, 32.1 mm SVL, and NMSL.2019.04.03, adult female, 33.7 mm SVL, collected from granite caves in Kokagala, Padiyatalawain Ampara District, Eastern Province, Sri Lanka (7.413086° N, 81.210161°E, WGS1984; elevation 306 m; around 12.00 hrs) on 22 October 2018 by Suranjan Karunarathna and Anslem de Silva.

Diagnosis. *Cnemaspis gotaimbarai* **sp. nov.**, can be readily distinguished from its Sri Lankan congeners by a combination of the following morphological and meristic characteristics and color pattern: maximum SVL 33.7 mm; dorsum with homogeneous, smooth granular scales; 2/2 supranasals, 1 internasal and 2/2 postnasals present; 2 enlarged postmentals; postmentals bounded

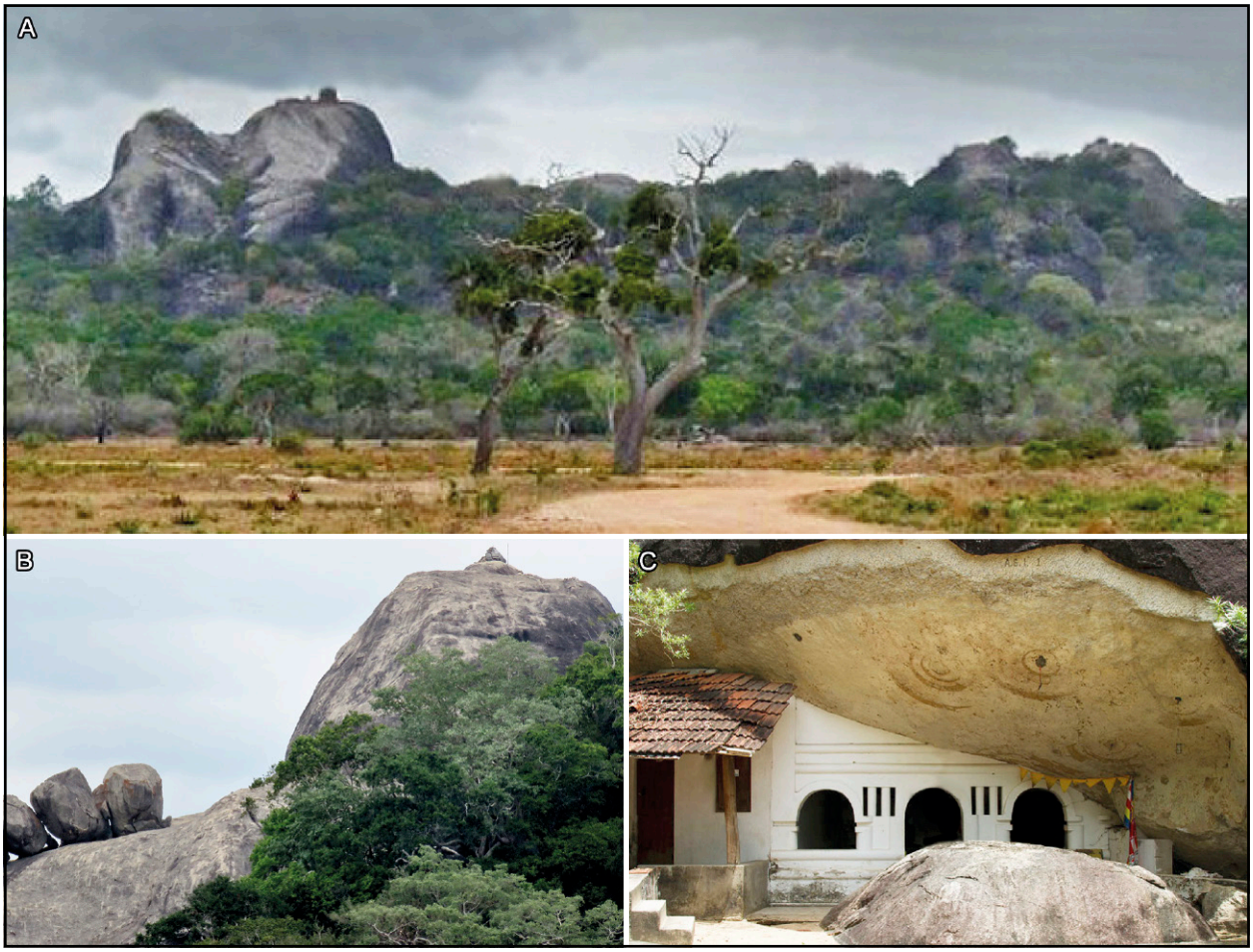

Fig. 6. General habitat of *Cnemaspis nandimithrai* **sp. nov.** at Kudumbigala isolated forest hill, Ampara District, Sri Lanka (A) complete view of the hill, (B) archaeological monuments on rock outcrops, (C) prehistorical-occupied granite caves with inscription, and evidence of remains of early humans (Photos: Majintha Madawala).

by 5 chin scales; chin, gular, pectoral and abdominal scales smooth, subimbricate; 23–25 belly scales across venter; 5–6 weakly developed tubercles on posterior flank; 117–121 paravertebral granules linearly arranged; 2–4 precloacal pores, 3 femoral pores on each side in males, on each side separated by 10–13 unpored anterior femoral scales, 1–5 unpored posterior femoral scales; 129–138 ventral scales; 72–79 midbody scales; subcaudals smooth, median row tiny, in an irregular series of subrhomboidal scales; 7–8 supralabials; 8–9 infralabials; 16–17 total lamellae on fourth digit of manus, and 19–20 total lamellae on fourth digit of pes.

Comparisons with other species. The new species, *C. gotaimbarai* **sp. nov.** differs from species of the *C. kandiana* clade *sensu* Agarwal *et al*. (2017) in having smooth ventral scales *versus* keeled in *C. pava*, *C. pulchra*, *C. samanalensis*, *C. silvula*, *C. tropidogaster*, and *C. upendrai*, and in also having smooth gular scales *versus* keeled gular scales in *C. amith.* It can be diagnosed from *C. ingerorum*, *C. kallima*, *C. kandiana*, *C. menikay*, and *C. retigalensis* by having homogeneous (*versus* heterogeneous) dorsal scales. The new species differs from *C. kumarasinghei* and *C. latha* by having a greater number of belly scales (23–25 *versus* 17–21 and 13–15, respectively), having greater number of paravertebral granules (117–121 *versus* 61–68 and 72–79, respectively), and also having greater number of interorbital scales (34–36 *versus* 24–26 and 22–25, respectively). Further, it can be differentiated from *C. nandimithrai* **sp. nov.** by having more supralabial scales (7–8 *versus* 5–6), more paravertebral granules (117–121 *versus* 95–99), and more ventral scales (129–138 *versus* 108–112).

The new species also clearly differs from the following species of the *C. podihuna* clade *sensu* Agarwal *et al*. (2017): *C. alwisi*, *C. gemunu*, *C. godagedarai*, *C. kandambyi*, *C. molligodai*, *C. nilgala*, *C. phillipsi*, *C. podihuna*, *C. punctata*, *C. rajakarunai*, *C. rammalensis*, and *C. scalpensis* by having small and irregular shaped subcaudal scales (*versus* clearly enlarged hexagonal or subhexagonal scales), and by the presence (*versus* absence) of precloacal pores, except in *C. kandambyi*, *C. molligodai* and *C. podihuna*, which differ from *C. gotaimbarai* **sp. nov.** by having a lower number of belly scales (16–17, 15–19 and 13–20 *versus* 23–25).

Description of Holotype. An adult male, 32.9 mm SVL. Body slender, relatively long (TRL 44.2% of SVL).

Fig. 7. Close-ups of *Cnemaspis gotaimbarai* **sp. nov.** male holotype (NMSL.2019.04.01) (A) dorsal head, (B) lateral head, (C) ventral head, (D) homogeneous dorsal scales, (E) scaleson lateral surface of trunk, (F) smooth ventral scales, (G) cloacal characters with precloacal pores and femoral pores (H) subdigital lamellae on manus, (I) subdigital lamellae on pes, (J) dorsal scalation of tail, (K) lateral side of tail, and (L) oval shaped subcaudals (Photos: Suranjan Karunarathna).

Head relatively large (HL 30.2% of SVL, HL 68.4% of TRL), narrow (HW 15.6% of SVL, HW 51.6% of HL), depressed (HD 10.1% of SVL, HD 33.4% of HL) and distinct from neck. Snout relatively long (ES 76.2% of HW, ES 39.3% of HL), more than twice eye diameter (ED 46.3% of ES), more than half length of jaw (ES 63.0% of JL), snout slightly concave in lateral view; eye relatively small (ED 18.2% of HL), larger than the ear (EL 24.3% of ED), pupil rounded; orbit length less than eye to ear distance (OD 80.1% of EE) and of length of IV digit of manus (OD 63.9% of DLM IV); supraocular ridges are moderately developed; ear opening very small (EL 4.4% of HL), deep, taller than wide, larger than nostrils; 3 rows of scales separate orbit from supralabials; in-

Fig. 8. *Cnemaspis gotaimbarai* **sp. nov.** male holotype (NMSL.2019.04.01) in life *in-situ* (A) dorsolateral view of the full body, and (B) dorsal view depicting color pattern (Photos: Majintha Madawala).

terorbital distance is broader than orbit length (IO 87.5% of ES), shorter than head length (IO 34.4% of HL); eye to nostril distance slightly greater than eye to ear distance (EN 114.5% of EE).

Dorsal surface of the trunk with unkeeled homogeneous granules, 117 paravertebral granules; 132 midventral scales, smooth; 79 midbody scales; 5/5 weakly developed tubercles on the flanks; ventrolateral scales slightly enlarged; granules on snout somewhat rough, larger than those on interorbital and occipital regions; canthus rostralis not pronounced,12/12 keeled round scales from eye to nostril; scales of the interorbital region circular and fairly keeled; tubercles present both on the sides of the neck and around the ear; ear opening vertically oval, slanting from anterodorsal to posteroventral, 17/17 scales between anterior margin of the ear opening and the posterior margin of the eye. Supralabials 7/8, infralabials 8/6, becoming smaller towards the gape. Rostral scale wider than long, partially divided (60%) by a median groove, contact with first supralabial. Nostrils separated by 2/2 enlarged supranasals with 1 internasal; no enlarged scales behind the supranasals. Nostrils oval, dorsolaterally orientated, not in contact with first supralabials; 2/2 postnasals, smooth, larger than nostrils, partially in contact with first supralabial.

Mental sub-triangular in shape, as wide as long, posteriorly in contact with 2 enlarged postmentals (smaller than mental, and lager than chin scales); postmentals in contact and bordered posteriorly with 5 unkeeled chin scales (smaller than nostrils), in contact with the 1st infralabial; ventral scales smaller than posterior postmentals. Smooth, rounded, juxtaposed scales on the chin and the gular region; pectoral and abdominal scales smooth, subimbricate to imbricate towards precloacal region, abdominal scales slightly larger than dorsals; 25 belly scales across venter; smooth scales around vent and base of tail, subimbricate; 4 precloacal pores; 3/3 femoral pores; 10/11 unpored anterior femoral scales in between pores on each side; 4/5 enlarged posterior femoral scales. Regenerated tail of holotype longer than the snout-vent length (TAL 123.6%

Table 4. Morphometric and Meristic data of holotype and two paratypes of *Cnemaspis gotaimbarai* **sp. nov.** from Kokagala, Ampara District, Sri Lanka (Abbreviations: L – left, R – right, M – male, F – female).

Measurements (mm)	NMSL 2019.04.01 Holotype (M)	NMSL 2019.04.02 Paratype (M)	NMSL 2019.04.03 Paratype (F)	Counts	NMSL 2019.04.01 Holotype (M)	NMSL 2019.04.02 Paratype (M)	NMSL 2019.04.03 Paratype (F)
ED	1.8	1.7	1.6	FLSP (L/R)	5/5	5/6	6/6
OD	2.1	2.0	2.0	SUP (L/R)	7/8	8/8	8/8
EN	2.9	2.9	3.0	INF (L/R)	8/8	8/9	8/8
ES	3.9	3.8	3.7	INOS	35	34	36
SN	0.7	0.7	0.8	PM	2	2	2
NW	0.2	0.2	0.2	CHS	5	5	5
EE	2.6	2.5	2.4	SUN (L/R)	2	2	2
SA	15.6	15.5	15.4	PON (L/R)	2	2	2
EL	0.4	0.4	0.4	INT	1	1	1
IO	3.4	3.3	3.2	SUS (L/R)	15/16	15/15	16/16
IE	3.7	3.6	3.5	BET (L/R)	17/17	18/17	18/18
HL	9.9	9.8	9.7	CAS (L/R)	12/12	12/11	12/12
HW	5.1	5.1	4.9	TLM (i) (L/R)	13/13	12/13	12/12
HD	3.3	3.3	3.1	TLM (ii) (L/R)	15/15	15/15	14/14
JL	6.2	6.1	5.9	TLM (iii) (L/R)	18/18	18/17	17/17
IN	1.2	1.2	1.2	TLM (iv) (L/R)	17/17	17/17	16/17
SED	8.5	8.4	8.2	TLM (v) (L/R)	15/14	15/15	15/15
UAL	4.5	4.4	4.3	PG	117	121	119
LAL	5.8	5.7	5.6	MBS	79	72	76
PAL	3.3	3.3	3.1	MVS	132	138	129
DLM (i)	1.4	1.4	1.2	BLS	25	23	23
DLM (ii)	1.9	1.9	1.8	TLP (i) (L/R)	9/9	9/9	8/8
DLM (iii)	2.6	2.6	2.4	TLP (ii) (L/R)	13/13	12/13	12/12
DLM (iv)	3.2	3.1	2.9	TLP (iii) (L/R)	14/14	14/15	15/15
DLM (v)	2.3	2.2	2.1	TLP (iv) (L/R)	19/19	19/20	20/19
SVL	32.9	32.1	33.7	TLP (v) (L/R)	21/21	22-22	21/22
TRL	14.5	14.4	14.9	PCP	4	2	—
TW	4.9	4.9	5.1	FP (L/R)	3/3	3/3	—
TD	3.3	3.2	3.3	AFS (L/R)	11/10	12/13	—
FEL	6.1	6.0	5.9	PFS (L/R)	4/5	2/1	—
TBL	5.6	5.5	5.4				
HEL	4.3	4.3	4.2				
DLP (i)	1.2	1.2	1.2				
DLP (ii)	1.9	1.9	1.7				
DLP (iii)	3.3	3.3	3.1				
DLP (iv)	3.4	3.4	3.3				
DLP (v)	2.7	2.7	2.6				
TAL	40.7	39.3	36.7				
TBW	3.1	3.1	2.7				
TBD	2.6	2.5	2.7				

of SVL); Hemipenial bulge greatly swollen (TBW 3.1 mm), heterogeneous scales on the dorsal aspect of the tail directed backwards, spine-like tubercles present at the base of tail; tail with 4–5 enlarged flattened obtuse scales forming whorls; a large, blunt post-cloacal spur on each side, dorso-ventrally flattened and narrow; subcaudals smooth, subrhomboidal, arranged in a median series.

Forelimbs moderately short, slender (LAL 17.7% of SVL, UAL 13.8% of SVL); hind limbs long, tibia shorter than the femur (TBL 17.1% of SVL, FEL 18.6% of SVL). Anterior and posterior surfaces of upper arm with keeled and less imbricate scales, scales of the anterior surface twice as large as those of the other parts; dorsal and anterior surfaces of lower arm with keeled and less imbricate scales, ventral and posterior surfaces with unkeeled imbricate scales those are imbricate. Scales on dorsal surface of femur smooth, rounded and juxtaposed, those on anterior surface well keeled, posterior and ventral surfaces smooth and imbricate, scales on the ventral surface twice the size ofthose of other aspects. Dorsal,

anterior and posterior surfaces of tibia with keeled and less imbricate scales, ventral surface with smooth and subimbricate scales, scales of the ventral surface twice as large as those on other aspects. Dorsal and ventral surfaces of manus and pes with keeled granules; dorsal surfaces of digits with granular scales. Digits elongate and slender with inflected distal phalanges joint, all bearing slightly recurved claws. Subdigital lamellae entire (except divided at first interphalangeal joint), unnotched; total lamellae on manus (left/right): digit I, 13/13, digit II, 15/15, digit III, 18/18, digit IV, 17/17, digit V, 15/14; total lamellae on pes (left/right): digit I, 9/9, digit II, 13/13, digit III, 14/14, digit IV, 19/19, digit V, 21/21; interdigital webbing absent; length of manual digits (left): I (1.4 mm), II (1.9 mm), V (2.3 mm), III (2.6 mm), IV (3.2 mm); length of pedal digits (left): I (1.2 mm), II (1.9 mm), V (2.7 mm), III (3.3 mm), IV (3.4 mm).

Variation of the type series. The SVL of adult specimens in the type series ($n=3$) size ranges from 32.1 to 23.7 mm; supralabials 7–8, and infralabials 8–9; interorbital scales 34–36; supraciliaries 15–16; scales from eye to tympanum 17–18; scales from eye to nostril 11–12; total lamellae on digit I of the manus 12–13, lamellae on digit II of manus 14–15, lamellae on digit III of manus 17–18, lamellae on digit IV of manus 16–17, lamellae on digit V of manus 14–15; total lamellae on digit I of pes 8–9, lamellae on digit II of pes 12–13, lamellae on digit III of pes 14–15, lamellae on digit IV of pes 19–20, lamellae on digit V of pes 21–22; ventral scales 129–138; belly scales across venter 23–25; midbody scales 72–79, and paravertebral granules 117–121; precloacal pores in males 2–4, anterior femoral scales in males 10–13, posterior femoral scales in males 1–5.

Color of living specimens. The color of the dorsum of head, body and limbs generally varies from light brown to light grey with 4–5 irregular dirty white cloud-like blotches (Fig. 8); an oblique black line is present along the canthal line, 2 straight, dark brown and grey postorbital stripes (each side) extend from eyes posteroventrally, and a longitudinal golden line with dark margins present in the occipital area; there is a narrow and faded human-face-like brown patch on the occipital area with scattered cream white spots; 3–4 distinct irregular cream white spots on the lateral surfaces of the body; tail brown-black on dorsum, with 6–7 faded white cross-bands; the pupil is circular and golden with surrounding red and white margins, with supraciliaries scales being yellowish; supralabials and infralabaials are cream white and black spotted; mid gular scales are yellow with tiny dark spots; pectoral, abdominal, cloacal and subcaudal scales are white with dark spots; dorsum of limbs with white and brown patches; manus and pes with cream white and black stripe arrangement.

Color of preserved specimens. Dorsally dark brown with pale colored, pale irregular blotches and much dark irregular lines are distinct; ventral surface completely cream colored with some scales on thigh, tail base and arms with dark brown margins.

Etymology. The specific epithet is an eponym Latinized (*gotaimbarai*) in the masculine genitive singular, honouring 'Gotaimbara Yodaya' (a gladiator, one of the ten giant warriors of King Dutugemunu's army) for his valiant services to his king and country.

Habitat and ecology. Kokagala Forest Reserv (7.400000°–7.450000° N and 81.200000°–81.233333° E; altitude ranges from 285–650 m) is a tropical dry mixed semi-evergreen forest with a *Vatica*-dominant floristic community (Gunatileke & Gunatileke, 1990). It is approximately 1000 ha in size and islocated in the lowland mid-peneplains of the dry bioclimatic zone of Eastern Sri Lanka (Eastern Province, Ampara District). The mean annual rainfall varies between 1,500 and 2,500 mm, received mainly during the northeast monsoon (November–February). The mean annual temperature of the area is 29.6–30.5 ºC. Kokagala is rich in granite caves with over 100 having been documented. *Cnemaspis gotaimbarai* **sp. nov.** could be a rare species as we only found 9 (±0.2) geckos per man-hour after surveying approximately a total area of 35 ha with 5 confirmed locations. This species was restricted to rock outcrops and granite caves in forested areas, and was found up to 10 m in height on vertical surfaces (Fig. 9). The microhabitats of *C. gotaimbarai* **sp. nov.** were poorly illuminated (light intensity: 0–821 Lux), relatively moist (relative humidity: 69–85%), cool and dry (ambient temperature: 30.2–31.8 °C, substrate temperature: 27.2–28.7 °C, canopy cover: 70–85%). The geckos were active during daylight hours (0800–1700 h) and, when disturbed, sought refuge in rocky crevices. The new species was sympatric (at both local habitat and the microsite scale) with several other micro-endemic cave-dwelling geckos (*Calodactylodes illingworthorum* and *Hemidactylus hunae*) as well as more generalist species (*Cnemaspis* cf. *podihuna*, *Gehyra mutilata*, *Hemidactlus depressus*, *H. frenatus*, *H. triedrus*, *H. parvimaculatus*). No eggs were found.

Conservation status. Application of the IUCN Red List criteria indicates that *C. gotaimbarai* **sp. nov.** is Critically Endangered (CR) due to having an area of occupancy (AOO) <10 km^2 (five locations, 0.2 km^2 in total, assuming a 100 m radius around the georeferenced locations) and an extent of occurrence (EOO) <100 km^2 (3.5 km^2) in the mid-elevations of the Eastern Province [Applicable criteria is B2-b (iii)].

Phylogenetic position. *Cnemaspis gotaimbarai* **sp. nov.** is a member of *C. kandiana* Clade B; the new species belongs to *C. kumarasinghei* species group (BIII) (Fig. 2), within which it is most closely related to *C. ingerorum* (*p*-distance 8.6%), *C. kumarasinghei* (*p*-distance 8.1%) and the new species *Cnemaspis nandimithrai* **sp. nov.** (*p*-distance 7.9%) (see Tab. 2).

Fig. 9. General habitat of *Cnemaspis gotaimbarai* **sp. nov.** at Kokagala isolated forest hill, Ampara District, Sri Lanka (A) complete view of the hill and corn plantation, (B) granite boulders along the stream, (C) abandoned wattle and daub house in lower margin (Photos: Madhava Botejue and Majintha Madawala).

Geographical distance. *Cnemaspis gotaimbarai* **sp. nov.** most closely resembles *C. ingerorum, C. kumarasinghei* and *C. nandimithrai* **sp. nov** morphologically, the type localities of which is separated by 121 km (Sandagala in Hambantota District), ~55 km (Maragala in Monaragala District) and ~ 102 km (Kudumbigala in Ampra District), straight line distance from Kokagala in Padiyatalawa.

Cnemaspis kohukumburai sp. nov.

ZooBank urn:lsid:zoobank.org:act:B0F2073D-A77F-43DA-85E3-27464BD2CF64

Kohukumbures' day gecko (English)
Kohukumburege diva-seri hoona (Sinhala)

Figs. 10–12; Table 5.

Holotype. NMSL.2019.05.01, adult male, 33.9 mm SVL (Fig. 10), collected from a granite tunnel in Kadugannawa, Kandy District, Central Province, Sri Lanka (7.251800° N, 80.509378° E, WGS1984; elevation 427 m; around 09.00 hrs) on 12 October 2018 by Suranjan Karunarathna and Anslem de Silva.

Paratypes. NMSL.2019.05.02, adult male, 32.5 mm SVL, and NMSL.2019.05.03, adult female, 31.0 mm SVL collected from a granite tunnel in Kadugannawa, Kandy District, Central Province, Sri Lanka (7.251658° N, 80.512561° E, WGS1984; elevation 435 m; around 10.00 hrs), on 12 October 2018 by Suranjan Karunarathna and Anslem de Silva.

Diagnosis. *Cnemaspis kohukumburai* **sp. nov.** can be readily distinguished from its Sri Lankan congeners by a combination of the following morphological and meristic characteristics and color pattern: maximum SVL 33.9 mm; dorsum with homogeneous, smooth granular scales; 2/2 supranasals, 1 internasal and 1/1 postnasal present; 3 enlarged postmentals; postmentals bounded by 5 chin scales; chin and gular scales smooth, granular, juxtaposed; pectoral and abdominal scales smooth, subimbricate; 7–8 well developed tubercles on posterior flank; 150–159 paravertebral granules linearly arranged; 23 belly scales across the venter; precloacal pores absent in males, 6–9 femoral pores on each side in males separated by 25 unpored femoro-precloacal scales, 1–2 unpored posterior femoral scales; 131–134 ventral scales; 81–88 midbody scales; subcaudals smooth, subhexagonal, enlarged, subequal, forming aregular median row; 8–9 supralabials; 7–8 infralabials; 21–22 total lamellae on digit IV of manus, and 23–25 total lamellae on digit IV of pes.

Fig. 10. Close-ups of *Cnemaspis kohukumburai* **sp. nov.** male holotype (NMSL.2019.05.01) (A) dorsal head, (B) lateral head, (C) ventral head, (D) homogeneous dorsal scales, (E) scales on lateral surface of trunk, (F) smooth ventral scales, (G) cloacal characters with precloacal pores and femoral pores (H) subdigital lamellae on manus, (I) subdigital lamellae on pes, (J) dorsal scalation of tail, (K) lateral side of tail, and (L) oval shaped subcaudals (Photos: Suranjan Karunarathna).

Comparisons with other species. The new species differs from species of the *C. podihuna* clade *sensu* Agarwal *et al*. (2017) as follows: from *C. kandambyi*, *C. molligodai* and *C. podihuna* by the absence (*versus* presence) of precloacal pores; from *C. gemunu*, *C. godagedarai*, *C. phillipsi*, *C. rammalensis* and *C. scalpensis* by the presence of fewer femoral pores (6–9 *versus* 11–14, 12–13, 15–16, 15 and 13–15, respectively); it further differs from *C. gemunu* and *C. scalpensis* by the presence of a greater number of belly scales (23 *versus* 13–16 and 17–19, respectively), from *C. rammalensis* by the presence of fewer ventral scales (131–134 *versus* 186–207), and from *C. phillipsi* by the presence of more total lamellae on digit IV of pes (23–25 *versus* 17–19).

It can be diagnosed from *C. alwisi* and *C. rajakarunai* by the presence of fewer ventral scales (131–134 *versus* 145–153 and 146–186, respectively), and by the presence of more unpored femoro-precloacal scales (25 *versus* 18–19 and 20–22, respectively). It can be differentiated from *C. punctata* by the greater number of paravertebral granules (150–159 *versus* 83–91), by the presence of more total lamellae on digit IV of manus (21–22 *versus* 17–18), and by fewer well-developed tubercles on the posterior flank (7–8 *versus* 11–13). Further, it can be distinguished from *C. nilgala* by the presence of a greater number of belly scales (23 *versus* 17–19) across the midbody, and by the presence of more total lamellae on digit IV of pes (23–25 *versus* 17–19).

Cnemaspis kohukumburai **sp. nov.** also clearly differs by the absence of precloacal pores and the presence of clearly enlarged, hexagonal or subhexagonal subcaudal scales from the following species of the *C. kandiana* clade *sensu* AGARWAL *et al*. (2017): *C. amith*, *C. gotaimbarai* **sp. nov.**, *C. ingerorum*, *C. kallima*, *C. kandiana*, *C. kumarasinghei*, *C. latha*, *C. menikay*, *C. nandimithrai* **sp. nov.**, *C. pava*, *C. pulchra*, *C. retigalensis*, *C. samanalensis*, *C. silvula*, *C. tropidogaster* and *C. upendrai*.

Description of Holotype. An adult male, 33.9 mm SVL. Body slender, relatively short (TRL 39.3% of SVL). Head relatively large (HL 30.9% of SVL, HL 78.6% of TRL), narrow (HW 19.0% of SVL, HW 61.6% of HL), depressed (HD 6.6% of SVL, HD 21.4% of HL) and distinct from neck. Snout relatively short (ES 61.0% of HW, ES 37.6% of HL), more than twice eye diameter (ED 47.7% of ES), more than half length of jaw (ES 63.2% of JL), snout slightly concave in lateral view; eye relatively small (ED 17.9% of HL), larger than the ear (EL 23.9% of ED), pupil rounded; orbit length less than eye to ear distance (OD 75.2% of EE) and nearly half ofthe length of digit IV of the manus (OD 51.5% of DLM IV); supraocular ridges not prominent; ear opening very small (EL 4.3% of HL), deep, taller than wide, larger than nostrils; 2 rows of scales separate orbit from supralabials; interorbital distanceis narrow (IO 78.9% of ES), shorter than head length (IO 29.6% of HL); eye to nostril distance little greater than the eye to ear distance (EN 103.2% of EE).

Dorsal surface of the trunk with smooth, small homogeneous granules, 150 paravertebral granules; 131 smooth midventral scales; 88 midbody scales; 8/8 well developed tubercles on the flanks; ventrolateral scales slightly enlarged; granules on snout smooth and fairly raised, larger than those on interorbital and occipital regions; canthus rostralis not pronounced, 15/15 smooth round scales from eye to nostril; scales of the interorbital region oval and smooth; 3/3 tubercles present on the sides of the neck and around the ear; ear opening vertically oval, slanting from anterodorsal to posteroventral, 25/26 scales between anterior margin of the ear opening and the posterior margin of the eye. Supralabials 8/9 infralabials 8/8, becoming smaller towards the gape. Rostral scale wider than long, partially divided (80%) by a median groove, in contact with first supralabial. Nostrils separated by 2/2 enlarged supranasals with 1 internasal and 1/1 postnasal; no enlarged scales behind the supranasals. Nostrils oval, dorsolaterally orientated, not in contact with first supralabials.

Mental sub-triangular, as wide as long, posteriorly in contact with three enlarged postmentals (smaller than mental, and larger than chin scales); postmentals in contact and bordered posteriorly by five smooth chin scales (smaller than nostrils), in contact only with the 1st infralabials; ventral scales smaller than chin scales. Smooth, rounded, juxtaposed scales on chin and gular region; pectoral and abdominal scales smooth, subimbricate towards precloacal region, abdominal scales larger than dorsals; 23 belly scales across venter; smooth, subimbricate scales around vent and base of tail; 8/9 femoral pores; 25 unpored femoro-precloacal scales; 2/1 small posterior femoral scales. Original tail of holotype longer than snout-vent length (TAL 121.5% of SVL); Hemipenial bulge greatly swollen (TBW 3.2 mm), homogeneous scales on the dorsal aspect of the tail directed backwards, 3/3 spine-like tubercles present at base of tail, latter very smooth; tail with 3–4 enlarged flattened obtuse scales forming whorls; a small, blunt post-cloacal spur on each side, dorso-ventrally flattened and narrow; smooth subcaudals are arranged into a median series of clearly enlarged, hexagonal or subhexagonal scales.

Forelimbs moderately short, slender (LAL 15.2% of SVL, UAL 19.2% of SVL); hind limbs long, tibia shorter than the femur (TBL 21.6% of SVL, FEL 26.2% of SVL). Dorsal, anterior, ventral and posterior surfaces of upper arm with smooth scales, those on anterior surface twice-as large as those on other faces of limb; dorsal, anterior, ventral and posterior surfaces of lower arm with smooth scales, anterior surface twice as large as those of the other parts; scales on dorsal surface of the femur smooth and granular, less imbricate scales on the anterior, posterior and ventral surfaces, scales on the anterior surface is twice the size ofthose of the other parts. Dorsal, anterior, posterior and ventral surfaces of tibia with smooth scales; both anterior and posterior surfaces of limbs are with smooth granules, scales of the ventral surface twice as large as those of the other parts. Dorsal and ventral scales on the manus and the pes smooth, granular; dorsal surfaces of digits with granular scales. Digits elongate and slender with inflected distal phalanges joint, all bearing slightly recurved claws. Subdigital lamellae entire (except divided at first interphalangial joint), unnotched; total lamellae on manus (left/right): digit I, 12/12, digit II, 18/19, digit III, 20/19, digit IV, 22/22, digit V, 24/24; total lamellae on pes (left/right): digit I, 12/12, digit II, 18/18, digit III, 20/19, digit IV, 24/25, digit V, 22/23; interdigital webbing absent; length of digits of manus (left): I (2.5 mm), II (3.3 mm), III (3.6 mm), V (3.6 mm), IV (4.1 mm); length of digits of pes (left): I (1.8 mm), II (3.7 mm), III (4.1 mm), V (4.2 mm), IV (4.9 mm).

Variation of the type series. The SVL of adult specimens in the type series ($n=3$) ranges from 31.0 to 33.9 mm;

Fig. 11. *Cnemaspis kohukumburai* **sp. nov.** (A) female paratype (NMSL.2019.05.03) in life *in-situ* (B) male holotype (NMSL.2019.05.01) in life *in-situ* depicting dorsal color pattern (Photos: Majintha Madawala).

number of supralabials 8–9, and infralabials 7–8; interorbital scales 38–39; supraciliaries 13–15; scales from eye to tympanum 24–26; total lamellae on digit I of the manus 11–12, lamellae on digit II of manus 17–19, lamellae on digit III of manus 19–20, lamellae on digit IV of manus 21–22, lamellae on digit V of manus 23–24; total lamellae on digit II of pes 17–18, lamellae on digit III of pes19–20, lamellae on digit IV of pes 23–25, lamellae on digit V of pes 21–23; ventral scales 131–134, midbody scales 81–88; paravertebral granules 150–159; femoral pores in males 6–9, and unpored posterior femoral scales in males 1–2

Color of living specimens. The dorsum of the head, body and limbs light brown and light grey; 5 irregular cloud-like black bands on the dorsum of the body; 2 oblique black and white lines are present between the eye and the nostrils on either side (Fig. 11); a straight, dark brown postorbital stripe extends from each eye posteroventrally across the ear, and broad dark spots are present in the occipital area; there is a narrow 'I' shaped, black patch on the occipital area with scattered small, irregular cream-white spots surrounding it. Tail dorsum is brownish, with 9 faded grey cross-bands; the pupil is circular and black with surrounding orange and white margins, with greyish supraciliaries scales; supralabials and infralabaials light brown with black spots; mid-gular scales dirty white without dark spots; pectoral, abdominal, cloacal and subcaudal scales are cream without dark spots; dorsum of limbs with brown patches; manus and pes with with an arrangement of black and cream white stripe on the dorsum.

Color of preserved specimens. Dorsally dark brown with pale colored, 5 irregular cloud-like pale bands clear

Table 5. Morphometric and Meristic data of holotype and two paratypes of *Cnemaspis kohukumburai* **sp. nov.** from Kadugannawa, Kandy District, Sri Lanka (Abbreviations: L – left, R – right, M – male, F – female).

Measurements (mm)	NMSL 2019.05.01 Holotype (M)	NMSL 2019.05.02 Paratype (M)	NMSL 2019.05.03 Paratype (F)	Counts	NMSL 2019.05.01 Holotype (M)	NMSL 2019.05.02 Paratype (M)	NMSL 2019.05.03 Paratype (F)
ED	1.9	1.8	1.9	FLSP (L/R)	8/8	8/7	7/7
OD	2.1	2.1	2.1	SUP (L/R)	8/9	8/8	8/8
EN	2.9	2.9	2.9	INF (L/R)	8/8	7/8	7/7
ES	3.9	3.9	3.8	INOS	38	38	39
SN	0.8	0.8	0.8	PM	3	3	3
NW	0.2	0.2	0.2	CHS	5	5	5
EE	2.8	2.8	2.6	SUN (L/R)	2	2	2
SA	16.9	17.1	17.0	PON (L/R)	1	1	1
EL	0.5	0.5	0.5	INT	1	1	1
IO	3.1	3.1	3.2	SUS (L/R)	14/15	15/15	13/13
IE	3.3	3.5	3.5	BET (L/R)	25/26	24/24	24/25
HL	10.5	11.2	11.0	CAS (L/R)	15/15	14/14	15/14
HW	6.5	6.5	6.3	TLM (i) (L/R)	12/12	11/11	11/11
HD	2.3	2.3	2.4	TLM (ii) (L/R)	18/19	18/18	18/17
JL	6.2	6.3	6.0	TLM (iii) (L/R)	20/19	20/20	19/19
IN	1.3	1.3	1.3	TLM (iv) (L/R)	22/22	21/21	21/21
SED	10.3	10.4	10.3	TLM (v) (L/R)	24/24	23/24	23/23
UAL	6.5	6.4	6.4	PG	150	154	159
LAL	5.2	5.2	5.1	MBS	88	83	81
PAL	6.1	6.1	5.9	MVS	131	134	134
DLM (i)	2.5	2.5	2.5	BLS	23	23	23
DLM (ii)	3.3	3.3	3.4	TLP (i) (L/R)	12/12	12/12	12/12
DLM (iii)	3.6	3.6	3.5	TLP (ii) (L/R)	18/18	17/17	17/18
DLM (iv)	4.1	4.1	4.2	TLP (iii) (L/R)	20/19	19/19	19/19
DLM (v)	3.6	3.6	3.7	TLP (iv) (L/R)	24/25	24/24	23/23
SVL	33.9	32.5	31.0	TLP (v) (L/R)	22/23	23/23	21/21
TRL	13.3	13.6	14.1	FP (L/R)	8/9	7/6	—
TW	5.4	5.4	5.3	PFS (L/R)	2/1	2/2	—
TD	3.8	3.8	3.7	IFS	25	25	—
FEL	8.9	8.6	8.3				
TBL	7.3	7.3	7.1				
HEL	7.8	7.6	7.3				
DLP (i)	1.8	1.8	1.8				
DLP (ii)	3.7	3.7	3.7				
DLP (iii)	4.1	4.1	4.2				
DLP (iv)	4.9	4.9	4.8				
DLP (v)	4.2	4.2	4.2				
TAL	41.2	41.4	42.0				
TBW	3.2	3.2	3.2				
TBD	2.7	2.7	2.5				

on the dorsum of the body; dark and narrow 'I' shaped patch on the occipital area; ventral surface completely whitewith some scales on thighs, tail base and arms with dark brown margins.

Etymology. The specific epithet is an eponym Latinized (*kohukumburai*) in the masculine genitive singular, honouring the Sri Lankan warrior 'Kohukumbure Walauwe Rate Rala' for his valiant feats in the Great Rebellion of 1817–1818 which was initiated in Uva-Wellassa.

Habitat and ecology. The Kadugannawa area (7.232356°–7.261469° N and 80.497639°–80.540933° E; altitude range from 354–567 m) is a tropical wet wet-evergreen forest (GUNATILEKE & GUNATILEKE, 1990) mixed with a mosaic of anthropogenic and anthropocentric habitats, and is approximately 600 ha in size, situated in the low-country wet zone of central Sri Lanka (Central Province, Kandy District). The mean annual rainfall varies between 3,000 and 4,500 mm, received mostly via the southwest monsoon (May–September). The mean annual

Fig. 12. General habitat of *Cnemaspis kohukumburai* **sp. nov.** at Kadugannawa isolated forest hill, Kandy District, Sri Lanka (A) complete view of the mountain range from top of the hill, (B) the granite tunnel in type locality along the tar road, (B) communal egg laying site (Photos: Majintha Madawala and Kalangi Rodrigo).

temperature of the area is 25.2–27.5ºC; *C. kohukumburai* **sp. nov.** is a rare species as 2 (±1) geckos per man-hour were found after surveying a total area of 25 ha with three confirmed locations. This species was restricted to rock outcrops and granite caves in forested areas, and was found at heights of up to 5 m on vertical surfaces (Fig. 12). These microhabitats were poorly illuminated (light intensity: 0–686 Lux), relatively moist (relative humidity: 73–89%), cool and wet (ambient temperature: 29.8–31.2°C, rock surface temperature: 26.2–27.8°C, canopy cover: 70–90%). The geckos were active during the day time (0800–1700 h) and when disturbed, sought refuge in rocky crevices. The new species was sympatric (at local habitat scale) with several other geckos (*Cnemaspis kandiana*, *Gehyra mutilata*, *Hemidactylus depressus*, *H. frenatus*, *H. parvimaculatus*, *Hemiphyllodactylus typus*). Eggs likely belonging to *C. kohukumburai* were found in crevices, typically laid in pairs communally. The eggs were pure white in color almost spherical in shape (mean diameter 4.9±0.02 mm; $n=22$), with a slightly flattened side attached to the rocky substrate. This species was recorded from granite caves, tunnel and rock outcrops located in both relatively undisturbed forests and less modified habitats in the Kadugannawa area.

Conservation status. Application of the IUCN Red List criteria indicates that *C. kohukumburai* **sp. nov.** is Critically Endangered (CR) due to having an area of occupancy (AOO) <10km^2 (three locations, 0.1 km^2 in total, assuming a 100 m radius around the georeferenced locations) and an extent of occurrence (EOO) <100 km^2 (0.01 km^2) in the lower elevations of Central Province [Applicable criteria is B2-b (iii)].

Phylogenetic position. A member of *C. podihuna* Clade A; the new species belongs to the species group AIII (Fig. 2), within which it is reconstructed as a sister species of *C. alwisi* (*p*-distance 11.9%) and *C. punctata* (*p*-distance 14.9%) (see Tab. 2).

Geographical distance. *Cnemaspis kohukumburai* **sp. nov.** most closely resembles *C. alwisi* and *C. rajakarunai*. The type localities of these species are separated by ~ 35 km and ~ 40 km straight line distance (Dolukanda in Kurunegala and Salgala in Kegalle, respectively) from Kadugannawa in Kandy.

Cnemaspis hitihami sp. nov.

ZooBank urn:lsid:zoobank.org:act:8DC0B6FC-C1F5-46FF-83C6-8FBF33563F5C

Hitihamis' day gecko (English)
Hitihamige diva-seri hoona (Sinhala)

Figs. 13–15; Table 6.

Holotype. NMSL.2019.06.01, adult male, 41.7 mm SVL (Fig. 13), collected from a granite cave in Kumaradola, Maragalakanda, Monaragala District, Uva Province, Sri Lanka (6.875428° N, 81.357289° E, WGS1984; elevation 421 m; around 16.00 hrs) on 18 September 2018 by Suranjan Karunarathna and Anslem de Silva.

Paratypes. NMSL.2019.06.02, adult male, 38.8 mm SVL, and NMSL.2019.06.03, adult female, 39.5 mm SVL, collected from a granite cave in Kumaradola, Maragalakanda, Monaragala District, Uva Province, Sri Lanka (6.879725° N, 81.364986° E, WGS1984; elevation 437 m; around 17.00 hrs) on 18 September 2018 by Suranjan Karunarathna and Anslem de Silva.

Diagnosis. *Cnemaspis hitihami* **sp. nov.**, can be readily distinguished from its Sri Lankan congeners by a combination of the following morphological and meristic characteristics and color pattern: maximum SVL 41.7 mm; dorsum with homogeneous, smooth granular scales; 2/2 supranasals, 1 internasal and 1/1 postnasal present; 3 enlarged postmentals; postmentals bounded by 5 chin scales; chin and gular scales smooth. granular, juxtaposed; pectoral and abdominal scales smooth, subimbricate; 21 belly scales across the venter; 4–5 well developed tubercles on posterior flank; 143–149 paravertebral granules linearly arranged; precloacal pores absent in males, 5–10 femoral pores in males on each side separated by 24–26 unpored femoro-precloacal scales, 5–7 unpored posterior femoral scales; 132–135 ventral scales; 96–99 midbody scales; enlarged subcaudals smooth, subequal, subhexagonal, arranged in a regular median row; 8–9 supralabials; 7–9 infralabials; 18–19 total lamellae on digit IV of manus, and 21–22 total lamellae on digit IV of pes.

Comparisons with other species. The new species, *C. hitihami* **sp. nov.** differs from all members of the *C. podihuna* clade *sensu* AGARWAL *et al*. (2017): from *C. kandambyi*, *C. molligodai* and *C. podihuna* it differs by the absence (*versus* presence) of precloacal pores. The new species differs from *C. godagedarai*, *C. phillipsi*, *C. rammalensis* and *C. scalpensis* in having fewer femoral pores (5–10 *versus* 12–13, 15–16, 15 and 13–15, respectively). It also differs from *C. godagedarai* by its greater number of paravertebral granules (143–149 *versus* 101–106), from *C. phillipsi* by its greater number of total lamellae on digit IV of the pes (21–22 *versus* 17–19), from *C. rammalensis* by fewer belly scales (21 *versus* 25–28) across the midbody, and from *C. scalpensis* by the presence of more belly scales (21 *versus* 17–19). It can be diagnosed from *C. alwisi* and *C. rajakarunai* by lower number of ventral scales (132–135 *versus* 145–153 and 146–186, resperctively), and by its greater number of unpored femoro-precloacal scales (24–26 *versus* 18–19 and 20–22, respectively). It can be differentiated from *C. gemunu* and *C. nilgala* by its greater number of belly scales (21 *versus* 13–16 and 17–19) and by a greater number total lamellae on digit IV of pes (21–22 *versus* 18–19 and 17–18, respectively). The new species also differs from *C. punctata* by in having more midbody scales (96–99 *versus* 71–78), by greater number of paravertebral granules (143–149 *versus* 83–91), and by fewer well developed tubercles on posterior flank (4–5 *versus* 11–13). It can be diagnosed from *C. kohukumburai* **sp. nov.** by a lower number of interorbital scales (30–33 *versus* 37–39), and by more total lamellae on digit IV of pes (21–22 *versus* 18–19).

The new species clearly differs from *C. amith*, *C. gotaimbarai* **sp. nov.**, *C. ingerorum*, *C. kallima*, *C. kandiana*, *C. kumarasinghei*, *C. latha*, *C. menikay*, *C. nandimithrai* **sp. nov.**, *C. pava*, *C. pulchra*, *C. retigalensis*, *C. samanalensis*, *C. silvula*, *C. tropidogaster* and *C. upendrai*, members of the *C. kandiana* clade *sensu* AGARWAL *et al*. (2017), by the absence of precloacal pores and the presence of clearly enlarged, hexagonal or subhexagonal subcaudal scales.

Description of Holotype. An adult male, 41.7 mm SVL. Body slender, relatively long (TRL 42.6% of SVL). Head relatively small (HL 27.2% of SVL, HL 63.9% of TRL), narrow (HW 16.6% of SVL, HW 61.1% of HL), depressed (HD 8.1% of SVL, HD 29.9% of HL) and distinct from neck. Snout relatively short (ES 67.1% of HW, ES 41.0% of HL), more than twice eye diameter (ED 41.4% of ES), more than half length of jaw (ES 59.4% of JL), snout slightly concave in lateral view; eye relatively small (ED 17.0% of HL), larger than the ear (EL 37.3% of ED), pupil rounded; orbit length greater than eye to ear distance (OD 118.5% of EE) and more than half of the length of IV digit of manus (OD 76.7% of DLM IV); supraocular ridges not prominent; ear opening very small (EL 6.3% of HL), deep, taller than wide, larger than nostrils; 2 rows of scales separate orbit from supralabials; interorbital distance is broad (IO 100.6% of ES), shorter than head length (IO 41.3% of HL); eye to nostril distance little greater than the eye to ear distance (EN 103.6% of EE).

Dorsal surface of the trunk with small, smooth, homogeneous granules; 145 paravertebral granules; 132 smooth midventral scales; 96 midbody scales; 5/5 well developed tubercles on the flanks; ventrolateral scales not enlarged; granules on snout smooth and fairly raised, larger than those on interorbital and occipital regions; canthus rostralis not pronounced, 18/19 smooth round scales from eye to nostril; scales of the interorbital region oval and smooth; 2/2 tubercles present on the sides of the neck and around the ear; ear opening vertically oval, slanting from anterodorsal to posteroventral, 18/18 scales between anterior margin of the ear opening and posterior margin of the eye. Supralabials 9/9 infralabials 8/9, becoming smaller towards the gape. Rostral scale wider than long, partially divided (50%) by a median groove, in contact with first supralabial. Nostrils separated by 2/2 enlarged suprana-

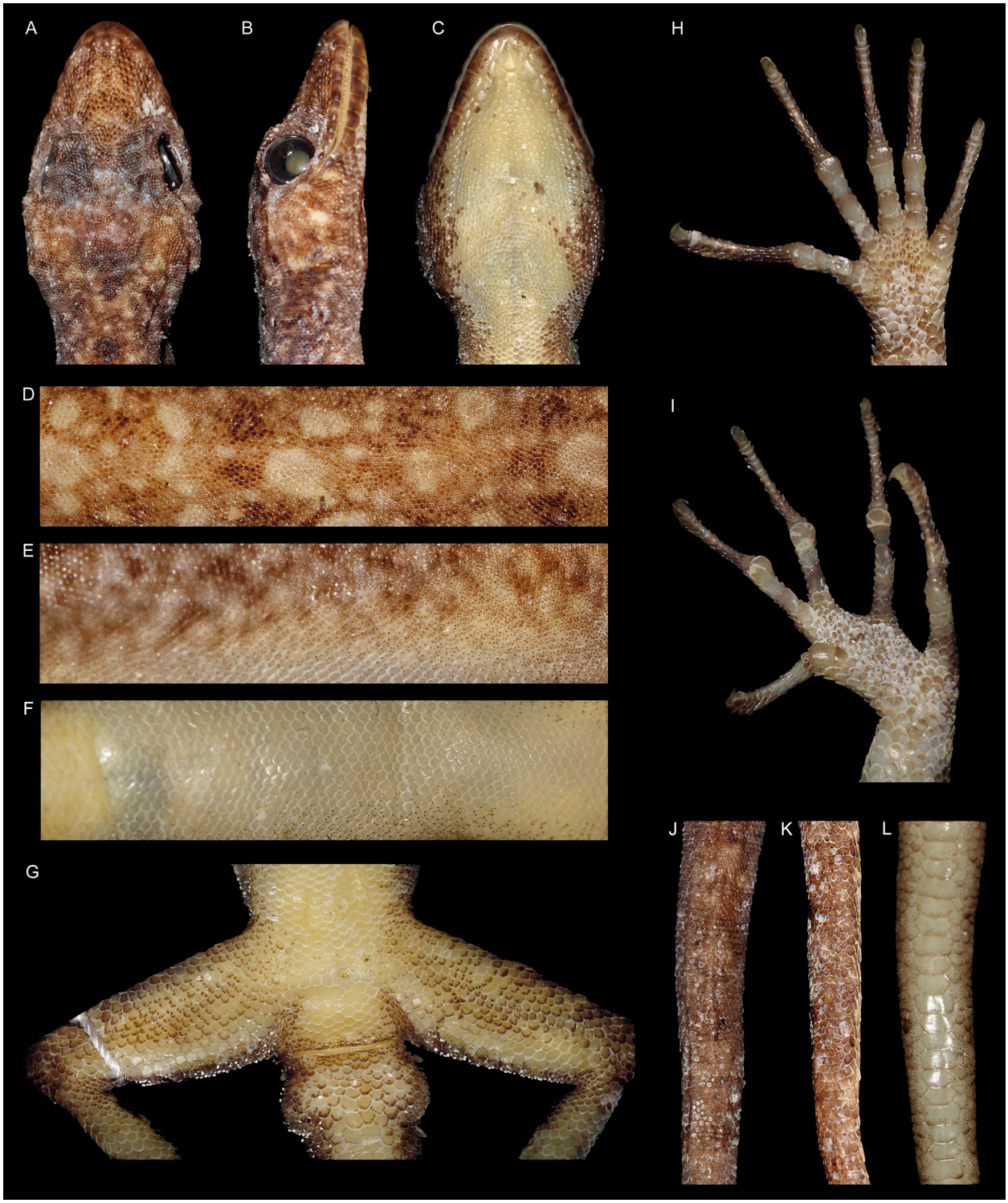

Fig. 13. Close-ups of *Cnemaspis hitihami* **sp. nov.** male holotype (NMSL.2019.06.01) (A) dorsal head, (B) lateral head, (C) ventral head, (D) homogeneous dorsal scales, (E) scales on lateral surface of trunk, (F) smooth ventral scales, (G) cloacal characters with precloacal pores and femoral pores (H) subdigital lamellae on manus, (I) subdigital lamellae on pes, (J) dorsal scalation of tail, (K) lateral side of tail, and (L) oval shaped subcaudals (Photos: Suranjan Karunarathna).

sals with 1 internasal and 1/1 postnasal; no enlarged scales behind the supranasals. Nostrils oval, dorsolaterally orientated, not in contact with first supralabials.

Mental sub-triangular in shape, as wide as long, posteriorly in contact with three enlarged postmentals (smaller than mental, and lager than chin scales); postmentals in contact and bordered posteriorly by five smooth chin scales (smaller than nostrils), in contact with the 1st infralabials; ventral scales smaller than chin scales. Smooth, rounded, juxtaposed scales present on chin and gular region; pectoral and abdominal scales smooth, subimbricate towards precloacal region, abdominal scales

Table 6. Morphometric and Meristic data of holotype and two paratypes of *Cnemaspis hitihami* **sp. nov.** from Maragalakanda, Monaragala District, Sri Lanka (Abbreviations: L – left, R – right, M – male, F – female).

Measurements (mm)	NMSL 2019.06.01 Holotype (M)	NMSL 2019.06.02 Paratype (M)	NMSL 2019.06.03 Paratype (F)	Counts	NMSL 2019.06.01 Holotype (M)	NMSL 2019.06.02 Paratype (M)	NMSL 2019.06.03 Paratype (F)
ED	1.9	1.9	1.9	FLSP (L/R)	5/5	5/4	4/5
OD	3.3	3.3	3.1	SUP (L/R)	9/9	8/8	8/9
EN	2.9	3.0	2.9	INF (L/R)	8/9	8/7	9/7
ES	4.7	4.8	5.4	INOS	31	33	31
SN	1.7	1.6	1.5	PM	3	3	3
NW	0.2	0.2	0.3	CHS	5	5	5
EE	2.8	2.7	2.7	SUN (L/R)	2	2	2
SA	18.8	18.0	18.6	PON (L/R)	1	1	1
EL	0.7	0.8	0.7	INT	1	1	1
IO	4.7	4.6	4.6	SUS (L/R)	15/15	15/16	14/14
IE	4.9	4.9	4.8	BET (L/R)	18/18	19/19	20/19
HL	11.4	10.8	10.5	CAS (L/R)	18/19	18/18	19/19
HW	6.9	6.7	6.5	TLM (i) (L/R)	12/12	12/13	12/12
HD	3.4	3.1	3.0	TLM (ii) (L/R)	15/14	15/15	15/15
JL	7.9	7.7	6.9	TLM (iii) (L/R)	15/15	16/16	15/16
IN	1.8	1.8	1.7	TLM (iv) (L/R)	18/18	18/18	18/19
SED	10.4	10.0	9.9	TLM (v) (L/R)	17/16	16/16	17/17
UAL	7.0	6.6	6.3	PG	145	143	149
LAL	7.4	6.7	7.1	MBS	96	97	99
PAL	5.9	5.7	5.9	MVS	132	133	135
DLM (i)	2.8	2.8	2.7	BLS	21	21	21
DLM (ii)	3.5	3.5	3.3	TLP (i) (L/R)	13/13	12/13	13/13
DLM (iii)	3.7	3.6	3.6	TLP (ii) (L/R)	16/16	16/16	16/16
DLM (iv)	4.3	4.1	4.1	TLP (iii) (L/R)	19/18	18/18	18/18
DLM (v)	3.8	3.6	3.6	TLP (iv) (L/R)	21/21	21/22	22/22
SVL	41.7	38.8	39.5	TLP (v) (L/R)	18/19	18/18	19/19
TRL	17.8	15.6	16.5	FP (L/R)	5/8	10/9	—
TW	7.8	7.9	7.3	PFS (L/R)	6/5	7/7	—
TD	3.9	3.9	4.3	IFS	24	26	—
FEL	9.4	8.4	8.7				
TBL	8.9	7.5	8.6				
HEL	7.3	7.1	8.2				
DLP (i)	1.9	1.8	1.8				
DLP (ii)	3.9	3.7	3.8				
DLP (iii)	4.2	4.2	4.0				
DLP (iv)	4.8	4.7	4.6				
DLP (v)	4.3	4.1	4.1				
TAL	54.1	45.9	44.1				
TBW	4.4	4.3	3.9				
TBD	3.3	3.3	2.9				

larger than dorsals; 21 belly scales across venter; smooth, subimbricate scales around vent and base of tail; 5/8 femoral pores; 24 unpored femoro-precloacal scales; 6/5 small posterior femoral scales. Original tail of holotype longer than snout-vent length (TAL 129.7% of SVL); Hemipenial bulge greatly swollen (TBW 4.4 mm), homogeneous scales on the dorsal aspect of the tail directed backwards, 3/3 spine-like tubercles present at the base of tail, latter very smooth; tail with 5–7 enlarged flattened obtuse scales forming whorls; a small, blunt post-cloacal spur on each side, dorsoventrally flattened and narrow; smooth, enlarged hexagonal or subhexagonal subcaudals arranged in a median series.

Forelimbs moderately short, slender (LAL 17.8% of SVL, UAL 16.7% of SVL); hind limbs long, tibia quite shorter than the femur (TBL 21.4% of SVL, FEL 22.6% of SVL). Dorsal, anterior, ventral and posterior surfaces of upper arm with smooth scales, those on anterior surface twice as large as those on other faces of limb. Dorsal, anterior, ventral and posterior surfaces of lower arm with

Fig. 14. *Cnemaspis hitihami* **sp. nov.** male holotype (NMSL.2019.06.01) in life in-situ (A) dorsolateral view of the full body, and (B) ventral aspect depicting gular and abdomen color (Photos: Majintha Madawala).

smooth scales, those on anterior surface twice as large as those of the other faces of limb; scales on dorsal surface of femur smooth and granular, less imbricate on anterior, posterior and ventral surfaces, scales on the anterior surface twice the size of those on other parts. Dorsal, anterior, posterior and ventral surfaces of tibia with smooth scales; both anterior and posterior surfaces of limbs with smooth granules, scales of the ventral surface twice as large as those of the other surfaces. Dorsal and ventral scales on the manus and the pes with smooth granules; dorsal surfaces of digits also with granular scales. Digits elongate and slender with an inflected distal phalanges joint, all bearing slightly recurved claws. Subdigital lamellae entire (except divided at first interphalangial joint), unnotched; total lamellae on manus (left/right): digit I, 12/12, digit II, 15/14, digit III, 15/15, digit IV, 18/18, digit V, 17/16; total lamellae on pes (left/right): digit I, 13/13, digit II, 16/16, digit III, 19/18, digit IV, 21/21 digit V, 18/19; interdigital webbing absent; length of digits of manus (left): I (2.8 mm), II (3.5 mm), III (3.7 mm), V (3.8 mm), IV (4.3 mm); length of digits of pes (left): I (1.9 mm), II (3.9 mm), III (4.2 mm), V (4.3 mm), IV (4.8 mm).

Variation of the type series. The SVL of adult specimens in the type series (n=4) ranges from 38.6 to 41.7 mm; supralabials 8–9; infralabials 7–9; interorbital scales 30–33; supraciliaries 14–16; scales from naris to orbit 18–19; scales from eye to tympanum 18–20; total lamellae on digit I of the manus 12–13, lamellae on digit II of manus 14–15, lamellae on digit III of manus 15–16, lamellae on digit IV of manus 18–19, lamellae on digit V of manus 16–17; total lamellae on digit I of pes 12–13, lamellae on digit II of pes 15–16, lamellae on digit III of pes 18–19, lamellae on digit IV of pes 21–22, lamellae on digit V of pes 18–19; spine-like tubercles on flank 4–5; ventral scales 131–135, belly scales across venter 21, midbody scales 95–99, and paravertebral granules 143–149; femoral pores in males 7–11, unpored femoro-precloacal scales in males 24–26, and unpored posterior femoral scales in males 5–7.

Fig. 15. General habitat of *Cnemaspis hitihami* **sp. nov.** at Maragala isolated forest hill, Monaragala District, Sri Lanka (A) a complete view of the granite hill, (B) rock outcrop with rubber plantation, (C) granite cave habitat on roadside (Photos: Majintha Madawala).

Color of living specimens. The dorsum of the head, body and limbs generally varies from golden brown to dark brown mixed with light grey; 5–7 small, irregular black paravertebral spots present; a narrow, short black longitudinal line on the occipital area with scattered cream-white spots;a single row of white spots present along vertebral line (Fig. 14). Tail dorsum cinnamon brown, with 8–12 faded grey cross-bands; pupil circular and black with surrounding orange and white margins, with supraciliaries scales cinnamon brown; supralabials and infralabaials light brown with black spots; chin and gular scales bright yellow, without dark spots; pectoral, abdominal, cloacal and subcaudal scales cream without dark spots; dorsum of limbs have brown patches; manus and pes intermixed with black and cream white stripe arrangement.

Color of preserved specimens. Dorsally dark brown with pale colored, paravertebral spots much dark and with pale vertebral spot line; ventral surface completely dirty white, with some scales on thighs, tail base and arms with dark brown margins.

Etymology. The specific epithet is an eponym Latinized (*hitihami*) in the masculine genitive singular, honouring the Sri Lankan warrior 'Meegahapitiye Walauwe Hitihami Mudiyanse Rate Rala' (a long-range archer with precise aim) for his valiant feats in the Great Rebellion of 1817–1818, which was initiated in Uva-Wellassa.

Habitat and ecology. The Maragalakanda area (6.842525°–6.922392° N and 81.336822°–81.413719° E; altitude ranges from 354–750 m) is characterized as tropical dry mixed semi-evergreen forest (GUNATILEKE & GUNATILEKE, 1990) mixed with anthropogenic habitats and rubber plantations. It is approximately 4,100 ha in size, situated in the lowland intermediate bioclimatic zone of eastern Sri Lanka (Uva Province, Monaragala District). The mean annual rainfall varies between 1,500 and 2,500 mm, received mostly during the northeast monsoon season (November–February). The mean annual temperature of the area is 26.8–28.9°C. *Cnemaspis hitihami* **sp. nov.** appeared to be very common, at least at the type locality, as we recorded 21 (±0.2) geckos per man-hour after surveying a total area of 25 ha with 7 confirmed locations. This species was restricted to rock outcrops and granite caves in forested areas and inside active rubber plantations, and reached heights of up to 6 m on vertical surfaces (Fig. 15). These habitats were poorly illuminated (light intensity: 0–753 Lux), relatively moist (relative humidity: 68–84%), cool and wet (ambient temperature:

29.8–32.3°C, rock surface temperature: 25.8–27.5°C, canopy cover: 75–90%). The geckos were active during the day time (0800–1700 h) and when disturbed, sought refuge in the crevices of rocky caves or jump on to the forest floor and retreated under leaflitter. The new species was sympatric (at both local habitat and the microsite scales) with two other micro-endemics (*Calodactylodes illingworthorum* and *Hemidactylus hunae*) and generalist gecko species (*Cnemaspis kumarasinghei*, *C. podihuna*, *Gehyra mutilata*, *Hemidactylus depressus*, *H. frenatus*, *H. leschenaultii*, *H. parvimaculatus* and *H. triedrus*). Eggs were observed in granite rock crevices, typically laid communally in pairs. The eggs were pure white, almost spherical in shape (mean diameter 5.1 ± 0.02 mm; $n = 16$), with a slightly flattened side attached to the rocky substrate. This species was recorded from granite caves, rock outcrops in both undisturbed and anthropogenic habitats around Maragalakanda.

Conservation status. Application of the IUCN Red List criteria indicates that *C. hitihami* **sp. nov.** is Critically Endangered (CR) due to having an area of occupancy (AOO) < 10 km^2 (seven locations, 0.2 km^2 in total assuming a 100 m radius around the georeferenced locations) and an extent of occurrence (EOO) < 100 km^2 (2.3 km^2) in the lower elevations of Uva Province [Applicable criteria is B2-b (iii)].

Phylogenetic position. A member of *C. podihuna* Clade A; the new species belongs to species group AIII (Fig. 2), within which it is reconstructed as a sister species of the clade comprising *C. nilgala* (*p*-distance 12.4%) + undescribed candidate species *Cnemaspis* sp. 8 (*p*-distance 11.9%) (see Tab. 2).

Geographic distance. *Cnemaspis hitihami* **sp. nov.** most closely resembles *C. nilgala* and undescribed candidate species *Cnemaspis* sp. 8. The type localities of these species are separated by an straight line distance of ~25 km (Nilgala in Bibila) and 38 km (Rahathankanda in Buttala) from Maragala in Monaragala.

Cnemaspis butewai sp. nov.

ZooBank urn:lsid:zoobank.org:act:6E8FB8CC-6F2C-4E75-B312-B300FF29CE38

Butewes' day gecko (English)
Butewege diva-seri hoona (Singhala)

Figs. 16–18; Table 7.

Holotype. NMSL.2019.07.01, adult male, 31.7 mm SVL (Fig. 16), collected from a large granite cave in Bambarabotuwa, Opanayake, Ratnapura District, Sabaragamuwa Province, Sri Lanka (6.630364° N, 80.628925° E, WGS1984; elevation 445 m; around 12.00 hrs) on 26 November 2018 by Suranjan Karunarathna and Anslem de Silva.

Paratypes. NMSL.2019.07.02, adult female, 27.2 mm SVL, and NMSL.2019.07.03, Adult male, 31.8 mm SVL, collected from a large granite cave in Bambarabotuwa, Opanayake, Ratnapura District, Sabaragamuwa Province, Sri Lanka (6.646919° N, 80.653892° E, WGS1984; elevation 458 m; around 11.00 hrs) on 26 November 2018 by Suranjan Karunarathna and Anslem de Silva.

Diagnosis. *Cnemaspis butewai* **sp. nov.**, can be readily distinguished from its Sri Lankan congeners by a combination of the following morphological and meristic characteristics: maximum SVL 31.8 mm; dorsum with heterogeneous, smooth, granular scales; 1–2 internasals, 2/2 supranasals and 1–2 postnasal present; 37–39 interorbital scales; 15–17 supraciliaries, 10–11 canthal scales, 23–26 eye to tympanum scales; 3 enlarged postmentals; postmentals bounded by 5–6 chin scales; gular scales keeled, chin, pectoral and abdominal scales smooth, subimbricate; 23–25 belly scales across the venter; 5–6 weakly developed tubercles on posterior flank; 134–138 paravertebral granules linearly arranged; 3–5 precloacal pores, 5 femoral pores on each side in males separated by 9–10 unpored anterior femoral scales, 2–3 unpored posterior femoral scales; 125–128 ventral scales; 92–98 midbody scales; subcaudals smooth, median row comprising a regular series of small, diamond shaped scales; 8 supralabials; 7–8 infralabials; 16 total lamellae on fourth digit of manus, and 17–18 total lamellae on fourth digit of pes.

Comparisons with other species. Among species of the *C. kandiana* clade *sensu* Agarwal *et al*. (2017) *C. butewai* **sp. nov.** differs by having heterogeneous (*versus* homogeneous) dorsal scales from *C. amith*, *C. gotaimbarai* **sp. nov.**, *C. kumarasinghei*, *C. latha*, and *C. nandimithrai* **sp. nov.**; it can also be diagnosed from *C. ingerorum*, *C. pava*, *C. pulchra*, *C. samanalensis*, *C. silvula*, *C. tropidogaster* and *C. upendrai* by having smooth (*versus* keeled) pectoral and gular scales. The new species differs from *C. kandiana* and *C. retigalensis* in having more belly scales (23–25 *versus* 19–20 and 16–20, respectively), more femoral pores (5 *versus* 3–4 and 3–4), and in having more precloacal pores (3–5 *versus* 2–4 and 1, respectively). It differs from *C. menikay* in having more femoral pores (5 *versus* 3–4), and more precloacal pores (3–5 *versus* 1–2) and from *C. kallima* by having fewer tubercles on the posterior flank (5–6 *versus* 12–15), and keeled (*versus* smooth) gular scales.

The new species clearly differs from the species of the *C. podihuna* clade *sensu* Agarwal *et al*. (2017): from *C. alwisi*, *C. gemunu*, *C. godagedarai*, *C. hitihami* **sp. nov.**, *C. kohukumburai* **sp. nov.**, *C. nilgala*, *C. phillipsi*, *C. punctata*, *C. rajakarunai*, *C. rammalensis* and *C. scalpensis* by the presence (*versus* absence) of precloacal pores, and by the absence (*versus* presence) of clearly enlarged, hexagonal or subhexagonal subcaudal scales from *C. kandambyi*, *C. molligodai* and *C. podihuna* it differ by having heterogeneous (*versus* homogeneous) dorsal scales and by the absence of clearly enlarged, hexagonal or subhexagonal subcaudal scales.

Description of Holotype. An adult male, 31.7 mm SVL. Body slender, relatively short (TRL 34.1% of SVL).

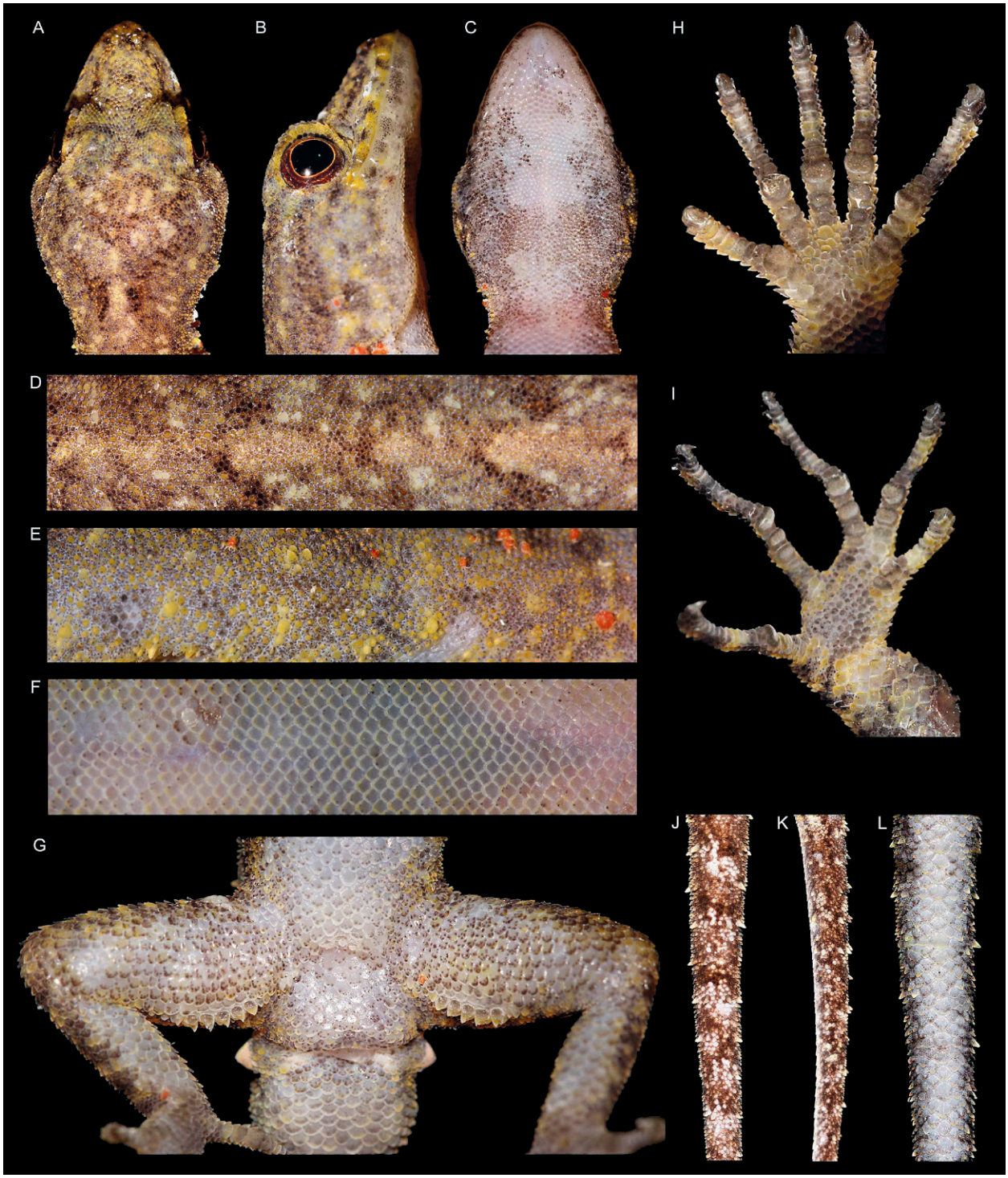

Fig. 16. Close-ups of *Cnemaspis butewai* **sp. nov.** male holotype (NMSL.2019.07.01) (A) dorsal head, (B) lateral head, (C) ventral head, (D) homogeneous dorsal scales, (E) scales on lateral surface of trunk, (F) smooth ventral scales, (G) cloacal characters with precloacal pores and femoral pores (H) subdigital lamellae on manus, (I) subdigital lamellae on pes, (J) dorsal scalation of tail, (K) lateral side of tail, and (L) oval shaped subcaudals (Photos: Suranjan Karunarathna).

Head relatively large (HL 29.0% of SVL, HL 84.9% of TRL), narrow (HW 16.6% of SVL, HW 57.3% of HL), depressed (HD 8.9% of SVL, HD 30.7% of HL) and distinct from neck. Snout relatively long (ES 71.2% of HW, ES 40.8% of HL), more than twice eye diameter (ED 49.9% of ES), more than half length of jaw (ES 60.2% of JL), snout slightly concave in lateral view; eye relatively small (ED 20.3% of HL), larger than the ear (EL 38.0% of ED), pupil rounded; orbit length greater than eye to ear distance (OD 111.4% of EE) and greater than to the length of IV digit of manus (OD 111.8% of DLM IV); supraocular ridges not prominent; ear opening very small (EL 7.7% of HL), deep, taller than wide, larger than nostrils; single row of scales separate orbit from suprala-

Table 7. Morphometric and Meristic data of holotype and two paratypes of *Cnemaspis butewai* **sp. nov.** from Bambarabotuwa, Ratnapura District, Sri Lanka (Abbreviations: L – left, R – right, M – male, F – female).

Measurements (mm)	NMSL 2019.07.01 Holotype (M)	NMSL 2019.07.02 Paratype (M)	NMSL 2019.07.03 Paratype (F)	Counts	NMSL 2019.07.01 Holotype (M)	NMSL 2019.07.02 Paratype (M)	NMSL 2019.07.03 Paratype (F)
ED	1.9	1.8	1.8	FLSP (L/R)	5/6	5/5	6/6
OD	3.2	3.3	3.3	SUP (L/R)	8/8	8/8	8/8
EN	2.7	2.8	2.7	INF (L/R)	8/8	7/8	8/7
ES	3.8	3.8	3.4	INOS	39	38	37
SN	1.6	1.7	1.6	PM	3	3	3
NW	0.2	0.2	0.2	CHS	5	5	6
EE	2.9	2.9	2.5	SUN (L/R)	2	2	2
SA	14.6	14.9	12.2	PON (L/R)	1	2	1
EL	0.7	0.7	0.8	INT	2	2	1
IO	3.6	3.7	3.8	SUS (L/R)	16/15	15/15	17/15
IE	3.8	3.9	4.0	BET (L/R)	24/26	25/24	23/25
HL	9.2	9.3	8.5	CAS (L/R)	10/10	11/10	10/10
HW	5.3	5.4	5.0	TLM (i) (L/R)	8/8	8/9	8/8
HD	2.8	2.9	2.4	TLM (ii) (L/R)	12/12	12/12	13/12
JL	6.2	6.3	6.0	TLM (iii) (L/R)	16/16	14/14	15/15
IN	1.6	1.7	1.6	TLM (iv) (L/R)	16/16	16/16	16/16
SED	8.7	8.7	8.5	TLM (v) (L/R)	14/14	14/15	14/14
UAL	5.9	5.9	5.5	PG	134	135	138
LAL	5.4	5.5	5.2	MBS	96	98	92
PAL	3.5	3.5	3.1	MVS	128	126	125
DLM (i)	1.4	1.5	1.4	BLS	23	25	23
DLM (ii)	1.8	1.8	1.7	TLP (i) (L/R)	9/9	8/8	8/8
DLM (iii)	2.4	2.3	2.4	TLP (ii) (L/R)	13/13	13/13	12/13
DLM (iv)	2.9	2.8	3.0	TLP (iii) (L/R)	15/16	15/15	15/15
DLM (v)	2.3	2.4	2.4	TLP (iv) (L/R)	18/18	18/17	18/18
SVL	31.7	31.8	27.2	TLP (v) (L/R)	17/17	17/17	17/17
TRL	10.8	10.9	9.8	PCP	3	5	—
TW	5.4	5.4	5.2	FP (L/R)	5/5	5/5	—
TD	3.4	3.4	3.1	AFS (L/R)	10/10	10/9	—
FEL	5.9	5.9	5.7	PFS (L/R)	2/2	3/3	—
TBL	5.6	5.7	5.3				
HEL	5.2	5.3	5.1				
DLP (i)	1.4	1.5	1.5				
DLP (ii)	3.1	3.2	3.2				
DLP (iii)	3.6	3.5	3.4				
DLP (iv)	4.1	4.1	4.2				
DLP (v)	3.9	3.8	3.9				
TAL	36.8	37.9	32.1				
TBW	3.7	3.9	3.4				
TBD	3.1	3.2	2.9				

bials; interorbital distance less narrow than snout length (IO 96.5% of ES), shoter than head length (IO 39.3% of HL); eye to nostril distance little less than eye to ear distance (EN 93.8% of EE).

Dorsal surface of the trunk with heterogeneous trihedral granules; 134 paravertebral granules; 128 smooth midventral scales; 96 midbody scales; 5/6 weakly developed tubercles on the flanks; ventrolateral scales not enlarged; granules on snout very smooth, larger than those on interorbital and occipital regions; canthus rostralis not pronounced, 10/10 smoothly oval scales from eye to nostril; scales of the interorbital region oval and smooth; blunt tubercles on the sides of neck, but absent around ear; ear opening vertically oval, slanting from anterodorsal to posteroventral, 24/26 scales between anterior margin of ear opening and posterior margin of the eye. Supralabials 8/8, infralabials 8/8, becoming smaller towards the gape. Rostral scale wider than long, partially divided (80%) by a median groove, in contact with first supralabial. Nostrils separated by 2/2 enlarged suprana-

sals with 2 internasals and 1/1 postnasal; no enlarged scales behind the supranasals. Nostrils oval, dorsolaterally orientated; not in contact with first supralabials.

Mental subtriangular, as wide as long, posteriorly in contact with three enlarged postmentals (smaller than mental, and lager than chin scales); postmentals not in contact and bordered posteriorly by 5 unkeeled chin scales (smaller than nostrils), in contact with only 1st infralabials; ventral scales smaller than chin scales. Chin scales smooth, rounded, juxtaposed; gular scales keeled; pectoral and abdominal scales smooth, subimbricate to imbricate towards precloacal region, abdominal scales slightly larger than dorsals; 23 belly scales across venter; scales around vent and base of tail smooth, subimbricate; 3 precloacal pores; 5/5 femoral pores; 10/10 unpored anterior femoral scales; 2/2 enlarged posterior femoral scales. Regenerated tail of holotype longer than the snout-vent length (TAL 116.0% of SVL); hemipenial bulge greatly swollen (TBW 3.7 mm). Heterogeneous scales on dorsum of tail directed backwards, spine-like tubercles present at base of tail; tail with 4–5 small flattened obtuse scales forming whorls; a large blunt post-cloacal spur on each side, dorso-ventrally flattened and narrow; subcaudals smooth, diamond-shaped, tiny, arranged in an irregular median series.

Forelimbs moderately short, slender (LAL 17.1% of SVL, UAL 18.5% of SVL); hind limbs long, tibia quite shorter than the femur (TBL 17.8% of SVL, FEL 18.6% of SVL). Anterior and posterior surfaces of upper arm with keeled and less imbricate scales, scales of anterior surface twice as large as those of the other parts; Anterior, dorsal and posterior surfaces of lower arm with keeled and less imbricate scales, ventral surface with smooth, imbricate scales. Scales on dorsal surface of femur smooth and granular, less imbricate, keeled scales on the anterior and posterior surfaces, scales on the anterior and ventral surfaces twice the size of those on the other aspects of limb. Dorsal, anterior and posterior surfaces of tibia with keeled and less imbricate scales, ventral surface with smooth, subimbricate scales, scales of the ventral surface twice as large as those of other parts. Manus and pes with keeled granules dorsally and ventrally; dorsal surfaces of digits with granular scales. Digits elongate and slender with inflected distal phalanges joint, all bearing slightly recurved claws. Subdigital lamellae entire (except divided at first interphalangial joint), unnotched; total lamellae on manus (left/right): digit I, 8/8, digit II, 12/12, digit III, 16/16, digit IV, 16/16, digit V, 14/14; total lamellae on pes (left/right): digit I, 9/9, digit II, 13/13, digit III, 15/16, digit IV, 18/18, digit V, 17/17; interdigital webbing absent; length of digits of manus (left): I (1.4 mm), II (1.8 mm), V (2.3 mm), III (2.4 mm), IV (2.9 mm); length of digits of pes (left): I (1.4 mm), II (3.1 mm), III (3.6 mm), V (3.9 mm), IV (4.1 mm).

Variation of the type series. The SVL of adult specimens in the type series ($n=3$) ranges from 27.2 to 31.8 mm; infralabials 7–8; interorbital scales 37–39; chin scales 5–6; postnasals 1–2, internasals 1–2; canthal scales 10–11; supraciliaries above the eye 15–17; scales from eye to tympanum 23–26; tubercles on posterior flank 5–6; total lamellae on digit I of the manus 8–9, lamellae on digit II of manus 12–13, lamellae on digit III of manus 14–16, lamellae on digit V of manus 14–15; total lamellae on digit I of pes 8–9, lamellae on digit II of pes 12–13, lamellae on digit III of pes 15–16, lamellae on digit IV of pes 17–18; precloacal pores in males 3–5, unpored anterior femorals in males 9–10, unpored posterior femoral scales in males 2–3; ventral scales 125–128, paravertebral granules 134–138, midbody scales 92–98, and belly scales across venter 23–25.

Color of living specimens. Dorsum of head, body and limbs varies from light brown to golden yellow, 5–6 faded irregular 'W'-shaped, dark cross bands on the trunk; an oblique black line between the eye and the nostrils on either side, 2 straight, faded brown postorbital stripes extend from eyes posteroventrally, and a dark line is present in the occipital area (Fig. 17); tail grey-white dorsally, with 10–12 faded brown cross-bands; pupil is circular and black with the surrounding orange and white margins, with supraciliaries scales being yellowish; supralabials yellowish, infralabaials greyish dusted with black; snout yellowish; mid-gular scales cream with dark spots; pectoral, abdominal, cloacal and subcaudal scales white, without spotting; dorsumof limbs with brown patches; manus and pes with black and cream white stripe arrangement.

Color of preserved specimens. Dark brown dorsum with pale colored, 'W'-shaped irregular pale bands distinct; ventral surface dirty white with some scales on throat, thigh, tail base and arms with dark brown margins.

Etymology. The specific epithet is an eponym Latinized (*butewai*) in the masculine genitive singular, honouring the Sri Lankan warrior 'Butewe Rate Rala' for his valiant feats in the Great Rebellion of 1817–1818, which was initiated in Uva-Wellassa.

Habitat and ecology. Bambarabotuwa Forest Reserve (6.623506°–6.674431° N and 80.588214°–80.643431° E; altitude range from 380–850 m) is a *Dipterocarpus*-dominated (Mahogany mixed) tropical wet-evergreen rainforest (GUNATILEKE & GUNATILEKE, 1990), approximately 3,500 ha in size, situated in the wet zone of south-central Sri Lanka (Sabaragamuwa Province, Ratnapura District). The mean annual rainfall varies between 3,000–4,000 mm, received mainly during the southwest monsoon (May–September). The mean annual temperature of the area is 28.5–30.7°C ºC. Many granite caves and rock ledges are found at this locality (Fig. 18). *Cnemaspis butewai* **sp. nov.** is very common, at least at this locality with 6 confirmed locations. We found 24 (±0.2) geckos per man-hour after surveying a total area of 45 ha. This species was restricted to rock outcrops and granite caves in forested areas, and reached heights of 10–15 m on vertical surfaces. These micro-

Fig. 17. *Cnemaspis butewai* **sp. nov.** male paratype (NMSL.2019.07.02) in life in-situ (A) dorsolateral aspect showing irregular colors on labials and trunk, and (B) dorsal view of the full body depicting color pattern (Photos: Majintha Madawala).

habitats were poorly illuminated (light intensity: 0–578 Lux), relatively moist (relative humidity: 73–92%), cool and wetty (ambient temperature: 29.7–30.4°C, rock surface temperature: 25.2–27.9°C, canopy cover: 70–90%). The geckos were active during the day time (900–1600 h) and, when disturbed, sought refuge in the crevices of the rocky caves and ledges. The new species was sympatric (at both local habitat and the microsite scale) with several other geckos (*Cyrtodactylus* sp., *Gehyra mutilata*, *Hemidactylus depressus*, *H. frenatus*, *H. parvimaculatus*). Eggs were observed in granite crevices, typically laid in pairs. The eggs were pure white and almost spherical in shape (mean diameter 4.7 ±0.01 mm (n=19)), with a slightly flattened side attached to the rocky substrate.

Conservation status. Application of the IUCN Red List criteria indicates that *C. butewai* **sp. nov.** is Critically Endangered (CR) due to having an area of occupancy (AOO) <10km^2 (six locations, 0.2 km^2 in total assuming a 100 m radius around the georeferenced location) and an extent of occurrence (EOO) <100 km^2 (3.8 km^2) at the lower elevations of Sabaragamuwa Province [Applicable criteria is B2-b (iii)].

Phylogenetic position. A member of *C. kandiana* Clade B; the new species belongs to *C. pulchra* species group (BV) (Fig. 2), within which it is most closely related to *C. pulchra* (*p*-distance 4.6%) and the undescribed candidate species *Cnemaspis* sp. 3 (*p*-distance 4.9%) (see Tab. 2).

Gegraphic distance. *Cnemaspis butewai* **sp. nov.** most closely resembles *C. kandiana* and *C. menikay* morphologically. The type localities of these species are separated by ~ 70 km (Kandy area) and ~ 85 km (Allauwa in Kegalle) straight line distance from Bambarabotuwa in Opanaka.

Fig. 18. General habitat of *Cnemaspis butewai* **sp. nov.** at Bambarabotuwa isolated forest hill, Ratnapura District, Sri Lanka (A) complete view of the wet forest, (B) thick, cool and shady forest, (C) moss covered granite cave wall microhabitat (Photos: Majintha Madawala).

Cnemaspis kivulegedarai sp. nov.

ZooBank urn:lsid:zoobank.org:act:EE63DFF2-250D-47E4-ACE7-DFE5EDD93E02

Kivulegedaras' day gecko (English)
Kivulegedarage diva-seri hoona (Singhala)

Figs. 19–21; Table 8.

Holotype. NMSL.2019.08.01, adult male, 28.5 mm SVL (Fig. 19), collected from a large granite wall in Keerthibandarapura, Walapane, Nuwara Eliya District, Central Province, Sri Lanka (7.127933° N, 80.867364° E, WGS 1984; elevation 539 m; around 14.00 hrs) on 17 June 2018 by Suranjan Karunarathna and Anslem de Silva.

Paratypes. NMSL.2019.08.02, adult female, 31.2 mm SVL, and NMSL.2019.08.03, adult female, 29.8 mm SVL, collected from a large granite wall in Keerthibandarapura, Walapane, Nuwara Eliya District, Central Province, Sri Lanka (7.140061° N, 80.872467° E, WGS 1984; elevation 562 m; around 15.00 hrs) on 17 June 2018 by Suranjan Karunarathna and Anslem de Silva.

Diagnosis. *Cnemaspis kivulegedarai* **sp. nov.**, can be readily distinguished from its Sri Lankan congeners by a combination of the following morphological and meristic characteristics: maximum SVL 31.2 mm; dorsum with heterogeneous, smooth, granular scales; 1 internasal, 2/2 supranasals and 1/1 postnasal present; 30–34 interorbital scales; 15–17 supraciliaries, 12 canthal scales, 17–21 eye to tympanum scales; 3 enlarged postmentals; postmentals bounded by 5 chin scales; chin with smooth granules; gular, pectoral and abdominal scales smooth, subimbricate; 19 belly scales across the venter; 4–5 weakly developed tubercles on posterior flank; 131–133 paravertebral granules linearly arranged; 2 precloacal pores, 4–5 femoral pores on each side in males separated by 9–10 unpored anterior femoral scales, 2 unpored posterior femoral scales; 109–114 ventral scales; 69–76 midbody scales; subcaudals smooth, diamond shaped, in irregular series forming a narrow median row; 7 supralabials; 6–7 infralabials; 14 total lamellae on fourth digit of manus, and 15 total lamellae on fourth digit of pes.

Comparisons with other species. Among species of the *C. kandiana* clade *sensu* AGARWAL *et al.* (2017) *C. kivulegedarai* **sp. nov.** differs from *C. amith*, *C. gotaimbarai* **sp. nov.**, *C. kumarasinghei*, *C. latha* and *C. nandimithrai* **sp. nov.** by having heterogeneous (*versus* homogeneous) dorsal scales. It also diagnosed from *C. pava*, *C. pulchra*, *C. samanalensis*, *C. silvula*, *C. tropidogaster* and *C. upendrai* by having smooth (*versus* keeled) pectoral and ventral scales, from *C. butewai* **sp. nov.**, *C. kandi-*

Fig. 19. Close-ups of *Cnemaspis kivulegedarai* **sp. nov.** male holotype (NMSL.2019.08.01) (A) dorsal head, (B) lateral head, (C) ventral head, (D) homogeneous dorsal scales, (E) scales on lateral surface of trunk, (F) smooth ventral scales, (G) cloacal characters with precloacal pores and femoral pores (H) subdigital lamellae on manus, (I) subdigital lamellae on pes, (J) dorsal scalation of tail, (K) lateral side of tail, and (L) oval shaped subcaudals (Photos: Suranjan Karunarathna).

ana, *C. menikay* and *C. retigalensis* by having smooth (*versus* keeled) chin and gular scales; from *C. kallima* by having fewer ventral scales (109–114 *versus* 131–138), and fewer total lamellae on digit IV of pes (15 *versus* 18–20); and from *C. ingerorum* by having more ventral scales (109–114 *versus* 88–95), and fewer total lamellae on digit IV of pes (15 *versus* 17–18).

The new species, *C. kivulegedarai* **sp. nov.** also clearly differs from the species of the *C. podihuna* clade *sensu* Agarwal *et al*. (2017). From *C. alwisi*, *C. gemunu*, *C. godagedarai*, *C. hitihami* **sp. nov.**, *C. kohukumburai* **sp. nov.**, *C. nilgala*, *C. phillipsi*, *C. punctata*, *C. rajakarunai*, *C. rammalensis*, and *C. scalpensis* it differs by the presence (*versus* absence) of precloacal pores

and also by the absence of clearly enlarged, hexagonal or subhexagonal subcaudal scales. From *C. kandambyi*, *C. molligodai* and *C. podihuna* it differs by having heterogeneous (*versus* homogeneous) dorsal scales and by the absence of clearly enlarged, hexagonal or subhexagonal-shaped subcaudal scales.

Description of Holotype. An adult male, 28.5 mm SVL. Body slender, relatively short (TRL 36.8% of SVL). Head relatively large (HL 32.0% of SVL, HL 86.8% of TRL), narrow (HW 17.3% of SVL, HW 54.2% of HL), depressed (HD 8.9% of SVL, HD 27.7% of HL) and distinct from neck. Snout relatively long (ES 75.7% of HW, ES 41.0% of HL), more than twice length of eye diameter (ED 49.1% of ES), more than half length of jaw (ES 65.2% of JL), snout slightly concave in lateral view; eye relatively small (ED 20.1% of HL), twice as large as the ear (EL 48.1% of ED), pupil rounded; orbit length greater than eye to ear distance (OD 133.2% of EE) and also greater than to the length of IV digit of manus (OD 101.9% of DLM IV); supraocular ridges not prominent; ear opening very small (EL 9.7% of HL), deep, taller than wide, larger than nostrils; single row of scales separate orbit from supralabials; interorbital distance equal to snout length (IO 100.3% of ES), head length twise a long than interorbital distance (IO 41.1% of HL); eye to nostril distance little greater than eye to ear distance (EN 105.4% of EE).

Dorsal surface of the trunk mixed with conical heterogeneous granules, 131 paravertebral granules; 109 smooth midventral scales; 69 midbody scales; 4/5 weakly developed tubercles on the flanks; ventrolateral scales not enlarged; granules on snout strongly keeled, larger than those on interorbital and occipital regions; canthus rostralis not pronounced, 12/12 smoothly rounded scales from eye to nostril; scales of interorbital region oval and smooth; tubercles present on the sides of the neck, and absent around the ear; ear opening vertically oval, slanting from anterodorsal to posteroventral, 17/18 scales between anterior margin of the ear opening and the posterior margin of the eye. Supralabials 7/7, infralabials 6/6, becoming smaller towards the gape. Rostral scale wider than long, partially divided (75%) by a median groove, in contact with first supralabial. Nostrils separated by 2/2 enlarged supranasals with 1 internasal and 1/1 postnasal; no enlarged scales behind the supranasals. Nostrils oval, dorsolaterally orientated, not in contact with first supralabials.

Mental subtriangular, as wide as long, posteriorly in contact with 3 enlarged postmentals (smaller than mental, and lager than chin scales); postmentals in contact and bordered posteriorly by 5 smooth chin scales (smaller than nostrils), in contact only with 1st infralabials; ventral scales smaller than chin scales. Smooth, rounded, juxtaposed scales on the chin and gular region; pectoral and abdominal scales smooth, subimbricate to imbricate towards precloacal region, abdominal scales slightly larger than dorsals; 19 belly scales across venter; scales around vent and base of tail smooth, subimbricate; 2 precloacal pores; 4/5 femoral pores; 10/9 unpored anterior femoral scales; 2/2 enlarged posterior femoral scales. Regenerated tail of holotype longer than the snout-vent length (TAL 135.5% of SVL); hemipenial bulge greatly swollen (TBW 2.8 mm), heterogeneous scales on tail dorsum directed backwards, spine-like tubercles present at the base of tail; tail with 4–5 enlarged flattened obtuse scales forming whorls; a large post-cloacal spur on each side, dorsoventrally flattened and narrow; median subcaudals smooth, irregular and oval.

Forelimbs moderately short, slender (LAL 15% of SVL, UAL 16.6% of SVL); hind limbs long, tibia quite shorter than the femur (TBL 19.6% of SVL, FEL 19.7% of SVL). Anterior and posterior surfaces of upper arm with keeled and less imbricate scales, scales of the anterior surface twice as large as those of the other parts, scales of dorsal and ventral surfaces smooth. Dorsal, anterior and posterior surfaces of lower arm with keeled and less imbricate scales, ventral surface with smooth, imbricate scales. Scales on dorsal and posterior surfaces of the femur smooth and granular, anterior surface with keeled and subimbricate scales; scales of ventral surface smooth and less imbricate. Dorsal, anterior and posterior surfaces of tibia with keeled subimbricate scales, and ventral scales smooth, subimbricate; scales of ventral surface twice as large as those on other aspects. Dorsal and ventral scales ofmanus and pes with keeled granules; dorsal surfaces of digits with granular scales. Digits elongate and slender with inflected distal phalanges joint, all bearing slightly recurved claws. Subdigital lamellae entire (except divided at first interphalangial joint), unnotched; total lamellae on manus (left/right): digit I, 8/9, digit II, 11/11, digit III, 13/13, digit IV, 14/14, digit V, 11/11; total lamellae on pes (left/right): digit I, 8/9, digit II, 11/11, digit III, 13/13, digit IV, 15/15, digit V, 12/12; interdigital webbing absent; length of digits of manus (left): I (1.7 mm), II (1.8 mm), V (2.6 mm), III (2.7 mm), IV (3.2 mm); length of digits of pes (left): I (1.6 mm), II (3.2 mm), III (3.7 mm), V (3.9 mm), IV (4.1).

Variation of the type series. The SVL of adult specimens in the type series ($n=3$) ranges from 28.5 to 31.2 mm; interorbital scales 30–34; supraciliaries above the eye 15–17; scales from eye to tympanum 17–21; total lamellae on digit I of the manus 8–9, lamellae on digit III of manus 12–13; total lamellae on digit I of pes 8–9, lamellae on digit II of pes 10–11, lamellae on digit III of pes 13–14, lamellae on digit V of pes 11–12; paravertebral granules 131–133, ventral scales 109–114, midbody scales 69–76; femoral pores in males 4–5, and unpored anterior femoral scales in males 4–5.

Color of living specimens. Dorsum of head, body and limbs generally orange-brown; marked with 5 faded, irregular brown cross-markings on the body dorsum and 7–8 cream vertebral blotches; an oblique black line is present between the eye and the nostrils on either side, two straight, dark brown postorbital stripes extend from eyes posteroventrally (Fig. 20). Tail grey-brown on dorsum, with 9–11 irregular 'W'-shaped faded brown

Fig. 20. *Cnemaspis kivulegedarai* **sp. nov.** male holotype (NMSL.2019.08.01) in life *in-situ* (A) dorsolateral view of the full body, and (B) dorsal view depicting the pale vertebral line (Photos: Majintha Madawala).

cross-bands present; pupil circular and black with the surrounding ring is gold and orange, with supraciliary scales light brownish; supralabials yellowish dusted with black; infralabaials greyish dusted with black; mid-gular scales greyish white dusted with black; pectoral, abdominal, cloacal and subcaudal scales white without tiny dark spots; dorsum of limbs with irregular brown patches and lines; dorsum of manus and pes with black and cream white stripes alternating.

Color of preserved specimens. Dorsum dark brown with grey, with indistinct irregular brown markings; vertebral blotches dirty white; venterdirty white with some gular, abdominal, thigh, tail base and forelimb scales with dark brown margins.

Etymology. The specific epithet is an eponym Latinized (*kivulegedarai*) in the masculine genitive singular, honouring ‘‘Kivulegedara Mohottala’ (a warrior) for his valiant feats in the Great Rebellion of 1817–1818, which was initiated in Uva-Wellassa.

Habitat and ecology. The Keerthibandarapura area (7.138467°–7.156942° N and 80.856094°–80.880067° E; altitude range from 500–750m) is characterized as a tropical wet-evergreen forest interspaced with savannah (Gunatileke & Gunatileke, 1990), approximately 900 ha in size, located in the submontane intermediate zone of central Sri Lanka (Central Province, Nuwara Eliya District). The mean annual rainfall is 3,000–4,000 mm, received mainly during the southwest monsoon (May–September) season. The mean annual temperature of the area is 22.6–25.2 ºC. *Cnemaspis kivulegedarai* **sp. nov.** was very commonat this locality, as we found 31 (±0.3) geckos per man-hour while surveying a total surveyed area of 60 ha with 4 confirmed locations.

Table 8. Morphometric and Meristic data of holotype and two paratypes of *Cnemaspis kivulegedarai* **sp. nov.** from Walapane, Nuwara Eliya District, Sri Lanka (Abbreviations: L – left, R – right, M – male, F – female).

Measurements (mm)	NMSL 2019.08.01 Holotype (M)	NMSL 2019.08.02 Paratype (F)	NMSL 2019.08.03 Paratype (F)	Counts	NMSL 2019.08.01 Holotype (M)	NMSL 2019.08.02 Paratype (F)	NMSL 2019.08.03 Paratype (F)
ED	1.8	1.8	1.7	FLSP (L/R)	4/5	4/4	5/5
OD	3.2	3.1	3.1	SUP (L/R)	7/7	7/7	7/7
EN	2.5	2.6	2.6	INF (L/R)	6/6	6/7	6/6
ES	3.7	3.8	3.9	INOS	32	30	34
SN	1.3	1.4	1.4	PM	3	3	3
NW	0.2	0.1	0.2	CHS	5	5	5
EE	2.4	2.5	2.5	SUN (L/R)	2	2	2
SA	14.1	14.2	14.3	PON (L/R)	1	1	1
EL	0.9	0.8	0.6	INT	1	1	1
IO	3.7	3.7	3.7	SUS (L/R)	16/17	16/16	15/16
IE	3.9	3.9	3.9	BET (L/R)	18/17	19/21	18/17
HL	9.1	8.9	9.0	CAS (L/R)	12/12	12/12	12/12
HW	4.9	4.2	4.6	TLM (i) (L/R)	8/9	9/9	9/9
HD	2.5	2.6	2.6	TLM (ii) (L/R)	11/11	11/11	11/11
JL	5.7	5.7	5.5	TLM (iii) (L/R)	13/13	12/13	13/13
IN	1.7	1.5	1.6	TLM (iv) (L/R)	14/14	14/14	14/14
SED	8.3	8.1	8.2	TLM (v) (L/R)	11/11	11/11	11/11
UAL	4.7	4.6	4.6	PG	131	133	132
LAL	4.3	4.1	4.2	MBS	69	76	71
PAL	3.1	3.2	3.2	MVS	109	114	111
DLM (i)	1.7	1.5	1.6	BLS	19	19	19
DLM (ii)	1.8	1.9	1.9	TLP (i) (L/R)	8/9	8/8	9/9
DLM (iii)	2.7	2.7	2.9	TLP (ii) (L/R)	11/11	11/11	11/10
DLM (iv)	3.2	3.1	3.2	TLP (iii) (L/R)	13/13	14/14	13/13
DLM (v)	2.6	2.5	2.5	TLP (iv) (L/R)	15/15	15/15	15/15
SVL	28.5	31.2	29.8	TLP (v) (L/R)	12/12	11/12	12/12
TRL	10.5	10.5	10.6	PCP	2	—	—
TW	5.7	5.9	5.9	FP (L/R)	4/5	—	—
TD	3.6	3.5	3.6	AFS (L/R)	10/9	—	—
FEL	5.6	5.4	5.5	PFS (L/R)	2/2	—	—
TBL	5.6	5.4	5.5				
HEL	4.0	3.8	3.8				
DLP (i)	1.6	1.5	1.6				
DLP (ii)	3.2	3.3	3.2				
DLP (iii)	3.7	3.7	3.6				
DLP (iv)	4.1	4.2	4.2				
DLP (v)	3.9	3.9	3.7				
TAL	38.6	38.6	39.0				
TBW	2.8	2.6	2.7				
TBD	2.4	2.1	2.2				

This species was restricted to rock outcrops and granite caves in forested areas, and was found at heights of 6 m along vertical surfaces (Fig. 21). These habitats were poorly illuminated (0–471 Lux), relatively moist (relative humidity: 76–89%), and cool (ambient temperature: 28.9–30.1°C, rock surface temperature: 25.8–27.4°C, canopy cover: 65–80%). The geckos were diurnally active (0800–1700 h) and, when disturbed, sought refuge in the crevices of rocky caves. The new species was sympatric (at both local habitat and microsite scales) with several other geckos (*Gehyra mutilata*, *Hemidactylus depressus*, *H. frenatus*, *H. parvimaculatus*). Eggs were observed on eadge of granite rock walls, typically laid in pairs (rarely trias) in communal nests. The eggs were pure white and almost spherical in shape (mean diameter 4.7±0.02 mm; $n=12$), with a slightly flattened side attached to the rocky substrate.

Fig. 21. General habitat of *Cnemaspis kivulegedarai* **sp. nov.** at Walapane isolated forest hill, Nuwara Eliya District, Sri Lanka (A) complete view of the water shed area in the mountain, (B) rock outcrop area in the type locality, (C) communal egg depositional site (Photos: Majintha Madawala).

Conservation status. Application of the IUCN Red List criteria indicates that *C. kivulegedarai* **sp. nov.** is Critically Endangered (CR) due to having an area of occupancy (AOO) < 10 km^2 (four locations, 0.1 km^2 in total assuming a 100 m radius around the georeferenced location) and an extent of occurrence (EOO) < 100 km^2 (2.3 km^2) in the mid-elevations of Central Province [Applicable criteria is B2-b (iii)].

Phylogenetic position. A member of *C. kandiana* Clade B; the new species belongs to the *C. latha* species group (BIV) (Fig. 2), within which it is reconstructed as a sister species of *C. latha* (*p*-distance 5.1%) (see Tab. 2).

Geographic distance. *Cnemaspis kivulegedarai* **sp. nov.** most closely resembles *C. latha*, the type locality of which is ~32 km (Bandarawela in Badulla District) straight line distance from Keerthibandarapura in Walapane.

Discussion

Sri Lanka is recognized as one of the global hotspots for herpetofaunal diversity as well as a local center for endemism (Bossuyt *et al*., 2004; Meegaskumbura *et al*., 2002). The addition of six more endemic gecko species to Sri Lankan reptile checklist underpines that the island is a centre of reptilian diversity and endemism (Amarasinghe *et al*., 2014, 2015; Batuwita, 2016; Batuwita & Udugampala, 2017; Batuwita *et al*., 2019; de Silva *et al*., 2019; Karunarathna *et al*., 2019; Wickramasinghe, 2016; Wickramasinghe *et al*., 2017). *Cnemaspis* now comprises 32 species in Sri Lanka, bringing the total number of geckos recorded in the country to 54. Among Sri Lankan gekkonids, 44 (81%) species are endemic to the island, most of which are restricted to the wet zone (>2,000 mm of annual average precipitation). Of them, 20 (37%) are Critically Endangered, 9 (16%) are Endagered, 5 (9%) are Vulnerable and 4 (7%) are Data Deficient. However, as our study demonstrated, Sri Lanka's *Cnemaspis* diversity is not limited to the south-western lowlands or to the central massif, but is scattered throughout multiple bio-climatic regions and floristic

Table 9. Key characters of currently known 32 *Cnemaspis* species in Sri Lanka (Abbreviations: MM – Millimeters, SVL – Maximum Snout to vent length, SUB – Subcaudals, SUP – Supralabials, INF – Infralabials, PG – Paravertebral, IFS – Interfemoral scales, FLSP – Flank spines, PCP – Precloacal pores, FP – Femoral pores, HET – Heterogeneous, HOM – Homogeneous, KD – Keeled, SM – Smooth).

Species	SVL (mm)	Dorsal	Gular	Pectoral	Abdomen	SUB	SUP	INF	Ventrals	Belly	Midbody	PG	IFS	FLSP	PCP	FP	Lamellae 4th finger	Lamellae 4th toe
Cnemaspis kandiana clade																		
Group (1)																		
C. pava	32.4	HET	KD	KD	KD	Small	7–8	6–7	139–145	22–25	64–75	83–98	–	9–11	2–4	4–5	16–17	18–19
C. pulchra	34.2	HET	KD	KD	KD	Small	7–8	7–8	120–135	24–27	67–73	94–103	–	5–7	3–4	4–6	15–17	17–20
C. samanalensis	37.5	HET	KD	KD	KD	Small	8–10	8–9	128–144	19–20	61–67	64–72	–	5–6	3–4	3–5	16–17	18–20
C. silvula	28.6	HET	KD	KD	KD	Small	7–8	7–8	132–139	19–21	73–81	102–113	–	10–15	3–4	4–5	15–16	18–19
C. tropidogaster	31.7	HET	KD	KD	KD	Small	7–8	7–8	132–146	21–25	92–98	99–106	–	5–7	3–4	4–5	16–17	18–19
C. upendrai	35.2	HET	KD	KD	KD	Small	7–8	7–8	112–128	16–25	69–74	97–102	–	13–15	2–3	4–5	17–18	17–21
Group (2)																		
C. ingerorum	26.9	HET	SM	SM	SM	Small	7	7	88–95	17–21	62–69	93–101	–	7–9	2	5	13–16	17–18
C. kivulegedarai **sp. nov.**	31.2	HET	SM	SM	SM	Small	7	6–7	**109–114**	19	69–76	**131–133**	–	4–5	2	4–5	14	**15**
C. kallima	35.1	HET	SM	SM	SM	Small	7–8	7–8	131–138	19–23	67–74	99–107	–	12–15	3–4	4–5	16–18	18–20
C. butewai **sp. nov.**	31.8	HET	KD	SM	SM	Small	8	7–8	**125–128**	**23–25**	**92–98**	**134–138**	–	5–6	3–5	5	16	17–18
C. kandiana	34.6	HET	KD	SM	SM	Small	8–9	7–8	119–138	19–20	68–75	86–99	–	5–7	2–4	3–4	12–14	18–20
C. menikay	28.0	HET	KD	SM	SM	Small	7–9	7–8	124–138	20–26	71–79	83–98	–	13–15	1–2	3–4	14–15	15–17
C. retigalensis	30.8	HET	KD	SM	SM	Small	7–8	7–8	121–128	16–20	69–77	82–86	–	4–5	1	3–4	14–15	16–20
Group (3)																		
C. amith	33.0	HOM	KD	SM	SM	Small	7–8	7	123–131	19–21	67–74	79–84	–	4–5	3	3	16–17	18–19
Group (4)																		
C. gotaimbarai **sp. nov.**	33.7	HOM	SM	SM	SM	Small	7–8	8–9	129–138	**23–25**	72–79	**117–121**	–	5–6	2–4	3	16–17	19–20
C. kumarasinghei	31.6	HOM	SM	SM	SM	Small	7–8	7–8	120–134	17–21	87–94	61–68	–	7–9	2–3	3–5	15–16	16–18
C. latha	30.4	HOM	SM	SM	SM	Small	7–8	7–8	109–115	13–15	69–73	72–79	–	5–7	2–3	4–5	15–17	17–18
C. nandimithrai **sp. nov.**	31.7	HOM	SM	SM	SM	Small	5–6	6	108–112	**25–27**	87–89	**95–99**	–	3–4	2–4	2–4	**12–13**	19–20
Cnemaspis podihuna clade																		
Group (1)																		
C. alwisi	40.4	HOM	SM	SM	SM	Enlarged	8–10	7–9	145–153	27–31	71–78	89–97	18–19	4–5	–	7–9	15–17	17–21
C. godagedarai	35.5	HOM	SM	SM	SM	Enlarged	7–8	7–8	133–137	21–23	98–102	101–106	8	5–6	–	12–13	17–18	20–21
C. gemunu	34.0	HOM	SM	SM	SM	Enlarged	8–10	7–8	112–118	13–16	74–87	79–93	10–12	7–8	–	11–14	15–17	18–19
C. hitihami **sp. nov.**	41.7	HOM	SM	SM	SM	Enlarged	8–9	7–9	132–135	**21**	**96–99**	**143–149**	**24–26**	4–5	–	5–10	18–19	21–22
C. kohukumburai **sp. nov.**	34.5	HOM	SM	SM	SM	Enlarged	8–9	7–8	131–134	23	81–88	**150–159**	**25**	7–8	–	6–9	21–22	**23–25**
C. nilgala	32.9	HOM	SM	SM	SM	Enlarged	7–8	6–7	122–129	17–19	71–78	179–187	14–15	3–4	–	7–9	17	17–18

Table 9 continued.

Species	SVL (mm)	Dorsal	Gular	Pectoral	Abdomen	SUB	SUP	INF	Ventrals	Belly	Midbody	PG	IFS	FLSP	PCP	FP	Lamellae 4th finger	Lamellae 4th toe
C. phillipsi	36.6	HOM	SM	SM	SM	Enlarged	8–9	8–9	128–143	18–25	76–91	86–93	11–14	4–6	–	15–16	16–19	17–19
C. punctata	39.9	HOM	SM	SM	SM	Enlarged	7–10	7–9	129–137	20–29	71–78	83–91	25–27	11–13	–	5–7	17–18	17–23
C. rajakarunai	40.2	HOM	SM	SM	SM	Enlarged	8–9	9–11	146–186	26–29	69–74	81–85	20–22	5–6	–	7–8	16–20	19–22
C. rammalensis	53.8	HOM	SM	SM	SM	Enlarged	8–10	8–9	186–207	25–28	119–131	94–96	19–24	4–5	–	14–16	22–23	22–23
C. scalpensis	36.6	HOM	SM	SM	SM	Enlarged	7–9	7–8	120–131	17–19	81–89	102–112	8–12	9–11	–	13–15	17–18	19–21
Group (2)																		
C. kandambyi	23.6	HOM	SM	SM	SM	Enlarged	7–8	7–8	128–137	16–17	71–77	85–92	–	4–5	3–4	5–6	11–14	19–20
C. molligodai	29.0	HOM	SM	SM	SM	Enlarged	8–10	7–8	127–135	15–19	73–82	76–83	–	5–7	4–5	8–9	15–18	19–23
C. podihuna	24.7	HOM	SM	SM	SM	Enlarged	7–9	6–8	111–118	15–19	79–83	102–106	–	4–6	3–4	3–6	14–15	18–19

regions, which suggests intricate biogeographic patterns possibly due to multiple colonizations from the Indian mainland rather than a singular event of insular radiation (Agarwal *et al*., 2017).

Since the early 2000s, there has been a surge of taxonomic research on the faunal diversity of Sri Lanka, mostly targeting vertebrates (Batuwita & Pethiyagoda, 2007; Bossuyt *et al*., 2004, 2005; Manamendra-Arachchi & Pethiyagoda, 2005; Manamendra-Arachchi *et al*., 2007; Meegaskumbura *et al*., 2002, 2007; Pethiyagoda *et al*., 2006, 2008, 2012) leading to the discovery and description of several new species across numerous habitats. For example, the number of day geckos of the genus *Cnemaspis* recognised by Deraniyagala (1953) has undergone over a eight-fold increase (from 4 to 32 species) since this taxonomic renaissance (Batuwita *et al*., 2019; de Silva *et al*., 2019; Karunarathna *et al*., 2019). Molecular phylogenetic analyses have indicated two distinct Sri Lankan clades, namely: *C. kandiana* and *C. podihuna* (Agarwal *et al*., 2017). Furthermore, among recent taxonomic and systematic research investigations, the rediscovery of purportedly extinct species, '*C. amith*' and another species categorized as Data Deficient, '*C. tropidogaster'*, are noteworthy (Amarasinghe *et al*., 2016). Use of molecular phylogenetics, detailed elucidation of morphological character states as well as their polarity, greater access to remote locations and wilderness, and enhanced knowledge on historical geology and geography have contributed to the taxonomic advances not only of *Cnemaspis*, but also among other reptiles (Agarwal & Karanth, 2015; Bauer *et al*., 2007; Grismer *et al*., 2014a; Karunarathna *et al*., 2016). Thus, continuation of faunal surveys and detailed examination of morphological as well as genetic diagnostic features is critical in revealing the true *Cnemaspis* diversity in Sri Lanka. We strongly recommend that such studies focus on isolated hills, smaller forests, rock outcrops, and granite caves, including historical tunnel systems (de Silva *et al*., 2019).

Among the previously recognized species of *Cnemaspis*, 14 belong to *C. kandiana* clade: *C. amith*, *C. ingerorum*, *C. kallima*, *C. kandiana*, *C. kumarasinghei*, *C. latha*, *C. menikay*, *C. pava*, *C. pulchra*, *C. retigalensis*, *C. samanalensis*, *C. silvula*, *C. tropidogaster* and *C. upendrai*, which are characterized by small and irregularly shaped subcaudal scales. Out of six new species, we assign four to this clade on this basis (*C. butewai* **sp. nov.**, *C. gotaimbarai* **sp. nov.**, *C. kivulegedarai* **sp. nov.** and *C. nandimithrai* **sp. nov.**). Interestingly, only four species of this clade are distributed at high elevations (above 900 m): *C. pulchra* (Rakwana Highlands, southwest of central highlands) and *C. samanalensis*, *C. upendrai* and *C. latha* (Central Highlands), whereas the rest are low-elevation taxa (Manamendra-Arachchi *et al.,* 2007; Wickramasinghe & Munidradasa, 2007). Further, only two species of the *C. kandiana* clade (*C. ingerorum* and *C. retigalensis*) are known from the dry zone and three species (*Cnemaspis kallima, Cnemaspis kumarasinghei* and *Cnemaspis latha*) are known from the intermediate zone. Two new species (*C. gotaimbarai* **sp. nov.** and *C. nandimithrai* **sp. nov.**) represent additions to the day-geckos of the dry zone, and one new species (*C. kivulegedarai* **sp. nov.**) from the intermediate zone. These are morphologically quite similar to *C. kumarasinghei* but each taxon occurs in a geographically isolated mountains (Kokagala, Kudumbigala and Maragala, respectively), with the straight line distances between these three locations are no further than 45 km. Due to notable morphological similarities and the close geographic proximity of the habitats, these three species are closely related and form a clade in our phylogenetic analyses (see Fig. 2).

Tweleve of the previously recognized species of Sri Lankan *Cnemaspis* belong to the *C. podihuna* clade, which includes *C. alwisi*, *C. gemunu*, *C. godagedarai*, *C. kandambyi*, *C. molligodai*, *C. nilgala*, *C. phillipsi*, *C. podihuna*, *C. punctata*, *C. rajakarunai*, *C. rammalensis* and *C. scal-*

Table 10. Geographic distribution and habitat features of six new *Cnemaspis* species from Sri Lanka (Abbreviation: m – meter, ha – hectare, mm – milimeters, Lux – light intensity, CR – critically endangered).

Species	Bioclimatic area	District	Coordinates		Elevation	Area size	Forest type	Micro-habitat	Annual Rainfall	Annual temperature	Ambient temperature	Substrate temperature	Lux	Relative humidity	Canopy cover	Conservation status
			N	E												
C. nandimithrai **sp. nov.**	Dry zone	Ampara	6.667519	81.747839	28 m	600 ha	Dry mixed Semie-vergreen	Granite cave	1000–1500 mm	29.8–31.4 °C	32.2 °C	26.6 °C	643	77%	70%	CR
			6.658708	81.753736	31 m			Granite cave			30.5 °C	27.2 °C	532	80%	65%	
			6.669422	81.750561	25 m			Granite cave			30.9 °C	27.7 °C	621	83%	60%	
			6.645103	81.725086	22 m			Granite cave			31.4 °C	28.4 °C	494	71%	75%	
C. gotaimbarai **sp. nov.**	Dry zone	Ampara	7.439517	81.207967	292 m	1000 ha	Dry mixed Semie-vergreen	Granite cave	1500–2000 mm	29.6–30.5 °C	30.2 °C	28.3 °C	752	72%	85%	CR
			7.413086	81.210161	306 m			Granite cave			31.5 °C	28.7 °C	821	85%	75%	
			7.417322	81.226047	327 m			Granite cave			31.8 °C	28.2 °C	784	82%	70%	
			7.421439	81.223567	297 m			Granite cave			30.9 °C	27.2 °C	731	69 %	80%	
			7.408897	81.223928	294 m			Granite cave			31.5 °C	28.6 °C	815	76%	70%	
C. kohukumburai **sp. nov.**	Wet zone	Kandy	7.251800	80.509378	427 m	600 ha	Tropical wet ever-green	Granite wall	3000–4500 mm	25.2–27.5 °C	30.7 °C	26.2 °C	686	76%	90%	CR
			7.251658	80.512561	435 m			Granite wall			31.2 °C	27.8 °C	547	73%	75%	
			7.252525	80.510281	413 m			Granite cave			29.8 °C	27.3 °C	593	89%	85%	
C. hitihami **sp. nov.**	Intermediate zone	Monaragala	6.875428	81.357289	421 m	4100 ha	Dry mixed Semie-vergreen	Granite cave	1500–2000 mm	26.8–28.9 °C	31.5 °C	27.3 °C	693	79%	90%	CR
			6.879725	81.364986	437 m			Granite cave			30.8 °C	26.8 °C	521	68%	85%	
			6.893278	81.369394	512 m			Granite cave			29.8 °C	27.1 °C	733	73%	75%	
			6.895650	81.373047	487 m			Granite cave			31.2 °C	27.5 °C	577	84%	80%	
			6.889972	81.372575	392 m			Granite wall			31.9 °C	26.6 °C	684	80%	85%	
			6.904797	81.370878	465 m			Granite cave			32.3 °C	27.2 °C	753	77%	75%	
			6.911967	81.373014	547 m			Granite cave			30.5 °C	25.9 °C	522	82%	80%	
C. butewai **sp. nov.**	Wet zone	Ratnapura	6.630364	80.628925	445 m	3500 ha	Tropical wet evergreen	Granite cave	3000-4000 mm	28.5–30.7 °C	30.1 °C	26.8 °C	551	84%	75%	CR
			6.646919	80.653892	458 m			Granite cave			29.9 °C	25.2 °C	495	81%	70%	
			6.640125	80.666367	396 m			Granite cave			30.4 °C	26.2 °C	507	90%	70%	
			6.638986	80.659875	514 m			Granite cave			29.7 °C	27.4 °C	438	88%	85%	
			6.648331	80.651686	482 m			Granite wall			29.8 °C	25.9 °C	578	92%	90%	
			6.650092	80.644100	417 mm			Granite cave			30.4 °C	27.9 °C	515	79%	70%	
C. kivulegedarai **sp. nov.**	Intermediate zone	Nuwara Eliya	7.127933	80.867364	539 m	900 ha	Tropical wet evergreen	Granite wall	3000-4000 mm	22.6–25.2 °C	30.1 °C	25.8 °C	394	76%	70%	CR
			7.140061	80.872467	562 m			Granite wall			29.6 °C	26.1 °C	471	89%	65%	
			7.148364	80.866878	522 m			Granite cave			29.9 °C	27.4 °C	452	81%	75%	
			7.157342	80.853992	587 m			Granite cave			28.9 °C	26.7 °C	426	79%	80%	

pensis – characterized by clearly enlarged, hexagonal or subhexagonal subcaudal scales. We assign two of the new species (*C. hitihami* **sp. nov.**, and *C. kohukumburai* **sp. nov.**) to the *C. podihuna* clade based on this feature. Only four species in this clade are distributed at high elevation (above 900 m) namely: *C. gemunu* (Central Highlands), *C. godagedarai* (Rakwana Highlands), *C. phillipsi* and *C. punctata* (Dumbara Highlands of the Knuckles Range, northeast of central highlands), whereas the rest are low elevation taxa (Manamendra-Arachchi *et al*., 2007; Wickramasinghe & Munidradasa, 2007). Further, only single species of the *C. podihuna* clade (*i.e.*, *C. podihuna*) are known from the dry zone, and six species (*i.e.*, *Cnemaspis alwisi, Cnemaspis kandambyi, Cnemaspis nilgala, Cnemaspis phillipsi, Cnemaspis punctata* and *Cnemaspis rammalensis*) are known from the intermediate zone – whereas the rest are wet zone species. One new species from *podihuna* clade (*C. hitihami* **sp. nov.**) is also from the intermediate zone. Two of the new species described here, *C. hitihami* **sp. nov.** and *C. kohukumburai* **sp. nov.**, are morphologically similar to *C. alwisi*, *C. nilgala* and *C. rajakarunai* but all are restricted to geographically isolated mountains (Maragala, Kadugannawa, Dolukanda, Nilgala and Salgala, respectively), and the minimum straight line distance between any two of these localities exceeds 35 km. In our phylogenetic analyses, *C. hitihami* **sp. nov.** and *C. kohukumburai* **sp. nov.** form a clade with *C. alwisi*, *C. nilgala* and *C. punctata* (see Fig. 2). This situation presents a case similar to that of *C. kandiana* clade where morphological similarities and geographical proximity together with mtDNA-based genealogy suggest common descent.

Our phylogenetic analyses uncovered six previously unknown mtDNA lineages within Sri Lankan *Cnemaspis*, suggesting that our understanding of the within-genus diversity in the island is still far from complete. With the exception of *C. hitihami* **sp. nov.**, which was included in the analysis of Agarwal *et al.* (2017) as *Cnemaspis* sp. 10, the other five new species described in the present paper are completely new and have not been included in previous phylogenies of the genus. At least eight other mtDNA lineages of *Cnemaspis* from Sri Lanka are recognized as putative candidate species and further morphological and molecular studies are required to evaluate their taxonomic status. Moreover, our analyses suggest that at least within the *C. podihuna* and *C. kandiana* species complexes molecular differentiation among mtDNA lineages approaches species level. Within the *C. podihuna* complex, four mtDNA lineages were revealed; three of them occur in the southeastern part of Sri Lanka (localities A1, A2, A4, see Fig. 1), while one highly divergent ($p = 4.3\%$) lineage tentatively identified as *C.* cf. *podihuna* is reported from northern part of the country (Anuradhapura, locality A3, see Fig. 1). The observed level of divergence suggest species status for *C.* cf. *podihuna* from the Anuradhapura District, however we do not here revise the taxonomy of this species complex pending examination and phylogenetic assessment of topotype specimens of *C. podihuna* (type locality – Lahugala, Eastern Province, Sri Lanka). Within the *C. kandiana* species complex, we report the presence of three moderately divergent mtDNA lineages ($p = 3.5\%$) occurring in a comparatively narrow area; further molecular and morphological studies are required to evaluate their distribution and taxonomic status.

Our morphological observations indicate the presence of four morphologically distinct subgroups within the *C. kandiana* clade: subgroup (I) is distinguished by the presence of heterogeneous dorsal scales and smooth ventral scales; subgroup (II) is characterized by the presence of heterogeneous dorsal scales and keeled ventral scales; subgroup (III) may be distinguished by the presence of homogeneous dorsal scales and smooth ventral scales, and subgroup (IV) can be recognized by the presence of homogeneous dorsal scales and keeled gular scales (Tab. 3–8). Further, we find morphological evidence for the presence of two subgroups within the *C. podihuna* clade: subgroup (I) characterized by the presence of homogeneous dorsal scales with precloacal pores and femoral pores, and subgroup (II) distinguishable by the presence of homogeneous dorsal scales and the absence of precloacal pores (Tab. 9). It is interesting to note that *Calodactylodes illingworthorum* and *Hemidactylus hunae* are sympatric with *Cnemaspis* in caves in the intermediate and dry zones of Sri Lanka (Karunarathna & Amarasinghe, 2011; Karunarathna & Kumarasinghe, 2011), especially in Uva Province, whereas *Cyrtodactylus* spp. are sympatric with *Cnemaspis* in caves in the intermediate and wet zones. Eventhough these species share the same habitat, the specific use of microhabitats differ with time of the day. *Cnemaspis*, being diurnal, prefer the outer edges of cave walls and illuminated parts of the caves during daytime, whereas other gecko species prefer darker parts of the cave. During night time these preferences are reversed.

The habitats of *Cnemaspis* species, including the type localities, are undergoing habitat conversion, and are threatened by localized human disturbances such as encroachments primarily for tea, crop-farming, and human settlements. Other adverse anthropogenic impacts, such as unplanned infrastructure development like road construction as well as granite mining, untimely forest fires and logging are further exacerbating the imperilment of these species and degradation of their habitats (see Gabadage *et al*., 2018; Karunarathna *et al*., 2016). Being rupicolous microhabitat specialists with a scansorialmode of life, these species are susceptible to both localized and widespread threats. Although saxicolous at the microhabitat scale, their presence is notably limited to caves and rock outcrops in forests, woodlands, and savannahs. As such, these habitat specialists can be vulnerable to adversities of edge effects. Sri Lanka's conservation polices should be reformed to protect both smaller habitat patches and taxonomically cryptic species that are overlooked in current legislation (see Amarasinghe *et al*., 2015, 2016; Karunarathna *et al*., 2017a, b). Unlike some other reptile lineages, *Cnemaspis* is genetically highly diverse and, as such, wildlife policy reforms should include conservation within

species level, including conservation of genetically distinct populations and subclades (ZIEGLER *et al*., 2016). Further, our study highlights the importance of granite caves and rock outcrops, which are shared with many other unique species assemblies, as critical habitats for this endemic reptile clade. Thus, we recommend protection of such cryptic habitats and their surrounding landscape as keystone ecosystems.

Moreover, a number of *Cnemaspis* species have restricted ranges, limited dispersal capabilities, and niche specialization; thus, most are point endemics (also see AGARWAL *et al*., 2017; BATUWITA *et al*., 2019; BAUER *et al*., 2007; DE SILVA *et al*., 2019; KARUNARATHNA *et al*., 2019). The overall ecoregional environmental gradients stemming from habitat heterogeneity, geographic and geological complexity, and climatic variations have formed biogeographic barriers leading to the isolation and subsequent allopatric speciation of these diminutive species (DE SILVA *et al*., 2019; WICKRAMASINGHE & SOMAWEERA, 2002). These findings suggest the possible speciation of *Cnemaspis* in geographically isolated mountains with granite caves, rock outcrops, and favorable environmental conditions, and the number of species is predicted to increase to more than 50 (e.g., AGARWAL *et al*. 2017; BATUWITA *et al*. 2019; DE SILVA *et al*., 2019; KARUNARATHNA *et al*., 2019). As evidenced by their microendemism, this genus may have also underdone peripatric and parapatric speciation as well. However, these hypotheses need testing in future studies that integrate phylogenetic afficinites with historical biogeography.

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Appendix

Comparative materials examined:

Cnemaspis alwisi: NMSL 2004.9.1 (holotype), NMSL 2004.9.2 (paratype), NMSL 2004.9.3 (paratype), WHT 5918, WHT 6518, WHT 6519, WHT 7336, WHT 7337, WHT 7338, WHT 7343, WHT 7344, WHT 7345, WHT 7346.

C. amith: BMNH 63.3.19.1066A (holotype), BMNH 63.3.19.1066B (paratype), BMNH 63.3.19.1066C (paratype).

C. gemunu: AMB 7495 (holotype), AMB 7507 (paratype), WHT 7221, WHT 7347, WHT 7348, NMSL 2006.11.01, NMSL 2006.11.02, NMSL 2006.11.03, NMSL 2006.11.04.

C. godagedarai: NMSL 2019.09.01 (holotype), NMSL 2019.16.01 (paratype), NMSL 2019.16.02 (paratype).

C. ingerorum: WHT 7332 (holotype), WHT 7330 (paratype) WHT 7331 (paratype).

C. kallima: WHT 7245 (holotype), WHT 7222 (paratype), WHT 7227 (paratype), WHT 7228 (paratype), WHT 7229 (paratype), WHT 7230(paratype), WHT 7239 (paratype), WHT 7249 (paratype), WHT 7251 (paratype), WHT 7252 (paratype), WHT 7253 (paratype), WHT 7254 (paratype), WHT 7255 (paratype).

C. kandambyi: WHT 9466 (holotype), WHT 9467 (paratype).

C. kandiana: BMNH 53.4.1.1 (lectotype), BMNH 80.2.2.119A (paralectotype), BMNH 80.2.2.119B (paralectotype), BMNH 80.2.2.119C (paralectotype), WHT 7212, WHT 7213, WHT 7267, WHT 7305, WHT 7307, WHT 7308, WHT 7310, WHT 7313, WHT 7319, WHT 7322.

C. kumarasinghei: NMSL 20061301 (holotype), NMSL 20061302 (paratype).

C. latha: WHT 7214 (holotype).

C. menikay: WHT 7219 (holotype), WHT 7218 (paratype), WHT 7349 (paratype).

C. molligodai: NMSL 2006.14.01 (holotype), NMSL 2006.14.02-5 (paratype), NMSL 2006.14.03 (paratype), NMSL 2006.14.04 (paratype), NMSL 2006.14.05 (paratype).

C. nilgala: NMSL 2018.07.01 (holotype), NMSL 2018.06.01 (paratype), NMSL 2018.06.02 (paratype), NMSL 2018.06.03 (paratype).

C. pava: WHT 7286 (holotype), WHT 7281 (paratype), WHT 7282 (paratype), WHT 7283 (paratype), WHT 7285 (paratype), WHT 7288 (paratype), WHT 7289 (paratype), WHT 7290 (paratype), WHT 7291 (paratype), WHT 7292 (paratype), WHT 7293 (paratype), WHT 7294 (paratype), WHT 7295 (paratype), WHT 7296 (paratype), WHT 7297 (paratype), WHT 7298 (paratype), WHT 7299 (paratype), WHT 7300 (paratype), WHT 7301 (paratype), WHT 7302 (paratype).

C. phillipsi: WHT 7248 (holotype), WHT 7236 (paratype); WHT 7237 (paratype); WHT 7238 (paratype).

C. podihuna: BMNH 1946.8.1.20 (holotype), NMSL 20061002, NMSL 20061003, NMSL 20061004.

C. pulchra: WHT 7023 (holotype), WHT 1573a (paratype), WHT 7011 (paratype), WHT 7021 (paratype), WHT 7022 (paratype).

C. punctata: WHT 7256 (holotype), WHT 7223 (paratype), WHT 7226 (paratype), WHT 7243 (paratype), WHT 7244 (paratype).

C. rajakarunai: NMSL 2016.07.01 (holotype), DWC 2016.05.01 (paratype), DWC 2016.05.02 (paratype).

C. rammalensis: NMSL 2013.25.01 (holotype), DWC 2013.05.001.

C. retigalensis: NMSL 20061201 (holotype), NMSL 20061202 (paratype), NMSL 20061203 (paratype), NMSL 20061204 (paratype).

C. samanalensis: NMSL 2006.15.01 (holotype), NMSL 2006.15.02 (paratype), NMSL 2006.15.03 (paratype), NMSL 2006.15.04 (paratype), NMSL 2006.15.05 (paratype).

C. scalpensis: NMSL 2004.1.1 (neotype), NMSL 2004.2.1, NMSL 2004.3.1, NMSL 2004.4.1, WHT 7265, WHT 7268, WHT 7269, WHT 7274, WHT 7275, WHT 7276, WHT 7320.

C. silvula: WHT 7208 (holotype), WHT 7206 (paratype), WHT 7207 (paratype), WHT 7209 (paratype), WHT 7210 (paratype), WHT 7216 (paratype), WHT 7217 (paratype), WHT 7018, WHT 7027, WHT 7202, WHT 7203, WHT 7220, WHT 7354, WHT 7333.

C. tropidogater: BMNH 71.12.14.49 (lectotype), NMSL 5152, NMSL 5151, NMSL 5159, NMSL 5157, NMSL 5970, NMSL 5974.

C. upendrai: WHT 7189 (holotype), WHT 7184 (paratype), WHT 7187 (paratype), WHT 7188 (paratype), WHT 7181 (paratype), WHT 7182 (paratype), WHT 7183 (paratype), WHT 7185 (paratype), WHT 7190 (paratype), WHT 7191 (paratype), WHT 7192 (paratype), WHT 7193 (paratype), WHT 7194 (paratype), WHT 7195 (paratype), WHT 7196 (paratype), WHT 7197 (paratype), WHT 7260 (paratype).

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